CGIAR Advisory Services

CGIAR Research Program 2020 Reviews: Climate Change, Agriculture and Food Security – List of Annexes

Contents

The full report is available here:
bit.ly/CCAFS-CRP2020-Report

A 2-page brief is available here:
bit.ly/CCAFS-CRP2020

Annex 1: Terms of Reference for the CRP2020 Review, Addendum

Links to CRP 2020 Reviews TOR and Addendum[1].

Annex 1.1: Call for Expressions of Interest

CRP 2020 Independent Reviews of Quality of Science and Effectiveness

Deliverables and consultation for the CRP Review (pag.9-10 of the ToR attached)

The review team is expected to produce the following deliverables:

1. A preliminary findings matrix, for discussion midway through the review process, to check the progress of the review and to provide a basis for early course correction if required. The CAS Secretariat will provide the review team with a template for the **P**reliminary **F**indings matrix.
2. A brief presentation of preliminary findings, for the debrief with the CRP management and the CAS Secretariat for validation, factual corrections, and feedback.
3. A draft report of the CRP review, for review by the CRP management and the CAS Secretariat for final feedback. The CAS Secretariat will provide a template for the draft and final reports.
4. A final report of the CRP review, following the report template with a maximum of 20 pages, a 2-3**-**page executive summary, and a set of annexes with additional information apart from the main body of the report.
5. A PowerPoint presentation covering the main points of the review, including purpose, methods, findings, conclusions, recommendations**,** and additional notes relevant to the review. The CAS Secretariat will provide a template for this presentation.

Templates for the Preliminary Findings matrix, draft, and final report, and the presentations will be provided to the review team in the first week of the review.

The review team will engage with the CAS Secretariat and the CRP under review at the following key points:

- Initial discussion with the CAS Secretariat to start the review and clarify questions from the review team**.**
- Briefing at the start of the review between the review team and CRP management, facilitated by the CAS Secretariat**.**
- Interview with the CRP Leader and a focus group discussion (FGD) with other members of the CRP management during data collection**.**
- Debrief presentation of the preliminary findings led by the review team, for validation, clarifications, and feedback by the CRP management and the CAS Secretariat**.**
- The draft report will be shared with the CRP Leader and staff for factual correction and final feedback.

Additional discussions between the review team, the CRP management, and the CAS Secretariat may be scheduled based as needed during the review.

[1] Accessed September 25, 2020

Annex 1.2: Addendum to the Terms of Reference & Call for Expressions of Interest, June 2020

The CAS Secretariat has made the following modifications to the Terms of Reference (TOR) and Call for Expressions of Interest, for the CRP 2020 Reviews of Quality of Science (QoS) and Effectiveness.

Please note: (i) the independent reviewers for CRP reviews that will begin in August (see Annex I for the working schedule) will be selected by the first week of July, and (ii) the overall deadline is 15 July 2020 for submission of expressions of interest for the CRP 2020 Review.

Methods. The proposed surveys of CRP researchers, partners and donors have been removed from the CRP 2020 Reviews. The sample frame of respondents for these surveys was considered to be smaller than anticipated, thereby limiting the value of quantitative data collected from the surveys. Given the extensive qualitative methods (primarily key informant interviews) already applied to the same pool of respondents, the value of the surveys was determined to be questionable. Further, the burden on respondents was considered excessive, and a higher value is placed on the in-depth qualitative interviews. Considering the limited value addition of the proposed surveys and the burden on respondents, CAS has removed the surveys as a method for the reviews.

Establishing contributions to Intermediate Development Outcomes (IDOs). Links between the outcomes (documented as milestones) from the CRPs and the CGIAR Strategic Results Framework will be examined at the sub-IDO level, not the IDOs themselves.

Data sources. CRP performance data will be drawn from the Plans of Work and Budget (POWBs) and Annual Reports for the period under review, with supplementary information from the CGIAR result dashboard. The CAS Secretariat supports the reviews by integrating data from the dashboard, the CRP internal monitoring, and the POWB and annual reports, to allow the review team to make quantitative assessments of performance. The dashboard data will also be used in conducting a 'deep dive' of selected CRP outcomes (OICRs).

Knowledge management. The review team will be responsible for uploading and storing its original data, analysis, and drafts on the secure online content site (SharePoint) provided by the CAS Secretariat, as a basic step in knowledge management for the review.

Analytics support. The team will also need to adhere to timelines for accessing technical consultants made available by the CAS Secretariat, e.g., for quantitative analysis of performance data.

Distribution of effort within team. The two members of each review team (subject matter expert and senior evaluator) are each allocated 39 days for execution of the work, over the 11-week period. An additional two days are allocated to the team member who takes on the team leadership role. The team leader will also commit to responding to any questions or need for clarifications that arise from copyediting the final report.

Annex 2: CRP specific methodology

Annex 2.1: Overall Approach

The methodology employed mixed methods. As well as analysis of the theory of change, qualitative and quantitative data were collected and combined in a process of triangulation in order to answer the three main review questions and all sub-questions, including additional review questions identified by CCAFS management.

As well as review questions on the Quality of Science and Effectiveness, the analysis supported an estimation of CRP potential up until the end of the CRP (2021), foreseen and unforeseen outcomes, and impacts beyond program timeframes, and for the one CGIAR transition period. To some extent, the implications of the COVID-19 pandemic for the CCAFS program were also explored.

The reviewers gathered and triangulated the evidence (qualitative, quantitative) to answer the three main review questions, using content analysis, interviews, and synthesis.

Annex 2.2: Assessing Quality of Science

Two key criteria were to be considered: Scientific Credibility and Legitimacy. These represent two of the four dimensions identified in the Quality of Research for Development Framework or Qo4RD (https://cas.cgiar.org/sites/default/files/pdf/ispc_brief_62_qord.pdf), which was provided by the ISPC in 2017, and updated in 2020. Key definitions are as follows:

Scientific credibility relates to robustness of research findings, dependability, and soundness of evidence, accuracy of data, appropriateness of methods, and clarity of presentation. This criterion recognizes the importance of good scientific practice, including peer review.

Legitimacy relates to the fairness and ethical nature of the research process, and the inclusiveness towards intended users, their interests and perspectives, implying trust, mutual commitment, "transparency, sound management of potential conflicts of interest, recognition of the responsibilities that go with public funding, genuine involvement of partners in co-design, and recognition of partners' contributions".

Both these dimensions of the Quality of Science were assessed by analyzing the following as achieved by CCAFS:

Research inputs, e.g. research staff, team compositions, availability of adequate research infrastructure and funding resources.

Research processes, e.g. incentives for achieving and maintaining the high scientific credibility of outputs.

Analyzing both inputs and process involved interviews with research managers, researchers (including early career researchers) and a wide variety of partners and stakeholders, to examine how research is designed, funded, managed and implemented to achieve scientific credibility and legitimacy, including equitable participation of women, youth and marginalized groups.

Research outputs: These were taken to include a wide variety of scientific outputs, notably peer-reviewed articles but also CCAFS papers, as well as outputs intended for stakeholders: guidelines, decision-support tools, training materials, policy briefs and other policy-change oriented actions.

A bibliometric analysis was conducted by the CAS Secretariat according to parameters set for all the current Independent Reviews and provided to the review team to enable assessment of the Quality of Science. This included citations of individual articles, impact factors of journals, h-indices of researchers, as well as Altmetric analysis of downloads etc. Aspects of this analysis most relevant to CCAFS was further developed and commented on in the report. The Subject Matter Specialist made an individual assessment of an ad-hoc selection of 18 peer-reviewed journal articles and 17 other outputs, mainly from lists provided by Flagship Leaders.

Annex 2.3: Assessing Effectiveness

The effectiveness of CCAFS was assessed in two ways:

To assess effectiveness, we:

- assessed planned versus completed outputs and outcomes as described in the annual POWBs and corresponding Annual Reports for 2017, 2018, and 2019. This included analysis of achievement or not of milestones that are used by CRPs to track progress by Flagship, year, and level of risk as well as other metrics used by the CRPs and FPs, such as policies and innovations.
- assessed reported achievements with respect to the relevant theories of change (CRP and nested flagship TOCs). This analysis assessed the quality of the CRP (and Flagship) theories of change and achievements against those proposed pathways from outputs to a sequence of outcomes and impacts. The available evidence was assessed to test the plausibility of cause-effect linkages and the contribution of the CRP to development outcomes.

The analysis was guided by the OECD-DAC evaluation framework on effectiveness and to answer ToR Evaluation Question 2, we analyzed the strengths and weaknesses of the CRP and considered progress over time and according to resources available and management.

The assessment considered:

- The extent to which planned outputs and outcomes have been achieved by 2019 by carrying out a quantitative and qualitative assessment of the CRP (and FPs') progress according to their ToC
- The extent to which planned milestones have been achieved, extended or canceled by comparing the milestones identified in the annual POWBs and progress reported in annual reports or on MARLO for the three years under review.
- The number and level of maturity of "policies", "innovations" and "partnerships" as reported in MARLO and the Results Dashboard for the three years under review.
- The extent to which achieved outcomes contributed to broader goals and cross-cutting issues (Capacity Development, Climate Change, Gender, Youth, and Partnerships) by means of a 'deep dive' on a sample of OICRs, taking account of the predictability of funding and legacy time frame for the CRP.
- The extent to which the program's management and governance has supported the CRP's effectiveness.
- The extent to which the CRP and its Flagship Programs have made progress along their theories of change, including an assessment of the quality of those TOCs.

Quantitative

Data were collected from the Results Dashboard, and as supplied by the CAS Secretariat technical analyst. These data were analyzed, alongside information in program documentation, especially the Annual Reports, to assess effectiveness. The quantitative data were triangulated with the qualitative data generated through stakeholders.

Common Framework Indicators (CFIs) are being used in the CRP. CFIs of relevance to this review included milestones, policies, innovations, and OICRs. Data were provided on all these indicators by the CAS data analyst to the review team. The analyst supported analysis of deliverables, outcomes, and milestones by CRP, flagships, and timeframes (yearly).

Qualitative

Interviews: Stakeholder interviews (internal staff, partners, and other stakeholders) were conducted to generate evidence on effectiveness (achievements, delays, and adaptations, etc.,) and key lessons. It is important to note that for many interviewees these interviews covered quality of science as well as effectiveness. Checklists were used to guide these interviews. The reviewers used the insights from the interviews to triangulate the information available from the quantitative data (e.g. reporting on milestones, policies, innovations, and OICRs). This triangulation approach allowed the reviewers to better understand *how* and *why* effectiveness has been achieved or not, and to assess the relative contribution of the CRP.

39 interviews were conducted with stakeholders over Microsoft Teams or similar remote means. Interviewees were selected to cover all major stakeholder categories, including CCAFS internal staff,

partners, donors, depending on availability are listed in Annex 4. An initial list was provided by CCAFS management, and the review team requested some additions to extend the list to fully represent key stakeholders, such as NARS. For example, interviewees from National Agricultural Systems (NARS) will be interviewed. In some cases, potential interviewees were unavailable or did not respond to emails, or we were unable to find mutually convenient times.

Deep Dives on selected Outcome and Impact Case reports (OICRs). Outcome Impact Case Reports or OICRs are produced by each CRP to report on key outcomes achieved, including Innovations at Level 3 and 4 and Policies at Levels 2 and 3. The CRP is responsible for writing new OICRs and updating existing ones (at same or higher level of maturity). Deep dive studies into existing OICRS were designed to help the review team to better understand *how* the program is conducting research for development. The OICRs provide a means of testing the theory of change in different cases. A template was provided to guide the analysis and ensure consistency and standardization, as well as documenting evidence. One such template was filled per OICR (see Annex 14). Where possible, as well as the relevant CRP documentation relating to the OICR, we conducted interviews for each OICR to provide more nuanced insights and support learning.

The TOR required a minimum of two OICRs will be reviewed in this way. The reviewers initially aimed to conduct a higher number to reflect the breadth of the CCAFS program and the strong differences between the FPs. Based on the criteria defined by the CAS Secretariat[2], a provisional selection of five OICRs was made to ensure good coverage of the Flagships and LPs, the geographic regions, and levels of maturity, but for reasons of availability of interviewers and the respondents' time, three were eventually selected and are analyzed in Annex 14.

Annex Table 2.1. Selection of OICRs for deep dive

No.	Title	Selection criterion				
		FP	Region	Maturity Level	Partners	Quality of evidence
3347	The adoption of Happy Seeder technology by 0.5 million farm-households on 1.3 million ha in NW India contributed to increased yields, profits, water, and nutrient saving.	3,2	South Asia	3	Universities, Research Institutes, private-sector agricultural machinery company, The Nature Conservancy	Multiple ICAR, GoI documents, media articles, and one peer-reviewed article.
3140	37,000 smallholders implementing low emissions agriculture resulting in 1 Mt CO2e verified mitigation in East Africa	3	East Africa	2	ECOTRUST - Environmental Conservation Trust; UNIQUE - Unique Forestry and Land Use GmbH; EcoAgriculture; Vi Agroforestry	Multiple documents from partners and CCAFS, and email correspondence. MoALFC contact nominated by CCAFS.
3313	Use of CIS in Senegal led to 10-25% increases in household income, whilst improving action planning of national and local stakeholders	4	West Africa	3	(ANACIM) National Agency of Civil Aviation and Meteorology	Two academic articles under review cited. Covered by the 2018 EC-IFAD Review. ANACIM contact nominated by CCAFS.

2 High-impact cases to demonstrate effectiveness; Different themes within a CRP; If new OICR, from 2019 to really grasp results from the three three-year period at stake in these reviews but preferable with maturity level 3; Access to key informants in a timely manner must be foreseen; At least one where partnerships are significantly relevant; Not being featured in the CRP annual report; Relationship with CGIAR cross-cutting issues can be evidenced.

During the study, the review team found that to assess progress against the program ToC required more than the OICR deep dives. While the deep dive studies provide important insights, they are too narrow to test the theory of change. The team developed a rapid 'Most Significant Outcome' Analysis approach which focused on individual FPs – while also recognizing that the program is more than the sum of the FP parts and that there are interlinkages between them involving diverse collaborations. The review team reviewed different sources of evidence, including OICRs reported in the Annual Reports as being of high quality by independent reviewers, stakeholder interviews, project outputs, and discussion with FP leaders. A draft was produced based on the evaluator's judgment, and using the FP impact pathway and its assumptions, and an iteration with FP leaders was conducted. The findings are presented in Annex 10, and synthesized in the main report to contribute to the overall assessment of program effectiveness. This provided a broader view at the meso-level of what the program has achieved and its importance. More systematic analysis of significant outcomes and the ability to create a contribution story is something that the program could explore in future in its own learning and reporting. In addition, evaluative scales could be used to provide transparent ways of assessing progress against the ToC.

Annex 2.4: Limitations

As a desk-based review, no travel and face-to-face interaction has been possible to CCAFS institutions, field research sites, or collaborating partners. The need to focus on specific elements of the program covered by selected OICRs compared with the breadth of the overall program means that the assessment cannot be representative of the breadth of program outcomes. The review is also constrained by the relatively short time frame allotted (August 2020 – 31st October 2020), and the difficulties of arranging remote interviews. Certain aspects of MARLO and the reporting system also make assessment challenging.

Annex 3: List of CCAFS and CGIAR Documents Reviewed

Documents
Annual Report 2017
Annual Report 2018
Annual Report 2019
Plan of Work and Budget 2017
Plan of Work and Budget 2018
Plan of Work and Budget 2019
CCAFS presentation by A. M. Loboguerrero
CCAFS Full program proposal 2016
CCAFS theory of change visuals
CGIAR Strategy and Results Framework 2016 – 2030.
ISPC Assessment of the Climate Change, Agriculture, and Food Security (CCAFS) CRP-II revised proposal (2017-2022) 14th September
ISPC Commentary on the Climate Change, Agriculture and Food Security (CCAFS) – Pre-proposal (2017-2022) 25th September
One CGIAR: A bold set of recommendations to the System Council. 13th – 14th November, 2019
CGIAR review 2018 CCAFS Case Study Climate Change, Agriculture and Food Security – D. Pillot and M.J. Dugue. September 2018. EC and IFAD.
Review of CCAFS Scaling Activities. Final Report. A. H. Theissen, 24th July, 2019.
Evaluation of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Volume 1. Evaluation Report, June 2016. S. Anderson, F. Khan, C. Robledo, C. Roth.
Management response to "Evaluation Report" of CCAFS. 26th July 2016.
Technical Report: Quality of Research for Development in the CGIAR context. January 2020.
Workshop Series Report. Lessons in Theory of Change from a Series of Regional Planning Workshops T. Schuetz, W. Förch, P. Thornton, L. Wollenberg, J. Hansen, A. Jarvis, K. Coffey, O. Bonilla-Findji, A.M. Loboguerrero Rodriguez, D. Martinez Baron, P. Aggarwal, L. Sebastian, R. Zougmore, J. Kinyangi, S. Vermeulen, M. Radeny, A. Moussa, A. Sajise, A. Khatri-Chhetri, M. Richards, C. C. Jost, A. Jay.
All references associated with the 5 selected OICRs
IEA Workshop: Development, Use and Assessment of TOC in CGIAR Research. Report Rome 12-13 January 2017.
CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) (2016 – 2024)
Carneiro, B., G. Resce, G. Ruscica, B.M. Yixin, G. Pacillo (2020) 'A web analytics approach to map the reach and influence of CCAFS'. CCAFS report.
A multiplicity of outputs reported in the Annual Reports and on MARLO

NB: Documents specifically cited in the Main Report (CCAFS Outputs and a small number of external articles) are listed in the References section of the Main Report

Annex 4: List of Persons Interviewed

40 people were interviewed from the CCAFS program, independent consultants, donors, NGOs. Of these interviewees, 25 are men and 15 are women.

Name	F/M	Position
1. Dhanush Dinesh	M	Global Policy Engagement Manager
2. Philip Thornton	M	Flagship Leader for Priorities and Policies for CSA
3. John Lynam	M	Current chair of CCAFS' Independent Steering Group
4. Tonya Schuetz	F	Head of Monitoring Evaluation and Learning – Alliance Bioversity-CIAT
5. Brian Keating	M	Former chair of CCAFS' Independent Steering Group
6. Ruben Echeverria	M	Former CIAT Director General, former member of CCAFS' Independent Steering Group
7. Laura Cramer	F	Science Officer for Priorities and Policies for CSA
8. Bruce Campbell	M	Director
9. Peter Laderach	M	Flagship Leader for Climate-Smart Technologies and Practices
10. Patti Kristijanson	F	Senior Scientist, ICRAF and commissioned researcher for CCAFS
11. Lini Wollenberg	F	Flagship Leader for Low Emissions Development
12. Steve Zebiak	M	Flagship Leader for Climate Services and Safety Nets
13. Deissy Martinez Baron	F	Regional Program Leader Latin America
14. Robert Zougmore	M	Regional Program Leader West Africa
15. Dawit Solomon	M	Regional Program Leader East Africa
16. Pramod Aggarwal	M	Regional Program Leader South Asia & South East Asia
17. Sophia Huyer	F	Gender and Social Inclusion Research Leader
18. Osana Bonilla-Findji	F	Science Officer for Climate-Smart Technologies and Practices
19. Alison Rose	F	Science Officer for Climate Services and Safety Nets
20. Hector Tobon	M	Knowledge and Data Sharing Coordinator
21. Wiebe Smit	F	Project Administrator
22. Ana Maria Loboguerrero	F	Head of Global Policy Research
23. Grazia Pacillo	F	Economist FP1 [Conducting evaluation study].
24. John Recha	M	East Africa Regional Team and
25. Maren Radeny	F	Science Officer for East Africa
26. Amos Wekesa	M	WeEffect (previously ViAgroforestry)
27. Maurice Juma Ogada	M	Independent consultant assessing project in East Africa (Professor of Agricultural Economics) – [OICR deep dive key informant]
28. Timm Tennigkeit	M	Unique (NGO) - [OICR deep dive key informant]
29. Le Hoang Anh	M	Ministry of Agriculture and Rural Development (MARD) - Vietnam
30. Hans Hoogeveen	M	Ambassador/Permanent Representative, Kingdom of the Netherlands to the UN Organizations for Food and Agriculture
31. Patricia Wagenmakers	F	Wageningen University

Name	F/M	Position
32. Hon. Winifred Masiko	F	African Group of Negotiators
33. Le Thanh Tung	M	Ministry of Agriculture and Rural Development (MARD) - Vietnam
34. Veronica Ndetu	F	Ministry of Agriculture, Livestock and Fisheries and Cooperatives – Kenya – [OICR deep dive interview]
35. Robin Mbae	M	Written feedback Apiculture, Climate Change and Emerging Livestock State Department for Livestock Ministry of Agriculture, Livestock and Fisheries
36. Alan Tollervey	M	FCDO (donor)
37. Andrew Challinor	M	University of Leeds [research partner]
38. George Wamukoya	M	African Group of Negotiators
39. Babou Bationo	M	INERA, Burkina Faso
40. Cristina del Rios	F	World Resources Institute
Female Interviewees 15, Male Interviewees 25, Total 39		

Annex 5: Data Collection Tools

A generic checklist was developed and tailored to different interviewees/stakeholders:

1. Overall impression of progress from CRP and its effectiveness?
    a. Flagships – how have these evolved over time? How would you describe their progress and effectiveness?
    b. Cross-cutting issues – how effectively are these issues being addressed within the CCAFS program?
        i. Gender
        ii. Capacity development – please explain your perspectives on CCAFS performance in this regard?
        iii. Youth - please explain your perspectives on CCAFS performance in this regard?
    c. Main achievements and challenges (and adaptations to challenges)?
    d. How does the CCAFS program add value?
    e. Responses to earlier evaluations

2. Are there additional review questions you like us to include to support CCAFS learning?

3. CRP ToC
    a. What are your perspectives on the role of ToC in the CCAFS program?
    b. How has use of the ToCs evolved over time?
    c. Which ToCs and impact pathways do you use?
    d. What are the strengths and weaknesses of the TOC from your perspective?

4. How would you describe the interactions between the FPs and other CRPs?

5. Please describe the funding situation for CCAFS over the period of study? (reliability, leveraging etc.,)

6. Please describe the future priorities/areas of work that you think are most important?

7. What are your perspectives on the One CGIAR transition and on future research modalities?

8. What, if anything, might you have done differently with hindsight? What key lessons can be learned to inform future research on climate change, agriculture and food security?

9. What is your perspective on governance structures (e.g. any issues of competition between centers and CRPs?)

10. OICRs
    a. How do you decide which OICRs to produce? (i.e. how do you define where your strongest impact is?)
    b. How are "new" and "updated" statuses defined?

11. What is your experience of the reporting system?

Annex 6: Bibliometrics and Altmetrics

Annex Table 6.1: Top CCAFS Scientific Outputs by Citations per Year

Authors and Title	Journal	Year	Total Citations	Citations per year	Lead Author affiliation
Griscom et al. Natural climate solutions*	PNAS	2017	179	44.75	The Nature Conservancy
Springmann et al. Options for keeping the food system within environmental limits*	Nature	2018	133	44.333	Oxford
Fricko et al. The marker quantification of the Shared Socioeconomic Pathway 2: A middle-of-the-road scenario for the 21st century	Global Environmental Change	2017	102	25.5	IIASA
Soussana et al. Matching policy and science: Rationale for the '4 per 1000 - soils for food security and climate' initiative	Soil Tillage Research	2019	43	21.5	INRA
Defourny et al. Near real-time agriculture monitoring at national scale at parcel resolution: Performance assessment of the Sen2-Agri automated system in various cropping systems around the world	Remote Sensing of Environment	2019	40	20	Université Catholique de Louvain
Patterson et al. Exploring the governance and politics of transformations towards sustainability	Environmental Innovation and Societal Transitions	2017	71	17.75	Utrecht
Hasegawa et al. Risk of increased food insecurity under stringent global climate change mitigation policy*	Nature Climate Change	2018	50	16.667	NIES, Japan
Campbell et al. Agriculture production as a major driver of the Earth system exceeding planetary boundaries*	Ecology and Society	2017	59	14.75	CCAFS
Hansen et al. Climate risk management and rural poverty reduction	Agricultural Systems	2019	26	13	IRI
Udomkun et al. Innovative technologies to manage aflatoxins in foods and feeds and the profitability of application – A review	Food Control	2017	48	12	IITA
Vetter et al. Greenhouse gas emissions from agricultural food production to supply Indian diets: Implications for climate change mitigation	Agriculture, Ecosystems & Environment	2017	39	9.75	Aberdeen
Udomkun et al. Mycotoxins in Sub-Saharan Africa: Present	Food Control	2017	38	9.5	IITA

Authors and Title	Journal	Year	Total Citations	Citations per year	Lead Author affiliation
situation, socio-economic impact, awareness, and outlook					
Liu et al. Global wheat production with 1.5 and 2.0°C above pre-industrial warming	Global Change Biology	2019	19	9.5	Nanjing Agric. University
Kanter et al. Evaluating agricultural trade-offs in the age of sustainable development	Agricultural Systems	2018	28	9.333	NYU and Columbia
Brocca et al. A Review of the Applications of ASCAT Soil Moisture Products	IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing	2017	36	9	National Research Council, Italy
Abdulai et al, Cocoa agroforestry is less resilient to sub-optimal and extreme climate than cocoa in full sun	Global Change Biology	2017	26	8.667	Goettingen
Frank et al. Reducing greenhouse gas emissions in agriculture without compromising food security?*	Environmental Research Letters	2017	32	8	IIASA
Challinor et al. Improving the use of crop models for risk assessment and climate change adaptation	Agricultural Systems	2018	24	8	Leeds
Van Etten et al. Crop variety management for climate adaptation supported by citizen science*	PNAS	2019	16	8	Bioversity
Choudhary et al. Changes in soil biology under conservation agriculture based sustainable intensification of cereal systems in Indo-Gangetic Plains	Geoderma	2018	23	7.667	ICAR-CSSRI
Byrnes et al. Biological nitrification inhibition by *Brachiaria* grasses mitigates soil nitrous oxide emissions from bovine urine patches	Soil Biology and Biochemistry	2017	28	7	CIAT
Aggarwal et al. The Climate-Smart Village approach: framework of an integrative strategy for scaling up adaptation options in agriculture	Ecology and Society	2018	19	6.333	CCAFS
Palazzo et al. Linking regional stakeholder scenarios and shared socioeconomic pathways: Quantified West African food and climate futures in a global context*	Global Environmental Change	2017	25	6.25	IIASA
Thornton et al. Responding to global change: A theory of change approach to making agricultural research for development outcome-based	Agricultural Systems	2017	25	6.25	CCAFS

Authors and Title	Journal	Year	Total Citations	Citations per year	Lead Author affiliation
Romasanta et al. How does burning of rice straw affect CH4 and N2O emissions? A comparative experiment of different on-field straw management practices	Agriculture, Ecosystems & Environment	2017	24	6	IRRI
Maidment et al. A new, long-term daily satellite-based rainfall dataset for operational monitoring in Africa	Scientific Data	2017	24	6	Reading
Ramcharan et al. Deep Learning for Image-Based Cassava Disease Detection*	Frontiers in Plant Science	2017	24	6	Penn State
Läderach et al. Climate change adaptation of coffee production in space and time*	Climatic Change	2017	23	5.75	CCAFS
Ayanlade et al. Comparing smallholder farmers' perception of climate change with meteorological data: A case study from southwestern Nigeria	Weather and Climate Extremes	2017	22	5.5	OAU, Nigeria and CCAFS
Shikuku et al. Smallholder farmers' attitudes and determinants of adaptation to climate risks in East Africa	Climate Risk Management	2017	20	5	CCAFS and Wageningen

* After a title indicates that the article also appears in Annex Table 6.3 of the top 30 articles by Altmetric Attention Score

Annex Table 6.2. Academic Journals by Frequency of Publication of CCAFS Outputs

Sources	Articles 2017-2020	Impact Factor 2019	JCR Category	Rank	Quartile in Category	Open Access
Agricultural Systems	26	4.212	Agriculture, Multidisciplinary	3 of 58	1	Green
PLOS One	17	2.74	Multidisciplinary Sciences	27 of 71	2	Green
Climatic Change	12	4.134	Environmental Sciences Meteorology & Atmospheric Sciences	65 of 265 19 of 93	1 1	Green
Agriculture, Ecosystems & Environment	11	4.241	Agriculture, Multidisciplinary Ecology Environmental Sciences	2 of 58 29 of 168 60 of 265	1 1 1	Green
Sustainability	11	2.576	Environmental Sciences Environmental Studies Green & Sustainable Science & Tech Green & Sustainable Science & Tech	120 of 265 53 of 123 6 of 8 26 of 41	2 2 3 3	Gold
Climate Risk Management	10	4.904	Environmental Sciences Environmental Studies Meteorology & Atmospheric Sciences	43 of 265 15 of 123 11 of 93	1 1 1	Green
Frontiers in Sustainable Food Systems	10	Not available in WoS				Gold
Environmental Research Letters	8	6.096	Environmental Sciences Meteorology & Atmospheric Sciences	27 of 265 6 of 93	1 1	Green
Global Change Biology	8	8.555	Biodiversity Conservation Ecology Environmental Sciences	1 of 59 7 of 168 9 of 265	1 1 1	Yellow
Science of the Total Environment	8	6.551	Environmental Sciences	22 of 265	1	Green
Scientific Reports	8	3.998	Multidisciplinary Sciences	17 of 71	1	Green
Ecology and Society	7	3.89	Ecology; Environmental Studies	32 of 168 27 of 123	1 1	Green
Global Food Security-Agriculture Policy Economics and Environment	7	6.034	Food Science & Technology	7 of 139	1	Green
Current Opinion In Environmental Sustainability	6	5.658	Environmental Sciences; Green & Sustainable Science & Technology	32 of 265 10 of 41	1 1	Green
Proceedings of the National Academy of Sciences of the USA	6	9.412	Multidisciplinary Sciences	8 of 71	1	Green

NB: The Open Access status of journals has been identified in some cases from CCAFS documentation, in other cases by the reviewers' best efforts: it is not always readily clear from journals' websites

Annex Table 6.3: Top CCAFS Scientific Outputs by Altmetric Attention Score

Authors and Title	Journal	Year	Altmetric Attention Score	Total Citations	Lead Author affiliation
Springmann et al. Options for keeping the food system within environmental limits	Nature	2018	2357	133*	Oxford
Griscom et al. Natural Climate solutions	PNAS	2017	1514	179*	The Nature Conservancy
Imbach et al. Coupling of pollination services and coffee suitability under climate change	PNAS	2017	1044	11	CCAFS
Anon. We need to talk about meat	Lancet	2018	959	0	n/a
Rumpel et al. Put more carbon in soils to meet Paris climate pledges	Nature	2018	624	10	CNRS, France
Hasegawa et al. Risk of increased food insecurity under stringent global climate change mitigation policy	Nature Climate Change	2018	530	50*	NIES, Japan
Rojas et al. Emergence of robust precipitation changes across crop production areas in the 21st century	PNAS	2019	341	9	Universidad de Chile
Shymasundar et al. Fields on fire: alternatives to crop residue burning in India	Science	2019	249	8	The Nature Conservancy
Nelson et al. Income growth and climate change effects on global nutrition security to mid-century	Nature Sustainability	2018	239	5	University of Illinois
Van Etten et al. Crop variety management for climate adaptation supported by citizen science	PNAS	2019	212	16*	Bioversity
Caron et al. Food systems for sustainable development: proposals for a profound four-part transformation	Agronomy for Sustainable Development	2018	2102	7	Université de Montpellier
Frank et al. Reducing greenhouse gas emissions in agriculture without compromising food security?	Environmental Research Letters	2017	186	32*	IIASA
Campbell et al. Agriculture production as a major driver of the Earth system exceeding planetary boundaries	Ecology and Society	2017	184	59*	CCAFS
Chirinda et al. Adequate vegetative cover decreases nitrous oxide emissions from cattle urine deposited in grazed pastures under rainy season food	Scientific Reports	2019	150	3	CIAT
Palazzo et al. Linking regional stakeholder scenarios and shared socioeconomic pathways: Quantified West African food and climate futures in a global context	Global Environmental Change	2017	128	25*	IIASA
Manners et al. Are agricultural researchers working on the right crops to enable food and nutrition security under future climates?	Global Environmental Change	2018	124	4	Univ. Politécnica de Madrid
Jiménez et al. A scalable scheme to implement data-driven agriculture for small-scale farmers	Global Food Security	2019	122	1	CIAT

Authors and Title	Journal	Year	Altmetric Attention Score	Total Citations	Lead Author affiliation
Castro-Llanos et al. Climate change favors rice production at higher elevations in Colombia	Mitig. Adapt. Strategy. Glob. Change	2019	119	1	CIAT
Imbach et al. Future climate change scenarios in Central America at high spatial resolution	PLOS One	2018	107	3	CCAFS
Aggarwal et al. How much does climate change add to the challenge of feeding the planet this century?	Environmental Research Letters	2019	101	3	CCAFS
Ramcharan et al. Deep Learning for Image-Based Cassava Disease Detection	Frontiers in Plant Science	2017	99	24*	Penn State
Enahoro et al. Supporting sustainable expansion of livestock production in South Asia and Sub-Saharan Africa: scenario analysis of investment options	Global Food Security	2019	98	4	ILRI
Carbonari et al. Reviewing Vietnam's nationally determined contribution: a new perspective using the marginal cost of abatement	Frontiers in Sustainable Food Systems	2019	93	1	Stockholm University/ CCAFS
Kidane et al. Genome-wide association study to identify the genetic base of smallholder farmer preferences of durum wheat traits	Frontiers in Plant Science	2017	93	10	Scuola Superiore Sant'Anna/ Bioversity
Nkurunziza et al. The potential benefits and trade-offs of using sub-surface water retention technology on coarse-textured soils: Impacts of Water and Nutrient Saving on Maize Production and Soil Carbon Sequestration	Frontiers in Sustainable Food Systems	2019	86	0	Swedish University of Agricultural Sciences
De Sousa et al. The future of coffee and cocoa agroforestry in a warmer Mesoamerica	Scientific Reports	2019	85	4	Inland Norway University of Applied Sciences/ Bioversity
Läderach et al. Climate change adaptation of coffee production in space and time	Climatic Change	2017	84	23*	CCAFS
Eitzinger et al. GeoFarmer: a monitoring and feedback system for agricultural development projects	Computers & Electronics in Agriculture	2019	80	8	CIAT
Christmann, Do we realize the full impact of pollinator loss on other ecosystem services and the challenges for any restoration in terrestrial areas?	Restoration Ecology	2019	76	4	ICARDA
Loboguerrero et al. Food and earth systems: priorities for climate change adaptation and mitigation for agriculture and food systems	Sustainability	2019	75	9	CCAFS

Annex Table 6.4: Assessment of the quality of ad hoc selected CCAFS research publications

FP/ LP	Journal article	Journal IF	Appropriateness of journal	Relevance	Originality	Rigor	Co-author-ship	CCAFS Contribution	Overall quality summary
1	Is agricultural adaptation to global change in lower-income countries on track to meet the future food production challenge? *Global Environmental Change*	10.466	High	4	High	High	Appropriate	CCAFS-funded, 3 CCAFS authors out of 6	A well-designed analysis of very large-scale survey data from 45 sites in 21 countries, allowing identification of elements of the enabling environment (supporting organizations, community awareness) for food security. The logic for a negative answer to the question in the title is persuasive and somewhat indirect, and the positive examples of adaptation given are drawn more widely from CCAFS experience than from the survey data but are nonetheless very relevant for policymakers.
1	Science-policy interfaces for sustainable climate-smart agriculture uptake: lessons learned from national science-policy dialogue platforms in West Africa, *International Journal of Agricultural Sustainability*	2.278	High	4	Moderate	Low	Appropriate, most authors are from African countries	CCAFS-funded, 6 CCAFS authors out 9	A very useful and informative account of the establishment, functioning, and achievement of three National Science-Policy Dialogue Platforms in West Africa, by researchers and others involved in the process. It will be highly relevant for those designing and implementing similar initiatives elsewhere. However, the conceptual frameworks introduced are not clearly incorporated into the method or the account of findings and add little.
1	Can climate interventions open up space for transformation? Examining the case of Climate-Smart Agriculture (CSA) in Uganda, *Frontiers in Sustainable Food Systems*	n/a	Moderate	4	High	Moderate	No authors from African countries	Partially CCAFS-funded, 2 CCAFS authors out of 4,	An ambitious, though sometimes hard to follow, attempt to examine how subjectivities of farmers are formed in the context of externally promoted CSA, and the interrelation of practical interventions, political contexts and personal perceptions (of both farmers and development agents). The article contains some important critical thinking about the over-identification of agricultural transformation with commercialization. The relevance is primarily to future researchers rather than users.

FP/ LP	Journal article	Journal IF	Appropriateness of journal	Relevance	Originality	Rigor	Co-authorship	CCAFS Contribution	Overall quality summary
2	Impacts of smallholder agricultural adaptation on food security: evidence from Africa, Asia and Central America, *Food Security*	2.095	High	2	Moderate	Moderate	An international research team for a global-level review	CCAFS-funded, 1 CCAFS author out of 4	A rigorously sampled and analyzed cross-country study but suffers from over-identification of "adaptation" with changes in cropping practices. There are possible problems with the methodology of counting changes in farming practices as adopted by households, regardless of how closely related to other practices they may be An interesting finding that households have been more successful in adapting to changing markets than to climate change, but relevance to next stage users remains unclear.
2	Inclusive agribusiness under climate change: a brief review of the role of finance, *Current Opinion in Environmental Sustainability*	5.658	High	3	High	Low	Appropriate	CCAFS-funded, 2 CCAFS authors out of 8	A short review and discussion piece, with no explicit inclusion criteria, but well-argued and contains important conclusions for future researchers on the need for greater qualitative understanding of the financial strategies of the poor, and the advantages (and limitations of specific research strategies such as financial diaries
2	Recommendation domains to scale-out climate change adaptation in cocoa production in Ghana, *Climate Services*	n/a	High	4	High	High	Appropriate, including national research partners and a standards body	CCAFS-funded	An exceptionally well-designed and relevant study, using gridded climate models and expert validation to identify cocoa production zones requiring different adaptation approaches. Findings will be highly relevant to Ghana and the method will be highly relevant internationally.
3	Direct Nitrous Oxide emissions from tropical and sub-tropical agricultural systems – a review and modeling of emission factors, *Scientific Reports*	3.998	High	4	High	High	Appropriate (representation of researchers from Asia and Latin America)	CCAFS-funded, 2 CGIAR authors out of 7	A well-designed systematic review using a transparent method to identify and interrogate studies from the literature. Conclusions are "negative" in that tropical Emissions Factors continue to be seen as linear and their mean within the uncertainty range for the global IPCC Emissions Factor, but nevertheless useful.

FP/ LP	Journal article	Journal IF	Appropriateness of journal	Relevance	Originality	Rigor	Co-authorship	CCAFS Contribution	Overall quality summary
3	Reducing greenhouse gas emissions in agriculture without compromising food security? *Environmental Research Letters*	6.096	High	4	High	High	Appropriate but Northern dominated	CCAFS-funded, only one author CCAFS/ CGIAR affiliated	A well-executed modelling study with very distinctive and relevant implications for national and global policy on mitigation through agriculture – land-rich developing countries could significantly reduce emissions by managing land-use change, while agricultural mitigation in densely-populated countries risks increasing food insecurity.
3	Making trees count: measurement and reporting of agroforestry in UNFCC national communications of non-Annex 1 countries, *Agriculture, Ecosystems and Environment*	4.241	High	4	High	High	Appropriate (ICRAF authors from a range of countries)	CCAFS-funded, 2 CCAFS authors and 8 other CGIAR authors out of 12	A very well-designed and clear study based on systematic review of NCs and NDCs. The conclusions are clear and compelling, that agroforestry is included widely in national policy documents such as NDCs and NAMAs, but that this is not reflected in MRV systems and quantitative estimates of carbon sinks. Four clear and useful recommendations are set out that will be of relevance to national and international policymakers and those who manage national climate data collection.
4	Evaluating agricultural weather and climate services in Africa: evidence, methods and a learning agenda, *WIRes Climate Change*	6.099	High	4	Moderate	High	Involving authors from African countries would have been preferable	FPL and one other CCAFS author out of 5	A clear and informative study, reviewing relevant evaluations in both the peer-reviewed and the grey literature, which was appropriate for the task. Comparative findings well-presented, quantified where appropriate, with qualitative dimensions explored. Clear recommendations for design and conduct of future evaluations. Relevance regionally restricted to Africa, but this is explicit.
4	Gender and climate risk management: evidence of climate information use in Ghana, *Climatic Change*	4.134	High	2	Moderate	Moderate	Appropriate (mainly authors from African countries)	CCAFS-funded, 5 CCAFS authors out of 7	A decent village-level empirical study with a large sample and good use of statistics. Important as an innovative look at gender and climate information services but lacks any novel insights or clearly expressed implications for CIS design.

FP/ LP	Journal article	Journal IF	Appropriateness of journal	Relevance	Originality	Rigor	Co-author-ship	CCAFS Contribution	Overall quality summary
4	Experimental evidence on the drivers of Index-Based Livestock Insurance demand in Southern Ethiopia, *World Development*	3.869	High	4	High	High	Japanese and US authors, no authors from African countries	Partially CCAFS-funded, 1 CGIAR author out of 4	A highly original piece of experimental economic research on the important topic of Index-Based Livestock Insurance (IBLI). Well executed and presented, though some of the discussion could be more accessible to non-specialists. Novel and highly relevant findings that a) understanding of IBLI does not necessarily increase uptake b) time-limited discounts increase uptake without lowering price expectations in the longer term and c) education level of household head is negatively correlated with IBLI uptake.
5	Addressing gender in agricultural research for development in the face of a changing climate: where are we and where should we be going? *International Journal of Agricultural Sustainability*	2.278	High	4	High	High	Appropriate	CCAFS-funded, 7 CGIAR authors out of 9	A well-designed review of a large body of survey-based research based on CCAFS target sites, analyzed against a well-presented conceptual framework, and used to revise that framework and resulting questions. A number of specific findings on gender and climate change are identified, but most importantly, strong arguments are made for context-specific, mixed qualitative-quantitative research approaches including action-research. Highly relevant for future researchers and research managers.
5	Does a Climate-Smart Village approach influence gender equality in farming households? A case of two contrasting ecologies in India, *Climatic Change*	4.134	Moderate (article is poorly text-edited)	2	High	Moderate	Appropriate, all but one author are Indian nationals	CCAFS-funded, all authors are CIMMYT staff	Interesting quasi-experimental design with well-argued choice of indices, but the article is hard to follow, and does not present clear and usable conclusions.
5	Gender-responsive rural climate services: a review of the literature, *Climate and Development*	2.405	High	3	Moderate	High	All authors are North America-based	CCAFS-funded, 3 out of 4 authors are core	A structured review with explicit inclusion criteria for studies reviewed. Several highly relevant conclusions for implementation of more gender-responsive climate services, and for future research.

FP/ LP	Journal article	Journal IF	Appropriateness of journal	Relevance	Originality	Rigor	Co-authorship	CCAFS Contribution	Overall quality summary
								CCAFS staff	
6	Urgent action to combat climate change and its impacts (SDG 13): transforming agriculture and food systems, *Current Opinion in Environmental Sustainability*	5.658	High	3	Moderate-high	Moderate	Appropriate	CCAFS-funded, 3 CCAFs authors and 1 other CGIAR author out of 6	A well-structured and well-referenced discussion piece, with effective graphics. Original content on optimum N-use is not sourced and Figure 3 is less effective in communicating options for policy change. Relevance to users moderate to low.
6	Facilitating change for Climate-Smart Agriculture through Science-Policy Engagement, *Sustainability*	2.576	High	3	High	High	Appropriate	CCAFS-funded, 10 CCAFS authors and 2 other CGIAR authors out of 16	A well-written study, using a transparent method to identify and interrogate CCAFS case studies. Conclusions are not highly novel but are effectively and usefully presented. Relevance to users moderate to high.
6	Food and earth systems: priorities for climate change adaptation and mitigation for agriculture and food systems, *Sustainability*	2.576	High	2	Moderate	Moderate	Appropriate	CCAFS-funded, 6 CCAFS authors out of 6	A very well-referenced review, though without any explicit rule for including or interrogating references. Discussion of CSA sidesteps definitional debates. Conclusions are not highly novel. Relevance to users low.

Annex Table 6.5: Assessment of the quality of ad hoc selected CCAFS technical publications and communication products

FP	Publication Type	Publication	Quality	Comments, including relevance to next stage users
All	Free-standing multi-donor report	Actions to Transform Food Systems under Climate Change	High	A high-level 60pp. synthesis, authored by senior leaders of international organizations, of a large body of CCAFS and other research findings. Clearly drafted with impressive visuals, and systematic presentation of eleven actions across mitigation and adaptation, with "what", "why" and how for each, but "how" sections under each action, are inevitably broad, and priorities for each class of stakeholder (countries, researchers, businesses etc.,) are inevitably very broad. More for general awareness raising of issues and options than a communication of priorities to specific audiences
All	Freestanding report by CCAFS and KOIS, a socially responsible investment form	Financing the Transformation of Food Systems Under a Changing Climate	Very High	An impressive synthesis of work on financing food system transformations, clear and comprehensible to those outside the finance sector. Three categories of current market failure are identified, with three broad strategies to counter then set out in detail, followed by a summary of short-, medium- and long-term strategies for governments, philanthropic donors, responsible investors and other corporate actors. Original and of high utility for investors and governments.
2	Freestanding guidance published by WBCSD	Smarter metrics in climate change and agriculture: Business guidance for target-setting across productivity, resilience, and mitigation	High	A guide very much targeted to businesses ("this...Guide helps your company understand and set targets for CSA"). Sets out a lot of information on CSA concepts and terminology. Fairly detailed advice on setting CSA targets for companies with different roles in the value chain. Good list of additional resources and some useful visuals such as decision trees.
2	Freestanding Guide	Climate-Smart Agriculture Investment Plan Development Guide: From Concept to Action	High	A guide to the process of developing CSAIPs, which could be very useful as an aide memoire to those involved in organizing or facilitating such a process, i.e. there are sections on stakeholder engagement, facilitation, collective scoring/ranking of priorities and actions etc. Good links to more technical material on climate change, CSA, and investment.
All	Working Paper	Changing diets and transforming food systems	Very High	A collection of short papers by various authors. Wide-ranging in terms of disciplines and topics including dietary history, lessons from high-income countries, discussion on different interpretations of transformation, and the role of social movements. Genuinely innovative and interesting in setting research agendas and the context for more policy-oriented pieces.
2	CSA Country Profile	Climate-Smart Agriculture in Ethiopia	Moderate	One of a series of 34 country profiles on the context for climate-smart agriculture and the main practices already adopted, the Ethiopia profile being jointly prepared with USAID's Feed the Future program. The text is too wordy to be easily accessible, although there are good visuals for ongoing CSA practices. While the technical information presented on climate-smart practices applied to major food crops is good, coverage of cash crops such as coffee and khat is poor. The issues of livestock and pastoralism are inadequately discussed, with some extremely questionable statements and vague descriptions of complex issues like veterinary services improvement. Nutritional issues and the different distributions of stunting and wasting are inadequately discussed. The institutional section is crowded with acronyms but fails to cover properly the mandates of Regional Governments, or the issues around the Agricultural Transformation Agency.

FP	Publication Type	Publication	Quality	Comments, including relevance to next stage users
3	Freestanding Guide published by FAO and GRA, based on CCAFS materials	Livestock Activity Data Guidance (L-ADG): Methods and guidance on compilation of activity data for Tier 2 livestock GHG inventories	Very High	Guide clearly targeted to "inventory experts with no livestock expertise and livestock experts who may be unfamiliar with the IPCC Guidelines on GHG inventory compilation". Very clear and systematic in presentation, with extensive use of decision-trees, information boxes and an extensive system of hyperlinks both between sections of the text and to external documents e.g. UNFCCC decisions. The guide is based on a number of other CCAFS-funded or CCAFS-published outputs, notably the 177 pp. "Tier 2 inventory approaches in the livestock sector: a collection of agricultural greenhouse gas inventory practices", based on a review of GHG inventory submissions by 63 countries that were using the Tier 2 approach by 2017.
4	Policy Brief	Participatory agro-climate information services: a key component in climate resilient agriculture	High	A concise, readable, and visually attractive policy brief based on research with women farmers and ethnic minorities in SE Asia. Good presentation of constraints experienced, key impacts, lessons learnt and brief recommendations.
4	USAID/CCAFS Report	Options de Modèles d'Affaires pour assurer la Durabilité de l'Utilisation des Services d'Information Climatique au Sénégal	High	Short project report clearly setting out four alternative business models for increasing the sustainability of climate information services in Senegal, and thus preparing the way for testing of these as pilots. Good visuals.
4	CCAFS website news item	Services d'informations climatiques au Sénégal: de l'espoir pour leur pérennisation	Good	Good short news item presenting quantified outcomes of the CINSERE project and reporting on a stakeholder workshop. Good use of quotes from USAID Country Director, Senegalese policymaker and female farmer
3	Policy Brief of national body	Innovative Viable Solution to Rice Residue Burning in Rice-Wheat Cropping System through Concurrent Use of Super Straw Management System-fitted Combines and Turbo Happy Seeder	Good	Policy Brief published by the National Academy of Agricultural Sciences, India, with strong CCAFS input. Brief clear discussion of the residue-burning problem, agronomic and financial advantages of the Happy Seeder Technology, business models for its promotion, and outline recommendations for State governments, manufacturers, and other stakeholders.
3	CIMMYT press release	Happy Seeder can reduce air pollution and greenhouse gas emissions while making profits for farmers	Moderate	Press release announcing publication of the "Fields on Fire" article in *Science*. Could have explained the underlying problem more clearly.
1	CCAFS Info Note	Exploring Opportunities around Climate-Smart Breeding for Future food and nutrition security	Good	Brief clear info note setting out context for climate-smart breeding, linked to a CCAFS workshop, and referencing CCAFS and other research findings. Good visuals on proportion of cropped areas requiring transformational change by crop and by RCP.
3	CCAFS Info Note	Enhancing Nationally Determined Contribution (NDC) ambition for soil organic carbon protection and sequestration	Good	Brief clear info note setting out challenge of non-inclusion of soil organic carbon in NDCs with recommendations for governments to develop soil carbon targets, and link national efforts to NDCs. Good in drawing attention to an obviously under-discussed topic

FP	Publication Type	Publication	Quality	Comments, including relevance to next stage users
2/3	CCAFS Info Note	Minimum emission pathways to triple Africa's cereal production by 2050	Moderate	Brief info note summarizing three CCAFS research studies. Title slightly misleading as only one study has emissions as a central theme. Argument is fairly dense but issues around land expansion vs intensification emerge clearly. Some very brief and broad recommendations
2	Magazine article	"CSA-Plan": strategies to put Climate-Smart Agriculture into practice	Moderate	One article in a special issue of *Agriculture for Development*, the magazine of the UK Tropical Agriculture Association, guest-edited by CCAFS leaders on the topic of Climate-Smart Agriculture. This article introduces the CSA-Plan but is rather wordy and diffuse in its argument
All	Briefing	Transforming Food Systems Under a Changing Climate: Adaptation and development pathways for different types of farmers: key messages	Good	A very short stand-alone briefing based on a Working Paper that fed into the "Actions to Transform Food Systems under Climate Change" report. Good visuals, good focus on concepts of transformation, with acceptance that the most viable pathway for some will be to leave agriculture, and disruptive actions including vertical farming, universal basic income, and alternative protein sources.

Annex 7: Financial Analysis

Annex Table 7.1: Actual expenditure by Flagship and funding window 2017-2019

	2017 Actual						2018 Actual						2019 Actual					
	W1/ W2	as % of FP	**W3/ Bil.**	as % of FP	**Total**	FP as % of total	**W1/ W2**	as % of FP	**W3/ Bil.**	as % of FP	**Total**	FP as % of total	**W1/ W2**	as % of FP	**W3/ Bil.**	as % of FP	**Total**	FP as % of total
FP1	3,361	32.5	6,977	67.5	**10,338**	18.5	3,687	33.8	7,221	66.2	**10,908**	21.2	3,708	23.9	11,824	76.1	**15,532**	28.9
FP2	5,061	22.7	17,236	77.3	**22,297**	40.0	5,105	27.6	13,415	72.4	**18,520**	36.0	4,821	32.4	10,078	67.6	**14,899**	27.8
FP3	4,223	39.3	6,535	60.7	**10,758**	19.3	4,462	36.0	7,917	64.0	**12,379**	24.1	3,777	38.6	5,996	61.4	**9,773**	18.2
FP4	3,312	34.2	6,374	65.8	**9,686**	17.4	3,182	41.2	4,537	58.8	**7,719**	15.0	3,202	27.6	8,420	72.4	**11,622**	21.7
Mgt & Support	2,252	83.7	437	16.3	**2,689**	4.8	1,888	100.0	0	0.0	**1,888**	3.7	1,923	104.3	-80	-4.3	**1,843**	3.4
Total	18,208	32.7	37,559	67.3	**55,767**	100.0	18,323	35.6	33,090	64.4	**51,413**	100.0	17,431	32.5	36,238	67.5	**53,668**	100.0

Source: CCAFS Annual Reports

Figures for actual expenditure by CCAFS Flagships 2017-2019, taken from CCAFS Annual Reports, are given in Annex 7. Annual Reports also include annual budget figures, which are higher, but not generally greatly higher, and the following discussion focusses on Outputs.

The main trends visible in these figures are, by Flagship:

FP1: An increase in the absolute amount of funding, mainly driven by a significant increase in Window 3/Bilateral funding in 2019, with an increase in FP1's proportion of total expenditure.

FP2 A decrease in the absolute amount of funding, mainly driven by a decrease in Window 3/Bilateral funding across the years, with a decrease in FP2's proportion of total expenditure.

FP3 A small decrease in the absolute amount and a decrease in FP3's proportion of total expenditure, despite a spike in Window 3/Bilateral funding in 2018.

FP4 An increase in absolute amount and proportion of the total, despite a dip in Window 3/Bilateral funding in 2018.

By Window:

- Window 1/Window 2 expenditure for FPs 1-3 increased slightly between 2017 and 2018, then decreased in 2019
- Window 1/Window 2expenditure for FP 4 decreased slightly between 2017 and 2018, then increased slightly in 2019
- Window 1/Window 2 expenditure has decreased in nominal terms by 4% between 2017 and 2019

- Window 3/Bilateral expenditure increased markedly for FP1, and more modestly for FP4
- Window 3/Bilateral expenditure decreased markedly for FP2, and more modestly for FP3.
- Window 3/Bilateral expenditure as a proportion of the total remained markedly constant over the three years.

Annex 8: Milestone Analysis

Overall, out of 104 milestones, 81 were achieved, 18 were extended, 1 was cancelled, and 4 were changed.

In 2017, out of 34 milestones, 23 were completed, 10 were extended and 1 was cancelled.

In 2018, out of 33 milestones, 26 were completed and 5 were extended.

In 2019, out of 37 milestones, 32 were completed, 3 were extended, 2 were changed.

Below we provide an assessment of milestone achievement compared with those that were planned. Green indicates successful completion, Orange indicates that the milestone was extended, Red indicates that the milestone was extended. A changed milestone is denoted in blue.

Flagship Program 1: Priorities and Policies for Climate Smart Agriculture

Out of 25 milestones, 21 were completed and 4 extended (3 in 2017 and 1 in 2018). The reasons for extension in 2017 were logistical or funding related. In the other two cases, the reason for the extension is unclear. 3 of the milestones that were extended were deemed low risk. Overall goal of FP 1 is to inform policy decisions informed based on sustained CCAFS engagement and information support, and integration of gender and social inclusion considerations.

Sub-IDO Increased capacity for innovation in partner development organizations and in poor and vulnerable communities *[measured by no. of policy decisions influenced].*

- One key milestone completed in 2017. The milestone - partner and national planner capacity strengthening to apply decision-support tools - was achieved through a series of capacity building events and national planner engagement influencing Subsidiary Body for Scientific and Technological Advice or SBSTA submissions (e.g. Ghana's submission on elements of the Gender Action Plan), sub-national plans in East Africa and ENSO activities, Southeast Asia.
- One key milestone completed in 2018 on training materials and workshop to strengthen capacity for scenario-based strategic planning and other targeted materials for partners was achieved through diverse contributions, including: training materials provision/dissemination on resilience building in several countries in Southeast Asia supporting National Adaptation Plans and Nationally Determined Contributions (NDCs); capacity strengthening on NDCs in West and East Africa; training for the African Group of Negotiators (AGNES) on gender mainstreaming in UNFCCC negotiations in West Africa; CSA planning / investment in coastal Asia; capacity strengthening for Cambodian Senate on climate change and national commitments; training materials and scenario-based strategic planning in Central American countries
- One key milestone completed in 2019. The first milestone - national decision-makers supported to develop CSA investment portfolios for international climate finance and awareness of 'good enough' enabling policy elements/barriers - CCAFS science and engagement has informed: diverse policies and programmes in Vietnam (e.g.); Myanmar's Climate-Smart Agricultural Strategy in turn shaping investment projects of value approximately USD 1 b); El Salvador government IADB loan proposal (USD 45 m) for climate resilience in coffee forests and digital CSA, and National Agriculture Policy; Honduras Agriculture and Livestock plan for climate change adaptation in agri-food sector; CCAFS and the Genebank Platform informed Philippines Department of Agriculture and Vietnam Regional Seed Cooperation Plan [AR 2019].

Sub-IDO Optimized consumption of diverse nutrient-rich foods [measured by no. of organizations and institutions in selected countries / states adapting plans and directing investment, and gender analysis]

- Two milestones were both extended in 2017; the milestone on developing / testing new multi-level CCAFS scenarios methodology was extended due to logistical challenges. The second milestone – use of CCAFS regional scenarios in multi-level policy development/implementation aimed at dietary diversity – was also delayed due to funding challenges [AR 2017].
- One milestone completed and one extended in 2018: the first milestone focuses on State of the art, multi-level scenarios methodology being tested was achieved through participatory scenarios work in all CCAFS regions informing policy with major policy outcomes and has a growing emphasis on food systems and food/nutrition security. Work on the International Model for Policy Analysis for

Agricultural Commodities and Trade or IMPACT[3] of IFPRI was undertaken to extend the analysis to livestock, fish, and nutrition. The second milestone focuses on the use of these climate and food/nutrition security scenarios including one country process to address gender dimensions was extended. Work began on a foresight mechanism for including gender and youth in Bangladesh and Ethiopia [AR, 2018].

- Three key milestones were completed in 2019; Two milestones were completed on combined climate, food/nutrition security scenarios developed/used for multi-level policy development (including in one country on gender dimensions via MEL systems). Achievements include the development and use of scenarios informed by food systems modelling. Participatory scenarios-based policy guidance work in all CCAFS target regions undertaken ensuring inclusion of gender and nutrition aspects (Bangladesh, Ethiopia). Foresight mechanisms used in relation to gender and youth issues and stakeholders. Models developed to assess climate impacts on different stakeholders, such as that produced by IFPRI (International Model for Policy Analysis for Agricultural Commodities and Trade or IMPACT[4]) including new livestock modules. Support given to the African Group of Negotiators Expert Support (AGNES) strategy meetings on climate and food security and gender implications (see the Deep Dive Analysis in Main Report Section 2.2.2, and Annex 14). One milestone was completed on methods to use multi-level, multi-driver scenarios in food/nutrition security policy and implementation at national and sub-national levels and gaming tools for youth engagement [AR 2019]. Achievements include diverse methods have been advanced, for example, how to develop scenarios and using models and scenarios, and gaming tools [AR, 2019].

Sub-IDO: Improved forecasting of impacts of climate change and targeted technology development *[measured by the no. of countries / states where CCAFS priority setting is used to target and implement interventions to improve food and nutrition security under a changing climate].*

- Two milestones were completed in 2017: The milestone was two modified versions of global and regional models to evaluate climate smart practices and technologies tested. This was achieved through the continued updating of the IFPRI IMPACT model and its use to evaluate CSA options and was employed in all CSA country profiles. RHoMIS dataset used in several African countries to create models and assess trade-offs, and a CCAFS-based CSA prioritization model is being used in India. Cross-CRP modes of operation defined (second milestone) was achieved through a special issue on foresight analysis in Agricultural Systems.
- Two milestones were completed in 2018: Global and regional models are applied in two countries (cross-level, cross-sector, and cross-CRP analyses, integrating other scale datasets) was achieved with contributions in six countries via: Bhutan (strategic vision document for agriculture), Nepal and India (investment plans for specific states), and Mali and Cote d'Ivoire on WB-led climate smart investment plans. The second milestone focused on country level recommendations for policy alternatives developed to identify robust climate smart strategies (addressing priority setting and trade-offs) was achieved through contributions to Colombia's Green Growth Policy and support for the Central American Agricultural Council's (CAC) implementation of their CSA strategy; facilitating alignment of medium term plans of FAO, the Colombian Agriculture Institute (ICA) and Economic Commission for Latin America and the Caribbean to support the implementation of the CAC CSA strategy. The CCAF's-informed IFAD Gender Transformation framework was used in one country and this is expanding to other countries.
- Two milestones were completed in 2019: The first focused on new priority setting frameworks for transformational food system interventions. Situation analyses led by IFPRI in Ghana, Ethiopia, Malawi, and Uganda informed IFAD priority setting to mainstream gender, youth, nutrition, and climate change. Additionally, priority setting was informed on food and nutrition security at different scales, from global (Global Commission on Adaptation resulting in the set-up of the Food Security Action Track), national (climate-proofing World Bank investment projects; climate-smart investment plans), and sub-national (climate-smart investment plans). The second milestone on feeding country level recommendations on climate-smart food systems at national and state level policy processes were achieved through the development of CSA profiles and investment plans (CSAIPs) to inform national investment initiatives in 6 African countries or states, such as Seychelles, Guinea Bissau. Future scenario methods used in four Central American countries to

[3] http://tools.foodsecurityportal.org/impacts-alternative-agricultural-investments-version-9
[4] http://tools.foodsecurityportal.org/impacts-alternative-agricultural-investments-version-9

support prioritization of CSAIPs feeding into national policies. A CSA gender guide informed a Guatemalan rural extension network.

Sub-IDO: Gender-equitable control of productive resources *[measured by no. of national/state institutions adapting their plans and directing investment to increase women's access to and control over productive assets and resources].*

- One milestone was completed in 2017: Comparative analysis of enabling policy environments and gender equity/social inclusion was achieved through a study on East Africa gender policy gaps, another on Uganda gender gaps in climate policy, and a study on community seed banks and gender [AR, 2017].
- One milestone was completed in 2018: on 'GSI focused components in CSA priority setting developed and tested and development/testing of improved modules for gender and sex-disaggregated output data from the integrated assessment models. This was achieved through engagement to inform national (Guatemala, Honduras) and regional (CAC) policy agendas. Support to the Africa Group of Negotiations on submissions to the UNFCCC (see Deep Dive). Promotion of the role of women in the governance of community seed banks being advanced by the South African Department of Agriculture. Additionally, support for gender mainstreaming in climate policy (Uganda, Ethiopia), innovative gaming work (COP participants, youth) and identification of barriers to gender inclusion in policy processes have contributed [AR, 2018].
- One milestone was completed in 2019: The milestone 'synthesis and comparative analysis of the inclusion of GSI in CCAFS scenario processes' was not completed as stated, but various activities are feeding into a synthesis on appropriate indicators and mechanism for tracking progress against CCAF gender policy sub-IDOs. A visiting CCAFS fellow informed six IDRC projects. A Transformation Framework for IFAD conceptualizes gender, youth, nutrition, and climate change,[5] but has wider applicability [AR 2019]. Support for the Ministry of Agriculture, Guatemala to develop a guide to facilitate the implementation of the CSA Regional Strategy and the Rural Women Agenda [AR, 2019]. In 2020, a draft chapter has been produced for an upcoming CGIAR Gender Platform book,[6] which synthesizes findings and case studies from CCAFS work in Phase II, plus a publication with CARE on 'Gender Transformation in Adaptation',[7] which includes two CCAFS case studies, and guest editing of a special issue on 'Climate Change on Gender Equality and Climate Smart Agriculture', covering labor-reducing technologies, an adaptation of the Women's Empowerment in Agriculture Index (WEIA) for CSA, and an analysis of Tanzanian and Ugandan climate policy.[8]

Sub-IDO: Enabled environment for climate resilience *[measured by USD new investments by state, national, regional, and global agencies, informed by CCAFS science and engagement].*

- One milestone was extended, and one was achieved in 2017: A milestone on novel analytical frameworks, indicators and metrics was delayed due to a request contribute to African Union country adaptation scorecards. The second, focused on science-policy exchange, stakeholder fora and learning alliances was completed as a series of dialogues were held in countries, such as Ghana and Uganda, and a webinar sharing lessons across regions (AR 2017].
- Two milestones were completed in 2018: The first milestone – 'novel tools used in comparative analyses of climate food / nutrition security policy etc.,' was completed via various achievements including new climate risk maps and tools, Southeast Asia, and Multi-stakeholder platforms for creating an enabling climate change policy environment in East Africa. The second milestone – 'development and dissemination of 'good enough' enabling policy environments etc' – was achieved through informing World Bank investment design and implementation in more than 20 low income countries (approx. several hundred million dollars of the overall WB portfolio[9]) and 45% of budgets focused on climate-resilience and mitigation actions, with CCAFS publication produced by P.

[5]https://cgspace.cgiar.org/bitstream/handle/10568/105556/Learning%20and%20action%20for%20gender%20transformative%20CSA.pdf
[6] "Advancing gender equality through agricultural and environmental research: past, present and future"
[7] "Gender Transformative Change: From Good Practice to Better Policy".
[8] https://link.springer.com/journal/10584/158/1
[9] https://hdl.handle.net/10568/101137

Kristjanson (2019) exploring how CCAFS has informed World Bank investments. A six-part action plan to transform food systems under climate change was published.[10]

- Two milestone were completed in 2019. The first milestone is to 'design MEL Frameworks to analyze and track climate-related policy design etc.' was achieved through support to diverse World Bank (WB) investment projects to mainstream CSA, including inputs to a CSA investment plan for Bangladesh (WB and other partners) informing loans of value USD 500m, and outputs on research methods for analyzing adaptation policy needs and implementation progress in Latin America and South Asia [AR, 2019]. On the second milestone, 'food/nutrition policy planning integrating climate change and local priorities etc.' has been achieved through the support to the WB projects. Initial has been given support to a new GIZ-funded Southern African Development Community (SADC) initiative for prioritizing agriculture and natural resource management investments in the members states, with the recommendation to mainstream climate change in the SADC Regional Indicative Strategic Development Plan 2020-30 was approved. Other key achievements relate to the Global Commission on Adaptation report and food action track, the informing of various Vietnamese MARD policies and programmes (see Deep Dive on relevant OICR) and the Myanmar Climate-Smart Agricultural Strategy, which has informed 19 government and civil society programmes, 4 policy documents and 19 investment projects (worth USD 1b). CSA promoted in Southeast Asia by the ASEAN Climate-Resilience Network [AR, 2019].

In summary, in terms of sub-IDO1, FP 1 has strengthened the capacity for innovation of partner development organizations and of poor and vulnerable communities. All milestones were delivered, and policies have been influenced. For example, work with the African Group of Negotiators (AGNES) has contributed to achieving consensus on Agriculture in the UNFCCC process and to the development of a Gender Action Plan. Other examples of CCAFS science and policy engagement strengthening capacity and informing decisions are national adaptation plans and Nationally Determined Contributions in Southeast Asia; scenario-based strategic planning for climate smart agriculture in Central America; informing Myanmar and Vietnamese policies on climate smart agriculture and investment projects.

On the nutrition sub-IDO, initially delivery was slow. Milestones were extended in 2017 due to funding challenges, but they have been delivered in later years and with a growing emphasis on nutrition and food systems more recently. A participatory, multi-level scenario methodology has been tested with IFPRI, and has informed policies in different countries on livestock, fish, and nutrition, and with a focus on gender dimensions in one country. On the sub-IDO focused on improving climate change impact forecasting and technology development, all milestones were delivered. Examples of achievements are the development of robust climate smart strategies to inform Colombia's Green Growth Policy and support for the Central American Agricultural Council's (CAC) implementation of their CSA strategy. Analysis of transformative food system interventions were undertaken. FP1 achieved influence over policies at global, national, and sub-national levels.

All milestones were completed for gender-equitable control of productive resources. Achievements include, *inter alia*, situation analyses of mainstreaming gender, youth, nutrition, and climate change to inform IFAD priority-setting, based on a transformation framework, support to AGNES (mentioned above), and informing regional (Central America) and national (Guatemala, Honduras, South Africa, Uganda, Ethiopia) policy agendas. Innovative work on gaming to engage youth on climate change issues also completed. Recently, synthesis work has been undertaken on gender and social inclusion in CCAFS scenario processes. In terms of achievement on creating an enabling environment for climate resilience, most milestones were completed, with extensive science-policy engagement, including stakeholder fora and learning alliances (Ghana, Uganda) and the establishment of multi-stakeholder platforms in East Africa. World Bank investments and project implementation was informed by CCAFS science via mainstreaming of CSA, informing loans of value USD 500 million and covering more than 20 low income countries. A six-part action plan to transform food systems under climate change was published in 2018.[11] Support has recently been provided to the Southern African Development Community (SADC) initiative for prioritizing agriculture and natural resource management investments in member states. The

[10] Dinesh D, Loboguerrero Rodríguez AM, Millan A, Rawe T, Stringer L, Thornton P, Vermeulen S, Campbell B. 2018. A 6-part action plan to transform food systems under climate change: Creative actions to accelerate progress towards the SDGs. CCAFS Info Note. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

[11] Dinesh D, Loboguerrero Rodríguez AM, Millan A, Rawe T, Stringer L, Thornton P, Vermeulen S, Campbell B. 2018. A 6-part action plan to transform food systems under climate change: Creative actions to accelerate progress towards the SDGs. CCAFS Info Note. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

recommendation to mainstream climate change in the SADC Regional Indicative Strategic Development Plan 2020-30 was approved. Engagement with the Global Commission on Adaptation has led to it creating a specific track on food action.

Flagship Program 2: Climate-Smart Technologies and Practices

Out of 30 milestones, FP2 has completed 24 milestones, with 6 being extended (4 in 2017). 1 of the extensions was categorized as low risk. Political insecurity was a challenge leading to one of the extensions. Another was extended as a publication was still being finalized.

Sub-IDO: Reduced production risks.

- One milestone was completed, one was extended: The first milestone – 'Synthesis reports on local-level enabling environment etc.' was extended. Good progress was achieved on climate risk profile development to inform CSA investments (Kenya), on guiding CSA for agribusiness in South Africa, use of UTFI by Uttar Pradesh government, SPICE adopted by Government of India etc. Synthesis reports were planned for 2018. The second milestone – 'Lessons learned and knowledge products...etc.' was completed, with multiple studies in all 5 target regions. For example, cost-benefit, adoption studies in CSVs (Senegal, Niger, Mali, Ghana, Burkina Faso), with cost-effectiveness assessment of the top ten CSA options and adoption rates assessed.
- Two milestones were completed in 2018: The first milestone – 'CSA technologies/practices successfully scaled-out in 1000 out-scale sites...etc.' was completed with agreements by three state actors in India to scale the CSV approach (residue management targeting 2 million farmers) and 2.3 million farmers receiving CSA adoption incentives via an UTZ certification scheme. The second milestone – 'Climate sensitive extension schemes...etc.' was completed, with training materials developed (coffee and cocoa in multiple countries), mobile application releases (Uganda) and climate specific advisories reaching 500,000 farmers in Latin America.
- Two milestones were completed in 2019: The first milestone – 'State of the art on successful business models for the best-bet CSA options...etc.' was completed, with a multiplicity of outputs reported, such as a literature review of business models and CSA, with fieldwork in Southern Africa on four business models, gathering of African CSA studies in the ERA database etc. The second milestone – 'Key factors influencing CSA performance identified to improve extension services peer reviewed journal articles...etc.' was completed, again with multiple outputs, such as the adoption of climate-smart aquaculture in North Central Coast of Vietnam, credit use-incentives-CSA adoptions relationships, climate-smart cocoa farmer segmentation tool and stepwise investment pathway. The second milestone – 'Synthesis of research on business models...etc.' was extended. Progress was made with publication of a poster, book chapter, journal article and info note, but a further journal was still in development.

Sub-IDO: Improved access to financial and other services.

- One milestone was completed, one was extended in 2017: The first milestone – 'A shortlist of CSA technologies, practices and services...etc.' was completed. Various CSA options trialed, and a shortlist of best bets prioritized for scaling in South Africa, with support from local authorities and the private sector. Potential business cases were selected, and value propositions considered. A trial in South Africa was taken up by local authorities. The second milestone – 'two pilots of widespread use of CSA practices in voluntary certification schemes...etc.' was extended. Good progress was made (e.g. four pilots in Ghana using CSA materials and advice with World Cocoa Foundation), but the merger of Rainforest Alliance and UTZ created an opportunity for greater scaling and this work was on-going. However, financial mechanisms were deemed challenging, although a collaboration with Root Capital was underway.
- Two milestones were completed, in 2018: The first milestone – 'Multi-stakeholder platforms established including representatives...etc.' was completed, with multi-stakeholder platforms established across West Africa target countries for CSA planning, science informing the World Cocoa Foundation multi-stakeholder platform and Peruvian Chamber of Commerce and influencing investment plans (Cote d'Ivoire, Mali). The second milestone – 'Range of innovative finance options...etc.' was completed, with a workshop with 12 Council of Smallholder Agricultural Finance members on climate and deforestation risk in loan due diligence, with scaling from Root Capital.
- One milestone complete and one extended in 2019: The first milestone – 'Engagement and building of new partnerships with public/private financiers...etc.' was completed, with partnerships with Adaptation of African Agriculture and World Bank, two national governments (Mali and Cote d'Ivoire), collaborations with investment vehicles (e.g. Althelia Biodiversity Fund in Brazil and with

UNEP. Micro-finance outputs explored inclusive finance and business models, and agricultural financing for cocoa, Ghana, to advance climate-smart cocoa, and a collaboration with Root Capital on micro-loan risk assessments. A partnership with the WBCSD began the development of an operational guide for corporate CSA target-setting.

Sub-IDO: Improved forecasting of impacts of climate change and targeted technology development.

- Two milestones were completed in 2017. The first milestone – '10 promising climate-smart water, crop-livestock-agroforestry practices and five value chains prioritized...etc.' was completed. More than 40 CSA options were tested in 20 countries (E.g. Optimizing yields of improved varieties of millet and sorghum under highly variable rainfall conditions using contour ridges in Cinzana, Mali). Climate smart practices also identified in Peru and Ghana and included in a Rainforest Alliance manual. The second milestone – 'Framework developed and validated to design, test and monitor transformative CSA crop-livestock-tree gender sensitive practices...etc.'. This was completed with a CSV Monitoring Plan developed for use in CSA evaluation activities across the CSVs, and its implementation piloted, and training provided. Diverse outputs reported.
- One milestone completed, and one extended in 2018: The first milestone – 'Structural and functional farm household and farming system typologies developed...etc.' was completed, with 94 CSA practices evaluated across the CSV network including 63 with gender dimensions assessed and 45 with mitigation potential. The second milestone – 'Participatory ex-ante scenario assessment conducted...etc.' was extended. Political insecurity in Nicaragua contributed to the delays.
- Two milestones were completed for 2019: The first milestone – 'Participatory ex-ante scenario assessment conducted to understand possible trajectories towards incorporation…etc.' was completed with a range of outputs. Participatory assessments include diverse outputs focus on climate-smart cocoa practices in Latin America and Caribbean, plus integration of PICSA with combinations of CSA options. Monitoring includes evidence from Latin American CSVs on practice adoption and gender.

Sub-IDO: Gender-equitable control of productive assets and resources.

- One milestone was completed and one extended in 2017. The milestone – 'Gender tailored CSA portfolios...etc.' has been completed. Numerous CSA options were being tested across the portfolio which are potentially positive in terms of gender equity (e.g. integrated crop management, and empowerment of women in climate smart dairy crop farming). Further, trials of biofortified potato with women and men were initiated (Burkina Faso), fruit trees introduced to benefit women in Senegal etc. The second milestone – 'Gender-disaggregated impact of CSA technologies and practices...etc.' was extended. However, multiple outputs are reported including a detailed monitoring system for CSVs in terms of gender-disaggregated data, and methods tested on intra-household gender dynamics, with piloting in two CSVs in Latin America and West Africa. There were plans to expand uptake in 2018 in other CCAFS regions.
- Two milestones were completed in 2018: The milestone – 'Evidence on the gender and youth related motivations, aspirations, opportunities, challenges, and associated benefits...etc.' was completed with a book produced[12]. The second milestone – 'Socially differentiated financial vehicles and incentive mechanisms identified...etc.' was completed. Testing was undertaken for an alternative financial delivery channel and a financial technology (CARE, SNV), and of financial instruments and impact investment via Root Capital amongst other partners.
- Two milestones were completed in 2019: The first milestone - 'Development organizations, private sector and sub-national initiatives testing CSA interventions...etc.' - was completed, with partnerships with diverse humanitarian organizations, funders and banks (e.g. IDRC, ADB, WFP, World Bank), financial institutions (e.g. Althelia Fund, Brazil) and NGOs (Heifer International), and value chain actors (e.g. Root Capital, Incofin, responsAbility) and a sustainable standard organization (Rainforest Alliance). The second milestone – 'Gender and youth tailored CSA information...etc' was completed, with application of the CSA Monitoring Framework across 11 countries, focusing on 5 gender indicators. A gender and ICT book chapter, peer review article and testing of a novel ICT technology (Geofarmer) also completed, amongst other outputs. Gender-

[12] Gender dimensions of climate change research for agriculture: Case studies in Southeast Asia" explores men and women farmers vulnerabilities and coping mechanisms or adaptation measures. Analysis of gender disaggregated CSA adoption trends in Tuma-La Dalia in Nicaragua.

disaggregated results of CSA monitoring shared online and widely promoted in Central America via the regional Agricultural Council and Council of Ministers of Women of the Central America Integration System (SICA) through webinars.

Sub-IDO: Increased capacity for innovation in partner development organizations and in poor and vulnerable communities.

- One milestone completed and one milestone extended in 2017: The first milestone - national policy and institutional frameworks analysis focusing on different options...etc' was completed, with multiple outputs covering Vietnam, Myanmar, Philippines, India and Colombia. An example is the inputs to the Government of India's new USD 1.25 billion scheme to implement solarization of farm irrigation. The second milestone – 'CSA knowledge products made available for partners etc' has been extended. Progress has been achieved on the draft compendium and one CSA X-Ray published.
- Two milestones were completed in 2018: The first milestone – '10 country profiles in SSA and South Asia developed...etc' was completed. CSA country profiles for 21 countries across sub-Saharan Africa and Asia had been completed. The second milestone – 'New CSA knowledge products...etc' was also completed, with the upgrading of the African Compendium Dataset, ready for publication in 2019.
- Two milestones were completed in 2019: The first milestone – 'Development of best-fit evidence-based CSA practices...etc' was completed. Public and private sector collaborations focused on cocoa actors in Ghana (World Cocoa Foundation, licensed buying companies, COCOBOD etc) on developing a Climate Smart Cocoa Manual, which is now integrated into the Climate Smart Cocoa Standard. Governmental capacity strengthening involved collaborations in Guatemala and with regional Central American entities, including a gender CSA guide, plus engagements in Philippines, Laos, Vietnam, Myanmar and Cambodia influencing government programs and policies. Finally, cooperatives in Guatemala and Honduras partnered with CCAFS on CSV approaches.

In summary, the milestones indicating a contribution to the sub-IDO on reducing production risks, were all completed on time, except for one which was delayed, because a synthesis report was still planned. A wide range of achievements are reported. Examples include; agreement to scale out CCAFS promoted residue management in three Indian states; uptake of CCAFS science by UTZ, a sustainability standard, linking farmers to incentives for CSA production; improving coffee and cocoa extension through provision of CSA training materials, release of mobile phone applications (Uganda) and climate specific advisories reaching 500,000 farmers in Latin America. Best bet CSA options have been identified and disseminated, such as the gathering of African CSA studies in the Evidence for Resilient Agriculture database.

Milestones relating to the sub-IDO improving access to financial and other services have been completed, with two extensions – one due to the merger of two sustainability standards which changed the nature of the opportunity open to CCAFS and requiring an adaptation of approach. FP2 has supported the identification and prioritization of best bets with local authorities in South Africa, supported pilots in Ghana using CSA materials with the World Cocoa Foundation multi-stakeholder platform, engagement with the Peruvian Chamber of Commerce, informing investment plans in Cote d'Ivoire and Mali. Latterly, the program has engaged with the World Bank and Adaptation of African Agriculture and also provided a contribution to the establishment of the Althelia Biodiversity Fund, Brazil. Micro-finance outputs explored inclusive finance and business models, a collaboration with Root Capital on micro-loan risk assessments, as well as the climate-smart cocoa work which explores agricultural financing incentives. Partnership with the World Business Council on Sustainable Development (WBCSD) led to the creation of an operational guide for corporate CSA target setting.

To improve climate change impacts forecasting and develop targeted technology (sub-IDO), FP2 has undertaken climate-smart cocoa practices in Latin America and the Caribbean, supported the integration of PICSA with combinations of CSA options, identified gender dimensions of CSA in Latin America, However, there were early delays on one milestone due to political insecurity in Nicaragua. 40 CSA options were tested in 20 countries (AR, 2017). An example of a technology tested by FP2 is optimizing yields of improved varieties of millet and sorghum under highly variable rainfall conditions using contour ridges in Cinzana, Mali. 94 CSA practices were evaluated across the CSV network including 63 with gender dimensions assessed and 45 with mitigation potential (AR, 2018).

Milestones on gender-equitable control of productive assets and resources (sub-IDO) were all completed, except for one extension. Of the large numbers of technologies and practices being tested by CCAFS, a large number were also assessed specifically in terms of gender equity. Farm trials with women and men were undertaken on biofortified potato (Burkina Faso) and fruit trees introduced to benefit women

(Senegal). Progress has been achieved on developing a monitoring system for the Climate-Smart Villages (CSVs) where the technologies are tested, to generate relevant analysis on 5 indicators and gender-disaggregated data, which was developed, piloted and is now being scaled up in 11 countries. Testing of different financial vehicles and incentive mechanisms unpacked the gender dimensions with partners. Diverse publications have been produced. The gender-disaggregated results of CSA monitoring has been shared online and widely promoted in Central America via the regional Agricultural Council and Council of Ministers of Women of the Central America Integration System (SICA) through webinars.

To increase capacity for innovation amongst partners and poor and vulnerable communities (sub-IDO), all milestones were completed, with one extension which was later completed. National policy and institutional frameworks have been influenced in many countries (e.g. Vietnam, Myanmar, Philippines, India, Guatemala, Colombia, Cambodia, Laos, Honduras). For example, the Indian Government has used CCAFS science in developing a major new solarization of farm irrigation scheme. CSA country profiles were completed for 21 countries in sub-Saharan Africa and Asia. The African Compendium Dataset was published in 2019. Best-fit CSA solutions have been shared with public and private sector collaborations in the cocoa sector and related multi-stakeholder platforms, informing a new national cocoa climate standard in Ghana. As well as national level capacity strengthening, FP2 has successfully influenced regional entities in Central America, which has cascaded into further national level policy-influencing.

Flagship Program 3: Low Emissions Development

Out of 24 milestones, 18 were completed, 3 were extended, 2 were changed and 1 was cancelled. In 2017, 1 was cancelled, 6 were completed, and 2 were extended. In 2018, 7 were completed, and 1 extended. In 2019, 2 were changed, and 6 completed. Of the 24 milestones, 3 were designated high risk. 1 was completed and 2 were changed. Of those designated medium risk 2 were completed and 1 was extended. 10 were categorized as low risk and all were completed. Figures on risk were not requested/reported for 2017 – 1 was cancelled, 6 were completed and 2 were extended.

Sub-IDO: More efficient use of inputs

- One milestone was completed, and one milestone was extended in 2017: The first milestone – 'Network of trial sites for more efficient management options for fertilizer, feed, water and land use in five to eight countries' was successfully completed as trials were established in Kenya (livestock and mixed crop-livestock systems), Colombia / Brazil (pasture restoration), East Africa (N-fertilizer management), Sub-Saharan Africa (biochar), and Vietnam (AWD, rice straw). A linkage with the CRP WLE led to trials on soil carbon sequestration. The second milestone was extended: 'Identification of Food Loss and Waste (FLW) opportunities for LED and commercially viable interventions in priority product value chains' was partially completed with the identification of priority value chains.' No reason is given for the extension.
- One milestone was completed, the second milestone was extended in 2018: The first milestone – 'Analysis of LED (livestock systems, rice, fertilizer) synergies with food security development and suitability etc' was completed. Diverse assessments were made of AWD in Southeast Asia, livestock in Kenya and Colombia, and fertilizer use in India, as well as gender studies. However, the second milestone – 'Identification of FLW opportunities for LED etc' was not completed due to poor performance of WUR staff member, although they were then replaced.
- One milestone was changed and one completed in 2019: The first milestone – 'Analysis of the causes of FLW in priority value chains and related drivers of emissions reductions' was changed. Earlier poor performance and staff changes were the cause of being behind schedule. The priority of FLW value chains was condcuted, but the causal analysis wasnot completed. The milestone was changed to refocus on the analysis of priorities for low emission finance initiatives (e.g. design of agriculture blueprint for World Bank, IFAD report on GHG footprint of their portfolio etc).

Sub-IDO: Land, water, and forest degradation (including deforestation) minimized and reversed

- One milestone was cancelled in 2017: The milestone 'Framework for institutional innovation and monitoring to enhance performance of cattle farming in Brazil' was cancelled due to budget cuts.

Sub-IDO: Reduced net GHG emissions from agriculture, forests, and other forms of land-use

- One milestone was extended and two were completed in 2017: The milestone 'Analysis supporting more ambitious INDC targets and resource guide to LED available to investors, donors and country partners with analysis including gender implications' was extended. The reason is not explained, but multiple substantial outputs are reported, such as provision of hotspots and suitability maps to national NDC planners and USAID project designers; methodological development for AWD suitability mapping). The second milestone 'Improved emission factors and estimation models for smallholder emissions for incorporation into LED planning and prioritization tools' was completed involving, for example, key report for the UNFCCC on MRV of livestock emissions. The third milestone – 'Mitigation hotspots and priorities by sector and country' was also successfully completed. As well as hotspots, priorities and suitability maps (mentioned above), nutrient gap mapping informed fertilizer companies and the public sector on minimal nitrogen use, and GHG footprints for major commodities in India were mapped.
- Two milestones were completed in 2018: The milestone 'Technical and policy guidance to focus countries, supply chains and donors for LED priorities etc.' was completed with a multiplicity of outputs, at global level (e.g. an MRV web-based platform informing IPCC 2019 refinement and land report, guidance on livestock, LED standards for Climate Bonds Initiative etc), nationally (e.g. blueprint to upscale AWD in Vietnam, Upscaling low emission livestock in Colombia etc) and at provincial levels (e.g. guidance for Tier 2 MRV of livestock at provincial levels China; guidance on LED standards in dairy, China; LED priorities, Mexico etc.,).
- Three milestones were successfully completed in 2019: The first milestone – 'Piloting of economic and social incentives to adopt mitigation practices' was completed for paddy rice (Vietnam), improved livestock feed investment case (Kenya) and on gender issues (Kenya, Vietnam). The second milestone – 'Proof of concept of mitigation practices for N management etc.,' were completed for various technologies e.g. AWD rice (Vietnam), Livestock (Colombia, Kenya), Nitrogen in maize (sub-Saharan Africa). The third milestone – 'Improved options for global donors to support LED. Etc.,' was completed, with inputs to East African NAMAs, hay production, gender in dairy and low emissions livestock, extension opportunities, amongst others.

Sub-IDO: Improved capacity of women and young people to participate in decision making

- One milestone was completed in 2017: 'Gender-disaggregated data on social factors influencing uptake of LED practices for rice and livestock' was successfully undertaken, including studies on women's participation in paddy rice and the potential of AWD, gendered impacts of high and low N-fertilizer in India, gender issues in livestock management in Colombia, and increasing equity in maize producing households. 6 of 11 climate and food scholarship students were women (CLIFFS-GRAD program of CCAFS and the Global Research Alliance on Agricultural Greenhouse Gases.
- One milestone was completed in 2018. The first milestone – 'Comparison of LED-related livelihood options for women and their mitigation co-benefits' was completed with recommendations produced for gender in dairy and low emissions livestock.
- One milestone was changed in 2019: The first milestone – 'LED monitoring systems incorporate indicators of women's and men's participation and benefits.' FP3 focused on informing World Bank project designs on intersectionality along lines of gender and youth, with plans to addressing monitoring indicators later, because of a perceived lack of prioritisation of gender monitoring indicators at national level. This was identified as a high-risk milestone. Other achievements are reported (Kenya Dairy Development Board Gender Strategy), as well as a focus on youth (training partnerships, Colombia).

Sub-IDO: Increased capacity for innovation in partner development organizations in poor and vulnerable communities

- Two milestones were completed in 2017: The milestone – 'Flagship knowledge products made available for partners including Mitigation Option Tool, etc.,' was completed, with contributions to the cross-CGIAR SAMPLES platform which supports developing countries to measure GHG emissions from agriculture and identify mitigation options compatible with food security, online publication of the Mitigation Option Tool (CCAFS-MOT), and the livestock MRV report for UNFCCC (mentioned above). A second milestone – 'Agricultural LED readiness indicators' was met, with the publication of such indicators, a WUR workshop and journal article.
- Two milestones were completed in 2018: The milestone – 'MRV methodology for livestock available to partner countries' was completed for MRV in ruminants (Colombia), agroforestry (global),

livestock tier 2 (global). The second milestone – 'Improved emissions models and factors...and LED suitability maps' was completed with 20 new measured emissions factors and 118 reported emissions factors from the CCAFS Compendium added to SAMPLES online platform, plus a Global N database dashboard developed, paddy rice information kiosk, and training on metrics for the World Business Council on Sustainable Development (WBCSD).

- Two milestones were completed in 2019: The first milestone – '6–8 countries trained in scenarios analysis for LED planning and MRV methodologies' - was completed. Methods for estimating GHGs were advanced (121 new emission factors, 5 countries developing improved inventories, MRV recommendations for agroforestry etc). The second milestone - 'Global donors and agricultural development organizations informed of options to support LED and agricultural climate readiness' was completed involving, for example: design of agriculture sector blueprint for WB Transformative Carbon Asset Facility, Out-scaling blueprint for Vietnam donor presentations on LED options and MRV etc.

In summary, milestone delivery relating to the sub-IDO on more efficient use of inputs were largely delivered, but analysis of Food Losses and Waste for Low Emissions Development (LED) were ultimately not delivered due to poor performance of a partner researcher and subsequent staff turnover. This led the FP to change the milestone for 2019 to re-focus on the analysis of priorities for low emission finance initiatives, with collaborations with the World Bank on designing an agriculture blueprint and IFAD on their GHG portfolio footprint. Trials were successfully undertaken on more efficient management options for fertilizer, feed, water, and land use in different countries. For example, livestock and mixed crop-livestock systems were established in Kenya, pasture restoration (Colombia, Brazil), N-fertilizer management (East Africa), biochar (sub-Saharan Africa), rice straw and Alternate Wetting and Drying (Vietnam) and soil carbon sequestration (with WLE CRP).

Milestones pertaining to sub-IDO on reducing net agricultural, forest and land use GHG emissions, were all delivered, with one extension in 2017 (later completed). Hotspot and suitability maps have been provided to national NDC planners and USAID project designers, plus methodological development for AWD suitability mapping (2017). FP3 contributed to a key report for the UNFCCC on MRV on livestock emissions. Nutrient gap mapping informed fertilizer companies and the public sector on minimal nitrogen use. GHG footprints for major commodities in India were mapped. Global achievements include: 2019 MRV web-based platform informed IPCC refinement of a land report, guidance on livestock and emissions, and provision of LED standards for the Climate Bonds Initiative. Nationally, a blueprint to upscale AWD was developed for Vietnam, upscaling low emission livestock in Colombia, and guidance on LED standards in dairy (China), plus LED priorities (Mexico) were completed and contributions also made at provincial levels (on livestock, China) (2018). Piloting of socio-economic incentives for mitigation practice adoption involved paddy rice (Vietnam), improved livestock feed investment case (Kenya) and on gender issues (Kenya, Vietnam).

Milestones on improving capacity of women and young people to participate in decision-making (sub-IDO) were achieved, such as studies on women's participation and gender issues in paddy rice, AWD, high and low fertilizer use in India, livestock management in Colombia, dairy in Kenya, but due to a perceived lack of national demand for gender monitoring indicators, one milestone was changed to instead focus on informing World Bank project design from a gender and youth perspective, and to influence other entities where opportunities arose (e.g. Kenya Dairy Development Board Gender Strategy).

Partner and community innovation capacity strengthening (sub-IDO) milestones were all successfully completed, with contributions to the SAMPLES platform which enables developing countries to measure GHG emissions from agriculture and to identify food-security and mitigation compatible solutions. Methods for estimating GHGs were advanced – with 121 new emission factors identified, and 5 countries developing improved inventories. A Mitigation Options Tool (CCAFS-MOT) was developed and made available online, and Agricultural LED readiness indicators formulated. A Global N Database dashboard was developed, training on CSA metrics delivered to the WBCSD as well as other relevant outputs.

Flagship 4: Climate Services and Safety Nets

Overall, out of 24 milestones, FP4 completed 18 milestones, with 4 being extended and 2 being changed. The reasons for extension and changing are sometimes explained in the Annual Reports, but not always. In 2017, 6 were completed, and 1 was extended. In 2018, 4 were completed, and 2 were extended and 2 changed. In 2019, 8 were completed and 1 extended. Two of the milestones that were extended were deemed low risk, namely, milestone 'based on assessment of current FP4 project portfolio and opportunities, an adjusted project portfolio will target analyses and engagement to inform at least seven

additional policy decisions within three years' – however this is continuing and more progress is expected in 2020. The second milestone 'Building on FP4 investment in its design/launch, ongoing CCAFS East Africa engagement of the Climate Research for Development Africa initiative etc.,' has seen work extended into 2019, but the milestone was completed in 2019.

Sub-IDO: Improved access to financial and other services.

- Two milestones were completed in 2017: The first milestone – 'Flood insurance theoretical and institutional framework, tools, community of practice, public-private partnership model, and analysis of scaling potential in SA' was completed, with successful piloting of index-based insurance, India, pipeline initiatives set up by the World Bank, etc. The second milestone – 'Evidence from existing insurance initiatives, capacity development etc.,' was completed with uptake of CCAFS science in new insurance for approx. 25,000 cotton farmers in Senegal (with a company and West African Development Bank). Similarly, CCAFS tools and bundled insurance assessments results into agricultural insurance services (Nigeria, Malawi).
- One milestone completed and one changed in 2018: The first milestone – 'National/sub-national initiatives incorporate flood insurance products in DRR financing solutions etc.' was completed. Flood insurance was piloted in 17 villages, India (with IWMI) and adopted at state and national level in India (MoA Farmer's Welfare co-financing) and in a World Bank project (Assam). The second milestone – 'Scaling of weather-related agricultural insurance in West Africa' was changed, as Nigeria's FMARD had endorsed an insurance roadmap but changed strategy to partner elsewhere (ICRISAT) on insurance scaling.
- One milestone completed in 2019: The milestone – 'Expansion of improved weather index insurance etc.' was completed through a scaling of two insurance products to 11,000 farmers in South Asia (with IWMI), adoption of the flood insurance pilot by Green Delta insurance company in Bangladesh, contribution to analysis for a global insurance project, and collaboration with the Dutch Research Council on Uganda insurance, including a gendered risk spectrum analysis.

Sub-IDO: Enhanced capacity to deal with climatic risks and extremes.

- One milestone was completed in 2017: The milestone – 'National Meteorological Services (NMS) and regional climate institutions implement new climate information or climate-related early warning products etc'., was successfully completed. Four national (Senegal, Mali, Ghana, Rwanda) and two regional (ICPAC, AGRHYMET) bodies employed FP4 outputs. Advances were also made in West Africa (via Africa RISING project partnership on PICSA), USAID projects in Senegal, an ICT company (Northern Ghana) etc. Two provinces in Vietnam also incorporated FP4 science into agricultural advisory services.
- One milestone was completed in 2018: The milestone – 'National meteorological services and regional climate institutions implement new climate information or climate-related early warning products' was completed, with enhancing of the climate information provided by three entities (ICPAC, AGRHYMET, Meteo-Rwanda). The PICSA tool was adopted in 17 countries, radio program was adopted in Senegal and Rwanda, and ICT-based advisories (India, Nepal).
- Two milestones were completed in 2019: The first milestone - 'New index-based insurance products and services adopted in at least one country' - was completed, with a flood insurance project adoption by an insurer, financial institutions, and local communities in five districts, Bangladesh. In Ethiopia, training and support was provided for the use of the CCAFS Regional Agricultural Forecasting Tool. The second milestone - 'Expanded set of development organizations, sub-national initiatives testing climate services and using CCAFS inputs for climate risk management services' - was completed. The East Africa regional climate centre (ICPAC) shifted to a flexible forecast format, and Maproom tools were expanded to NMS in Ethiopia, Senegal, Colombia, Bangladesh. Expansion continued in Latin America (26 LTACs in 6 countries promoting climate information in 300 institutions). Additional examples are provided for Rwanda, Vietnam, Ethiopia, and Niger.

Sub-IDO: Enabled environment for climate resilience.

- One milestone was completed, and one was extended in 2017: The first milestone – 'Methodology for economic valuation of climate services reviewed etc.,' was completed, with a cost-benefit analysis literature review on agricultural climate services working paper produced. The second milestone – 'Preliminary CBA of agricultural climate services provided to climate services investors'

was extended. The reasons for non-delivery are not explained in the AR, but the FP reported at the time that issues emerged with the ACPC partnership and a lack of supervision for the postdoc understanding the analysis. Both issues were eventually resolved. However, various outputs were completed, including a willingness-to-pay experiment with Ethiopian farmers, and initial preparation of an economy-wide model for climate services valuation undertaken.

- Two milestones were extended in 2018: The first milestone – 'Science-policy engagement processes, guidance policy briefs inform new climate service investments in CCAFS regions' was extended. It is not clear the reason for the extension, but progress was achieved engaging donors (USAID, DFID, World Bank, EU, Adaptation Fund, IFAD) on their support for climate services and a contribution to the USAID learning agenda on climate services[13]. The second milestone – 'CCAFS cost-benefit analyses etc.,' was extended (no clear reason given in the AR, but FP reporting noted challenges with ACPC as an obstacle), although FP4 science informed the Climate Research for Development Africa initiative. This was deemed to be low risk.

- Three milestones were completed in 2019 (but only 2 were planned in the POWB 2019): The first milestone – 'Science-policy engagement processes, guidance policy briefs inform new climate service investments in CCAFS regions' was completed, with engagement in the Global Commission on Adaptation, expanding the use of CS-MAP in Vietnam, and trainings undertaken with the National Bank for Agriculture and Rural Development in India. The second milestone – 'CCAFS cost-benefit analyses for one new region provided to development funders' was completed, with a journal publication on cost-benefit analysis for Ethiopian economy, engagement USAID to inform climate services investments. However, the FP did not secure IFPRI collaboration to expand its work on climate service cost-benefit analyses. The third milestone – 'CCAFS cost-benefit analyses, methods, guidance integrated into ACPC guidance etc.,' was completed (although does not appear in POWB, 2019)[14]. While efforts to engage USAID East Africa in lesson-learning and ACPC on cost-benefit work under WISER were not successful, the FP4 delivered via its influence over a CR4D-Africa program for investment in climate services, co-development of principles for a WISER program grant mechanism.

Sub-IDO: Gender equitable control of productive assets and resources.

- One milestone was completed in 2017: The milestone – 'four organizations adapt climate services communication strategy etc.,' with four organizations are differing stages of adaptation of CCAFS strategies to better support women farmer's participation in climate services and agricultural insurance (Cambodia, Laos, Vietnam with the NGO CARE; Rwanda; Malawi).

- One milestone was completed in 2018: The milestone – 'Based on assessment of current FP4 project portfolio and opportunities, an adjusted project portfolio will target research and engagement etc.'' was completed. Examples include informing the Guatemala food security monitoring and early warning system with research on gender differentiated impacts. Another is the uptake by an agricultural insurance provider focusing more on women and under-served groups in product design and M&E (approx. 600,000 farmers in Africa). Further, in Rwanda, gender balance in rural climate service provision was advanced through training of intermediaries and farmers on gender in monitoring and evaluation.

- One milestone was completed in 2019: The milestone – 'Three additional development organizations adapt plans and direct investments to increase women's participation in decision-making about climate services and safety nets' was completed, with expansion of PICSA training in Rwanda, including promotion of women's participation in training, and engagement of at least one women-focused farmer organization in Guatemala providing digital, gender-sensitive CIS. Additionally, there was support for gender-sensitive M&E strategy of project partners in Uganda via the Dutch Research Council, provision of guidance materials for a project in Myanmar (GIZ project and Canada/ADB supported project).

[13] The FP leader reports that the briefs were actually were produced, but that there is an error in the MARLO system, which characterizes the milestone as extended in 2018.
[14] This is the milestone reported in MARLO as extended in 2018.

Sub-IDO: Enhanced capacity for innovation in partner development organizations and poor and vulnerable communities.

- One milestone completed in 2017: The milestone – 'Climate services and weather-related insurance are incorporated into training materials…etc.,' was completed with progress in at least four countries, including Honduras, Nigeria, Colombia, and Rwanda.
- One milestone was completed, and one was changed in 2018: The first milestone – 'National planners in at least one country supported to incorporate CCAFS-informed climate services etc.,' was changed. The reason is not explained. However, policy advances were achieved, for example in Nepal and Colombia, where national planners were supported to take up CCAFS evidence and guidance. The second milestone – 'Agroclimatic risk management approach etc.,' was completed. The policy had already been adopted in Colombia, but the approach was extended regionally – a major achievement – via the Regional Strategy for Disaster Risk Management in Agriculture Sector.
- One milestone was completed and one was extended in 2019: The first milestone – 'Evidence from FP4 projects integrated into (sub)national policy etc.,' was completed with influence over policy implementation in Latin America (e.g. Guatemala Ministry of Food Security promoting innovations in food and nutrition security), Africa (e.g. Rwanda, a National Framework for Climate Services has been endorsed, with policy dialogues being co-planned, and promotion by the Ministry of Agriculture and Animal Resources in advancing a national agricultural insurance strategy; e.g. Ethiopia – two policy processes influenced) and Southeast Asia (i.e. policy dialogue in Vietnam). The second milestone – 'Based on assessment of current FP4 project portfolio and opportunities, an adjusted project portfolio will target analyses and engagement to inform at least seven additional policy decisions within three years' was extended – the reason is unclear, however progress has been made (e.g. collaboration with ACToday influencing two policy processes in Ethiopia, policy dialogue in Vietnam, and launch of new projects intended to influence 11 policy decisions in 2019-21).

In summary, all milestones relating to improving access to financial and other services have been delivered on time, although one was changed. Index-based flood insurance was piloted and adopted at national level in India and adopted in a World Bank project (Assam). In Senegal, uptake of CCAFS science informed new insurance for approximately 25,000 cotton farmers and similarly informed agricultural insurance services in Nigeria and Malawi. Further, uptake of improved weather index insurance occurred in 2019 in South Asia, and FP4 contributed to analysis for a global insurance project and collaborated with the Dutch Research Council on Uganda insurance, including a gendered risk spectrum analysis. The milestone 'Scaling of weather-related agricultural insurance in West Africa' was changed, as Nigeria's FMARD had endorsed an insurance roadmap but changed strategy to partner elsewhere on scaling insurance.

FP4 milestones building capacity to deal with climate risks and extremes (sub-IDO) were all delivered with four national (Senegal, Mali, Ghana, Rwanda) and two regional (ICPAC, AGRHYMET) bodies using FP4 outputs. Other examples include the following achievements: With support from CCAFS and in collaboration with the Africa RISING project, the PICSA tool was adopted in 17 countries and various other collaborations led to improved climate services (Norther Ghana, two provinces in Vietnam; radio programming was taken up in Senegal and Rwanda and ICT-based advisories improved in India and Nepal; in Ethiopia, training and support was completed on using CCAFS Regional Agricultural Forecasting Tool; ICPAC, the East Africa regional climate centre, shifted to a flexible forecast format; Maproom tools were expanded to National Meteorological Services (NMS) in Ethiopia, Senegal, Colombia, Bangladesh; expansion continued in Latin America (26 LTACs in 6 countries promoting climate information in 300 institutions).

FP4 completed 4 milestones on enabled environment for climate resilience sub-IDO, but two have been extended, and the reasons are not completely clear from the ARs. A literature review on cost-benefit analysis of climate services in agriculture was completed, but dissemination to investors was not completed in 2017. A willingness-to-pay experiment with Ethiopian farmers, and initial preparation of an economy-wide model for climate services valuation were, however, undertaken (AR, 2017). In 2018, two milestones were extended, but progress was achieved in engaging donors on their support for climate services. FP4 also contributed to the USAID learning agenda on climate services, and information was used by Climate Research for Development Africa (CR4D-Africa). But it is not clear why this 'low risk' milestone was not achieved. In 2019, support / engagement occurred with the Global Commission on Adaptation, the CS-MAP was extended in Vietnam, and trainings were undertaken with a national agricultural bank in India. A cost-benefit analysis for climate services and the Ethiopian economy was completed and there was engagement with USAID to inform their climate services investments (AR,

2019). However, planned collaboration with IFPRI did not materialize. One of the completed milestone did not appear in the POWB, 2019, as influence over the CR4D-Africa program was achieved, and there was co-development of principles for a grant mechanism of WISER.

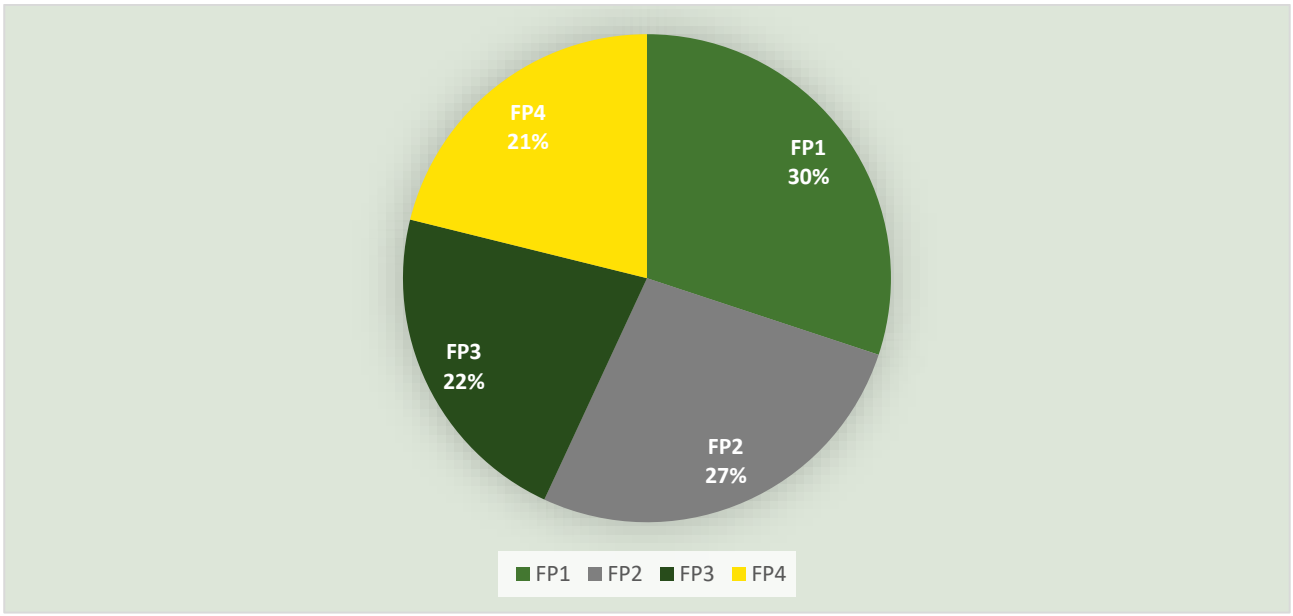
On the gender sub-IDO, all milestones were delivered. Four organizations have utilized CCAFS strategies to better support women farmer's participation in climate services and agricultural insurance (e.g. in Cambodia, Laos, Vietnam, Rwanda, and Malawi) (2017). In 2018, research on gender informed the Guatemala food security monitoring and early warning system. An agricultural insurance provider in Africa also utilized CCAFS science. In Rwanda, training was undertaken to support gender balance in rural climate service provision. PICSA training was expanded in Rwanda, including encouragement of women's participation in training, and a Guatemala farmer organization provided digital, gender-sensitive CIS to farmers (2019). Projects and partners in Uganda and Myanmar were also supported in a similar vein.

Partner and community innovation capacity strengthening milestones were partially delivered – 3 were completed, one extended and one was changed. Progress occurred in Honduras, Nigeria, Colombia and Rwanda through training materials provision and uptake in climate services and weather-related insurance (2017). Collaboration with national planners in Nepal and Colombia on CIS were progressed, but the milestone was changed – the reason for the change is not specified in the AR (2018). The approach to Agroclimatic risk management had already been taken up in Colombia, but the approach was adopted regionally via the Central American Regional Strategy for Disaster Risk Management in the Agriculture Sector (AR, 2018). CCAFS contributions occurred in Latin America (e.g. Guatemala Ministry of Food Security promoting innovations in food and nutrition security), Africa (e.g. Rwandan endorsement of the National Framework for Climate Services, as well as progress in Ethiopia and policy dialogues in Southeast Asia etc. The reason for the extension on the milestone is not clear – but policy dialogues are underway.

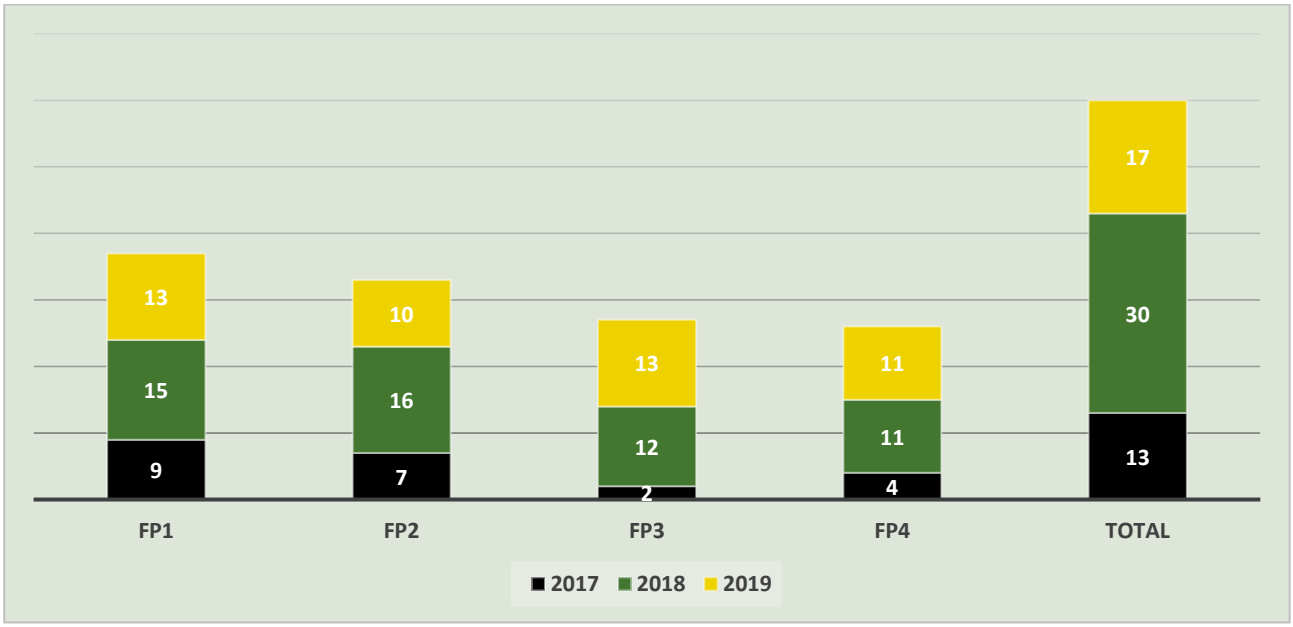
Annex 9: Policy and Innovation Analysis

Overall policy contributions: CCAFS has delivered 58 policy contributions, with the highest number reported by FP 1 (35), followed by FP 2(31), and FP3 and 4 reporting 25 and 24 respectively (2017-19) (Dashboard data pre-analyzed by CAS - see Annex Figure 9.1). More policy contributions occurred in 2018 (30), with 17 in 2017 and 17 in 2019. See Annex Figure 9.2 for further breakdown by FP and year.

Annex Figure 9.1: Proportion of policy contributions by flagship (2017-2019)



Annex Figure 9.2: Number of policy contributions by flagship and year



The slight decline in 2019 reflects the budget cuts suffered by the program, especially in 2018. In terms of level of policy impact, the scale for measuring this changed in 2018. A consolidated analysis however shows that a clear majority of contributions classify as having achieved Level 2, i.e. a policy or law has been enacted, with 16 achieving level 1 (research taken up by next user), but only 4 achieving level 3

(evidence of impact on people and /or natural environment of the changed policy or investment. Further work may be required in terms of the evaluative scale used: there is a significant difference between influence on policy formulation compared with policy implementation. This should be captured in the scale, especially since there has been a shift in focus within CCAFS Phase II to focus upon the latter. This shift is to be welcomed, as literature indicates that there are often gaps between the policies as articulated in statements, and implementation (Andrews et al, 2017).[15]

Types of policy contributions: The vast majority of policy contributions are policy or strategy (44), with 9 budget or investment contributions, 3 curriculum and 3 legal instrument contributions. A more refined scale would give greater insights into the 'Policy or Strategy' type of contribution. Examples of policy or strategy contributions include contributions to: the Vietnam government strategy for implementation of Climate-Smart Maps and Adaptation Plans; the Myanmar Climate-Smart Agriculture Strategy and the Systematic use of Climate Information for developing strategies and planning policies in Senegal. Examples of budget contributions are the informing of Climate Smart Agriculture investment in Niger (USD 1.6 million) and World Bank agricultural investment's for improved climate change resilience in the agriculture sector and reduced contributions to GHG emissions rise from 28% (2016) to 45% (2018) of committed budgets of new agriculture projects. Contributions in the legal sphere include developing a new international system of plant germplasm exchange, informing the Mbale District (coffee) management bill (2018) in Uganda, and contributing to new laws being passed to enhance the capacity to adapt to climate change by implementing the International Treaty on Plant Genetic Resources for Food and Agriculture (ITTPGRFA) and the Nagoya protocol in Madagascar and Benin. An example relating to curriculum contribution is the integration of CSA competencies in the Philippine Department of Education in the curricula of 75 schools nationwide that now serve as CSA information hubs among the 278 technical and vocational (TechVoc) secondary schools. A second is the National extension and training materials developed for cocoa in Ghana, which form the basis for all private and public cocoa extension in the country.

Geographic scale of policy contributions: Of the 58 policy contributions made by CCAFS, 32 occurred at national level (by far the highest), followed by sub-national (10), multi-national (7), global (5), and regional (4). [More than 1 FP will report involvement in a policy contribution). Policy contributions by region: In terms of contributions from CCAFS Regions, Eastern Africa (16) and South-Eastern Asia (15) were the highest. Flagship policy contributions: Unsurprisingly, FP 1 makes the highest number of policy contributions (35 in total, of which 27 are classed as 'Policy or Strategy' and FP 1 is the only FP to make contributions classed as 'Legal Instruments'. The most contributions to Budget or Investments are made by FP 2 (6), with FPs 1 and 3 reporting 4 contributions.

It is important to recognize the wide scope of the contributions from different organizations, countries, and types of policies. And that this success reflects both the quality of the science and the critical role of the regional teams in providing sustained interactions with policy and investment decision-makers which can enable the teams to work proactively and responsively, and to be closely aligned to the needs and interests of decision-makers at different levels. Assessing contribution to policies is notoriously challenging – yet it is critical to achieving systemic change. It is welcomed that CCAFS is undertaking a study to map and interrogate the policy contributions achieved, and which should inform improved planning and reporting in future more fully.

[15] 'Building State Capability: Evidence, Analysis, Action'. M. Andrews, L. Pritchett, M. Woolcock. https://oxford.universitypressscholarship.com/view/10.1093/acprof:oso/9780198747482.001.0001/acprof-9780198747482-chapter-3

Annex Table 9.1: Flagship policy contributions by type and stage

Legend:	Level 1. Research taken up by next user (decision maker or intermediary) = Level 1 of outcome/impact case. *[2017 - Stage 1 of outcome/impact case study. Research taken up by next user (decision maker or intermediary)].*	*Level 2. Policy/Law etc. Enacted = Level 2 of Outcome/Impact Case. [2017 - Stage 2 of outcome/impact case study. Policy/Law etc. Enacted. Please note the definition of the stages changed from 2017 to 2018/2019. Stage 1 and Stage 2 were used in 2017. Instead, Level 1, 2 and 3 were used in 2018-2019].*	Level 3: Evidence of impact on people and/or natural environment of the changed policy or investment = Level 3 of Outcome/Impact Case

Flagship/ Type of Policy Contribution	FP1	FP2	FP3	FP4
Policy or Strategy	Vietnam government strategy for implementation of Climate-Smart Maps and Adaptation Plans (CS MAP)			
	CCAFS's contribution to Africa Group of Negotiators Expert Support (AGNES) inputs and facilitation of the finalization of the 5-Year Gender Action Plan adopted at COP25			
	National Policy of Agriculture of El Salvador 2019-2024			
	Scientific inputs from CCAFS inform Climate Smart Agriculture policy of El Salvador			
	Uganda National Seed Strategy 2018/19 - 2022/2023			
	Action Plan for Implementing Greenhouse Gas Emission Reduction in Agriculture Sector under Intended Nationally Determined Contributions (INDC) of Vietnam			
	Myanmar Climate-Smart Agriculture Strategy (MCSAS)			
	The Cauca Department Secretariat of Women, Colombia, has updated its Rural Women Policy to include climate change and variability and the role of women in addressing climate and environmental challenges.			
	CCAFS and PIM science referenced in formulating the national and sectoral Philippine Medium-Term Development Plan 2017 – 2022			
	Inputs on Land Productivity for the Long-Term Green Growth Policy of Colombia			
	Supporting Directives and Circulars of the Ministry of Agriculture and Rural Development of Vietnam (MARD) and the Department Crop Production for implementation of Climate-Related Risk Maps and Adaptation Plans (CS-MAP) particularly the adjustment of planting dates			
	Kenya Climate Smart Agriculture Implementation Framework (2018 - 2027)			
	Local Technical Agroclimatic Committees as an implementing tool of the Regional Strategy for Disaster Risk Management in the Agriculture Sector and Food and Nutrition Security in Latin America and the Caribbean (2018 - 2030)			
	Kenya launched the Climate Smart Agriculture Strategy 2017-2026.		Gender and Social Inclusion Incorporated into the Kenya Dairy Board Strategic Plan	A Rwanda initiated a national policy framework for climate services under the UN Global Framework for Climate Services
	Informed investment of a USD 21.5 billion by the Indian Government to provide 2.75 million solar pumps to farmers and farmer cooperatives			
	Informed investment of a USD 2 million for a regional Climate Smart Agriculture (CSA) strategy for Central America			

Flagship/ Type of Policy Contribution	FP1	FP2	FP3	FP4
	National policies and laws for implementing the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) adopted by Bhutan, Burkina Faso, Costa Rica, Cote D'Ivoire, Guatemala, Nepal, Rwanda and Uganda	Extension policy of Olam Uganda -- Olam Uganda, a private company working with coffee farmers, has incorporated 'Stepwise', an approach to climate change, into its farmer training	Sustainable livestock policy of Colombia's national livestock producer organization (FEDEGAN) included information on improved pasture nutrition and methane emissions, which is informing livestock options in the development of the Government of Colombia's Nationally Appropriate Mitigation Action policy	National Council on Food Security (CONASAN) approves a community-based food security monitoring and early warning system developed using CCAFS science
	Informed investment of USD 66 million in Colombia for scaling up Climate Smart Agriculture (CSA) in Cauca, Colombia	CCAFS' Climate Resilience and Vulnerability Assessment (CRVA) maps were used as referenced in developing the National Color-Coded Agricultural Guide (NCCAG) in the Philippines.	Circular on Crop Residue Management issued by Vietnam's Ministry of Agriculture and Rural Development (MARD)	Implementing the resolution of 9th Congress of the Farmers Association of Ha Tinh province, Vietnam that integrates climate-smart agriculture as part of the 2018 - 2023 provincial strategy.
	Mbale District (Uganda) counterfeit agricultural inputs (prohibition) ordinance, 2018. Passed to stem the influx of fake agricultural inputs which was discouraging farmer use and reducing trust in the market.	Agriculture and Fisheries Modernization Plan 2018-2022 integrates CCAFS' Climate Risk Vulnerability Assessment(CRVA) as one of its planning tools	Development of a roadmap for the Ministry of Agriculture and Rural Development of Vietnam, for scaling low-emission rice production in the Mekong River Delta	Climate Research for Development (CR4D) Africa 2018 - 2022 Strategic Plan: CR4D is an African-led initiative that aims to strengthen links between climate science research and climate information needs in support development planning across Africa.
	Guideline for mainstreaming climate change adaptation and mitigation in national and sub-national agricultural sector policies and plans in Uganda	Local government of Guinayangan, Quezon Province, Philippines emphasized Climate Smart Agriculture in its 2017-2022 Comprehensive Development Plan & Municipal Agriculture Office Banner Programs, following the participatory development of Guinayangan Climate-Smart Village.	CCAFS Contributes to Policies and Action Plans for a Secure and Sustainable Agriculture in India	Systematic use of Climate Information (CI) for developing strategies and planning policies in Senegal (Ministry of Agriculture, Directorate of Water Resources Management and Planning, Civil Protection Department)
	Investment by two Nepalese states in the "Chief Minister's Climate-Smart Agriculture Village Model Program"			
	Implementation guidelines approved in Benin and Madagascar to operationalize laws adopted in 2017 governing access and benefit sharing of plant genetic resources. National partners in the two countries developed guidelines for the day-	Rainforest Alliance Sustainable Agriculture Standard used as a basis for the development of Rainforest Alliance crop-specific certifications		

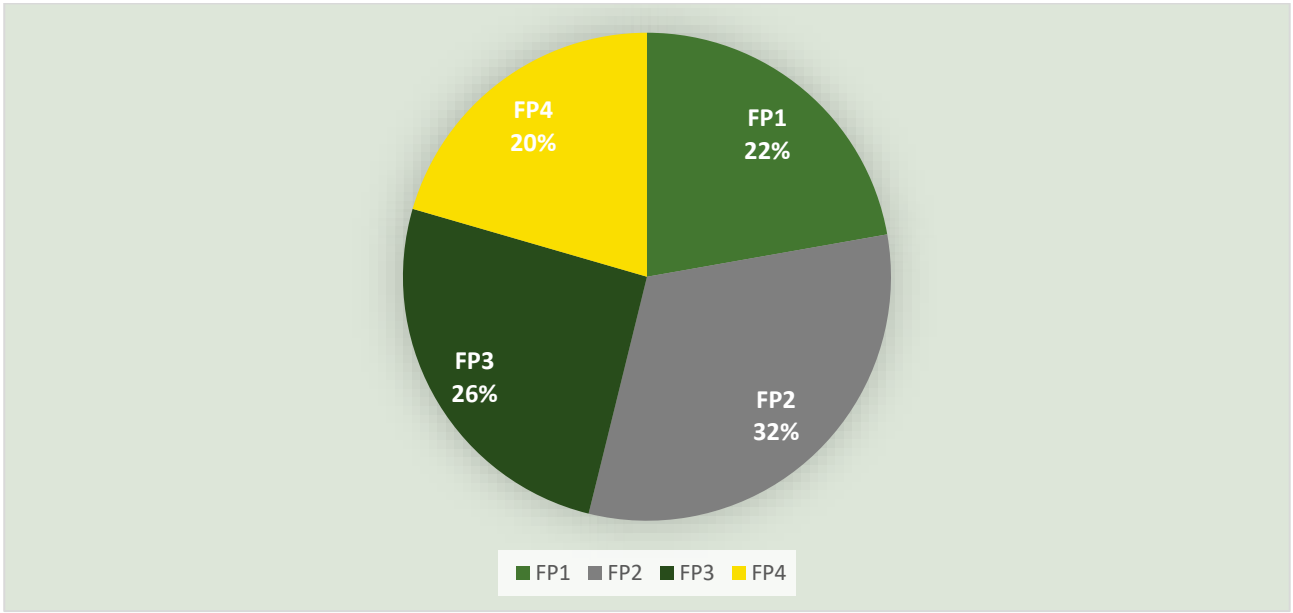
Flagship/ Type of Policy Contribution	FP1	FP2	FP3	FP4
	to-day operation of these laws, including details about processes, decision making, relationships between agencies with different, but related, responsibilities under the laws.			
	Two community biocultural protocols aimed at promoting farmers as managers, providers and recipients of genetic materials and developing expertise for climate change adaptation approved by municipal governments in Benin	The Climate-Smart Village approach and associated tools have been taken up at the sub-national level in Vietnam, Colombia, and the Philippines.		
	CCAFS inputs used for an institutional plan for adaptation to climate change for the agrifood sector in Honduras 2019-2023			
	Post-2020 Global Biodiversity Strategy			
	Vision 2045 for Agriculture Sector in Bhutan - strategic planning to achieve food self-sufficiency, livelihood security, and environmental conservation.			
	Revised National Seed Policy 2018 (Uganda)			
	United Nations Framework Convention on Climate Change (UNFCCC) decision on agriculture after six years of negotiations.			
Budget or Investment	Canada International Development Research Centre (IDRC) increases investment in gender equality research in their climate change programming.			
	World Bank agricultural investments for improved climate change resilience in the ag sector and reduced contributions to GHG emissions rise from 28% (2016) to 45% (2018) of committed budgets of new agriculture projects	Informed investments of USD 170 million in India for scaling up the Happy Seeder technology	Kenya Climate-Smart Agriculture Project (KCSAP) Monitoring and Evaluation Manual Incorporates CGIAR Methods for GHG Emissions	
		Informed investment of a USD 1.2 million for scaling up `Underground Taming of Floods for Irrigation` (UTFI) in India	Investment in Climate Smart Livestock in East Africa by German government	
		Impact investor Root Capital introduced CCAFS data on climate change risk into its process for underwriting and prioritizing > $146M of loans to producer organizations in cocoa, coffee		

Flagship/ Type of Policy Contribution	FP1	FP2	FP3	FP4
		etc., and promoted uptake by numerous peer agencies in the Council on Smallholder Agricultural Finance (CSAF) community.		
	Informed investment of USD 1.6 million for Climate Smart Agriculture (CSA) in Niger			
Legal instrument	Developing a new international system of plant germplasm exchange, as part of implementation of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).			
	New laws were passed to enhance capacity to adapt to climate change by implementing the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the Nagoya protocol, in Madagascar and Benin.			
	Mbale District (Uganda) coffee (management) bill, 2018			
Curriculum	Integration of Climate Smart Agriculture (CSA) competencies by the Philippine Department of Education in the curricula of 75 schools nationwide that now serve as CSA information hubs among the 278 technical and vocational (TechVoc) secondary schools.			
	Adoption of Manual for Climate-Smart Rice Production by Vietnam's National Agriculture Extension Center.			
		National extension training materials/ curriculum developed for cocoa in Ghana. These materials form the obligatory base for all public and private extension materials for cocoa in the country		

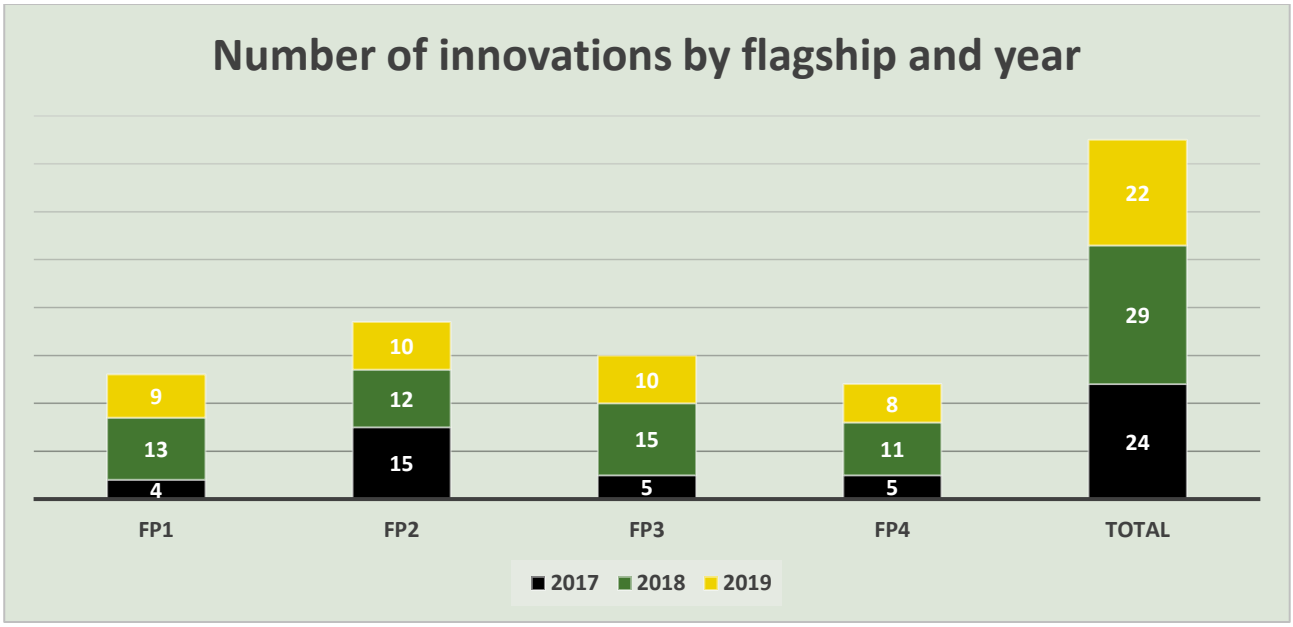
Innovations Analysis

Overall innovations achievements reported: CCAFS has produced 74 innovations (2017-19), with an even spread across the years (CAS Secretariat; Dashboard). Summary statistics on the characteristics of these contributions are found in Annex Figures 9.3 and 9.4. However, as no targets for policies and innovations are set it is not clear how to judge this performance against plans.

Annex Figure 9.3: Proportion of Innovations by Flagship (2017-2019)



Annex Figure 9.4: Number of Innovations by Flagship and Year



Type of Innovations: The largest proportion of innovations are Research and Communication Methodologies and Tools (44). This is followed by Production systems and management practices (14) and Social science (12) innovations. Finally, there were no biophysical research (0) or other (0) innovations reported (CAS, Dashboard). Examples of the *Research and Communication Methodologies and Tools* include Global Community Seedbanks Platform, New method for GHG measurements with closed chambers at night time, Food Security and Drought Monitoring and Early Warning Tool. *Production System* examples include: Using roof-top rainwater harvesting system (RWHS) to irrigate home-based vegetable gardens in Laos, Climate-related risk maps and adaptation plans for rice production in Vietnam's Mekong River Delta. *Social Science* examples include: Innovation Platforms for CSA in Honduras and the Local Technical Agroclimatic Committees (LTACs) approach generating climate forecasts and crop response. Tool to integrate and measure gender equality in monitoring and evaluation of climate services. The innovations have been mapped to Flagship – some innovations are developed by multiple-FPs in collaboration. See Annex 9.

Stage of innovation: The innovations are mostly stage 3 (25 for the CRP as a whole) and especially in 2019, with 19 at stage 1, 15, at stage 2, and 16 at stage 4 (1 being discovery and 4 being uptake by next user (CAS statistics). [Note: the stage of innovation provides one measure of success, but it does not capture the importance of the innovation, for example in terms of its scale or transformative potential). In terms of geographic spread, a majority are of global (24) or national (28) relevance, with some having regional significance, but relatively few of sub-national (4) and multi-national focus (4). Beyond the global level (24), the largest number of innovations emanated in South-Eastern Asia (11) and Southern Asia (12) in terms of regions, and from South America (10) and Eastern Africa (8).

Innovations by Flagship: By Flagship, the highest proportion of innovations has been developed by FP2 (36), followed by FP 3 (29), FP1 (25), and FP4 (23), reflecting the focus / role of FP2 to generate, test and scale CSA Technologies and Practices. Note that the numbers reported per FP do not add up to the total number of innovations (74), because more than one FP can contribute to an innovation (CAS Secretariat, Dashboard).

Annex Table 9.2: Flagship innovations by type and stage

Flagship/ Type of Innovation	FP1	FP2	FP3	FP4
Research and Communication Methodologies and Tools	Global Community Seedbanks Platform	Evidence for Resilient Agriculture (ERA): a meta-data based tool for technology-shift decision in Agriculture in Sub-Saharan Africa	New method for GHG measurements with closed chambers at night-time	The CCAFS Regional Agricultural Forecasting Tool (CRAFT)
	Decision-making tool for national implementation of the Plant Treaty's multilateral system of access and benefit-sharing	Climate Smart Agriculture (CSA) monitoring framework to track adoption, outcomes, synergies and tradeoffs at household and farm level	Estimating minimum nutrient (N, P, K) requirements for climate-smart intensification of maize cropping	Method that improved area selection and consistently enhance forecast skill.
	Climate Smart Agriculture investment plans		Framework of analysis of country-level mitigation potential from agricultural sector	Pronosticos AClimateColombia: A system for the sustainable provision of agro-climatic information for agricultural adaptation in Colombia
	Stakeholders Prioritization Framework of Climate-Smart Agriculture Interventions			
	Validation of RUMINANT model of enteric methane emissions	Climate Risk Profiles	Validation of RUMINANT model of enteric methane emissions	Agriculture and Food Security Maprooms
	ICT-based App for disseminating climate and market information to smallholder farmers developed and is being tested in northern and southern Ethiopian highlands through a public-private partnership			
	Climate tipping game for Conference of Parties (COP) delegates	The Climate-Smart Agriculture (CSA) Compendium: a systematic review of CSA practices and the scientific basis of CSA	Adoption and testing of the Gold Standard Smallholder Dairy Methodology	Food security and drought monitoring and early warning tool considering local vulnerabilities
	Course for Cambodian parliament on climate politics	Multi-level ICT-based Smart Monitoring system to track implementation, performance, perceived efficiency of Climate -smart Agricultural Practices and technologies at farm and household level	Measurement, Reporting and Verification (MRV) Platform for Agriculture	One farmer, one loan, one Internet of Things (IoT) rain gauge

Flagship/ Type of Innovation	FP1	FP2	FP3	FP4
		including their effects on food and livelihoods security.		
	Developing, testing, and making available an integrated climate and agro-climate advisory to enhance adaptive capacity and sustainable agricultural productivity in Ethiopia.			
		'ClimMob' digital platform and software for crowdsourcing climate smart-agriculture solutions and collect data from a large number of small farmers	Estimation of minimum nitrogen requirements as vital inputs to develop context-specific fertilizers recommendations that optimize yield and minimize greenhouse gas emissions	AloWeather - ICT tool for delivering agro-advisory service to farmers
		Voice calls for remote data collection	SECTOR: Source-selective and Emission-adjusted Greenhouse Gas Calculator for Cropland	Participatory Integrated Climate Services for Agriculture (PICSA)
		Allometric framework for estimating soil C (carbon) sequestration on smallholder farmer fields	Allometric framework for estimating soil C (carbon) sequestration on smallholder farmer fields	Development of robust and highly skilled forecasts capabilities of dynamical models used to simulate crop performance in the Colombian agricultural context
	Crop-loss assessment monitor tool that uses multiple indicators of weather, remote sensing and crop growth simulation modelling			
	Computer game prototypes developed around food security and climate change	'Climate Wizard' : online tool providing access to downscaled climate change information	Carbon Footprint Assessment Model for Chinese Dairy Sector	Meghdoot App to support the digitalization of agro-advisories in India
	Ethiopian Digital Agro-climate Advisory Platform (EDACaP)			
	8 Guide steps for setting up a Climate-Smart Village in South east Asia (Multi-language)			
	School-on-the-air on Climate-Smart Agriculture (SOA-CSA) in Cagayan Valley (The Philippines)			
	Global Foresight for Food and Agriculture Tool	CSA Country Profiles		AClimateColombia: a new platform for climate services
Production systems and management practices	Integrating Rice Crop Manager with ICT based tool for scaling out climate-smart agriculture interventions			
	Using roof-top rainwater harvesting system (RWHS) to irrigate home-based vegetable gardens in Laos			

Flagship/ Type of Innovation	FP1	FP2	FP3	FP4
	Climate-Related Risk Maps and Adaptation Plans (Climate Smart MAP) for Rice Production in Vietnam's Mekong River Delta			
	A new global data set on farm size distribution by country	Investment pathways (Stepwise approach) tailored to specific farmer segments for improving resilience and smart agriculture practices	Feeding cassava leaves to livestock for reducing methane emissions	
	Holistic and dynamic approach and methodology to establish and support multifunctional community seedbanks	Science-informed large-scale routine public investment (business model) to promote the "Happy Seeder" technology for in-situ management of crop residues aiming to curb air pollution and build resilience	Grazing management innovation to improve animal production and reduce GHG emissions	
		Two-chamber gasifier cook stove. Innovative research on standard boiling tests and emission measurements to quantify savings in firewood consumption and offsets in emissions as compared to commonly used incineration systems		
		Innovative underground storage for mitigating water disasters and building climate resilience	CCAFS-validated animal nutrition model for methane emissions in Colombia: a tool to develop low-emission livestock options and strategy	
		Climate Smart Cocoa: a mobile application for climate smart cocoa cultivation		
		Smart-Valleys approach in Burkina Faso for land and water management for rice-based systems		
Social Science	Resilience for development framework that supports the integrated analysis of climate change, gender, youth, and nutrition (CGYN)			
	Local Technical Agroclimatic Committees (LTACs) approach generating climate forecasts and crop response.			
	Tool to integrate and measure gender equality in monitoring and evaluation of climate services			
	Innovation platforms for Climate Smart Agriculture in Honduras.	Qualitative methodological approach to better understand the socioeconomic factors that influence adoption of Climate-art Agricultural options in smallholder farming communities.	Policy-oriented national Low Emissions Development (LED) assessments and investment analyses with the intent of supporting both national policy and climate finance proposals	

Flagship/ Type of Innovation	FP1	FP2	FP3	FP4
	Activation of subnational platform to broker institutional changes	Social learning approaches in Climate-Smart Villages (CSV) development and scaling	Participatory development of scaling plan as a part of low emission roadmap in rice production of Mekong River Delta	
	Assessment of the potential of Large Field Models (aiming to increase the efficiency of rice production and the quality of rice) to offer an opportunity to apply CSA principles and reduce greenhouse gas (GHG) emissions	Farm record keeping: A must-have women-targeted practice accounting, farm management (and empowerment tool) tool, that also aims to support gender-enabled climate smart agriculture practice scaling strategy for development		
		Gender equitable knowledge Index on climate smart agriculture practices (CSAPs) adoption to support food and nutrition security under climatic risks		
Biophysical Research		Satellite imagery as an alternative to collecting site-specific agronomic data on harvesting, planting date, phenological stages, etc., through surveys	Analytical approach for predicting potential areas of agroforestry expansion	
Other	Resilient seed systems approach and methodology	Athelia Biodiversity Fund Brazil (ABF-Brazil)		

Legend:

Innovation stage	1 = discovery/ proof of concept	2 = Successful piloting	3 = Available / ready for uptake	4 = uptake by next user
Text in **bold** = Innovation to which multiple FPs have contributed				

Annex 10: Theory of Change Analysis

Flagship 1: Theory of Change and Significant Outcomes

The FP1 **vision** is that 'organizations and institutions at multiple scales are transforming the enabling policy environment to accelerate food and nutrition security and poverty reduction in a changing climate' (CCAFS Proposal, 2016). **FP1 objectives** are: (a) improved priority setting, trade-off analyses, and foresight; (b) improved understanding of effective enabling policy environments; (c) more evidence as to how CSA at scale can contribute to food security; and (d) effectively informed investment decisions. Primary target beneficiaries are climate-vulnerable and food insecure groups, including smallholder men and women, and (via national to global policy influence) the urban poor and broader populations in target countries.

FP1 is anticipated to involve three **clusters of activity**, namely: ex-ante evaluation and priority setting for climate-smart options; food and nutrition futures under climate change; and enabling policy environments for CSA.

Annex Table 10.1: Clusters of activity and outputs - Flagship 1

Clusters of Activity	Outputs
Ex-ante evaluation and priority setting for climate-smart options	Data maintained on CCAFS and partner websites, including up-to-date downscaled climate information that builds on current data portals (e.g. ccafs-climate.org) Decision support tools developed and curated by CCAFS and partners for helping to set priorities and target policy development for CSA, particularly analysing trade-offs to inform investment choices. Training materials developed and archived in the public domain, to strengthen the capacity of partners in applying decision tools in targeting, policy, and investment decision-making. Tools for cross-level analyses of policy alternatives in different contexts. Modelling of impacts on specific crop, fish and livestock species and quantification of uncertainties, in part fuelled by next generation G×E×M analyses and empirical/big data approaches to understand relevant abiotic constraints across climate gradients. Ideotypes identified that have climate-adaptive capacity using new and historical genetic, environmental, physiological, and agronomic information.
Food and nutrition security futures under climate change	A toolbox of state-of-the art micro-level models of nutrition behaviour of individual consumers and macro-level models of natural resource use, food system activity, consumption and nutrition, with long-term time horizons and opportunities, for the quantification of future scenarios and the exploration of levers for innovation and policy reform. Cutting-edge scenario development methodology for incorporating many drivers of change and exploring multi-dimensional scenario possibility spaces in a structured process, beyond the limits of current methods. Innovative methodology developed for the analysis of composite scenario results, which supports the investigation of key trade-offs in mainstreaming climate adaptation in broader policy contexts and across food systems. Strategy documents, with a focus on implementation plans, informed by inclusive, multi-level scenario processes in several countries. Combined climate and food security scenarios developed across regional, national, and subnational levels, with a link to global level scenarios, focusing on policy implementation across levels. Reports on scenario-guided investments by private sector partners in each focus region. Capacity for scenario-based strategic planning strengthened in national, regional, and global partners, emphasizing implementable and tractable plans.
Enabling policy	Syntheses of case studies of selected regional and global bodies and comparative analyses of current and emerging climate-related food security policies and "good practice" guidelines on engagement with national planners, and relevant international institutions, in different sectors.

Clusters of Activity	Outputs
environments for CSA	Monitoring and evaluation and impact assessment of climate and food security policy processes and their effectiveness. Capacity strengthening for formulating local and national priorities in regional and global fora. Novel analytical tools, indicators, and metrics for evaluating the effectiveness and impact of enabling environments to support the scaling of CSA. Global syntheses and evidence of conditions that support scaling and learning under climate uncertainty, including those that are needed to facilitate transformative change. Innovative ICT-based tools and gaming to support accountability mechanisms in institutions at multiple scales and to engage youth in decision-making.

Source: Program proposal, 2016

These sets of outputs are anticipated to contribute to **five sub-IDOs** (Improved forecasting of impacts of climate change and targeted technology development; Enabled environment for climate resilience; Gender-equitable control of productive assets and resources; Increased capacity for innovation in partner development organizations and in poor and vulnerable communities; Optimized consumption of diverse nutrient-rich foods). In turn, this is anticipated to contribute to 4 IDOs (Mitigation and Adaptation achieved; Improved diets for poor and vulnerable people; Equity and inclusion achieved; National partners and beneficiaries enabled) and ultimately to SLO 1 (Reduced Poverty) and SLO 2 (improved food and nutrition security for health).

The planned 2022 outcomes are:

- 14 organizations and institutions in selected countries/states adapting plans and directing investment to optimize consumption of diverse nutrient-rich foods, with all plans and investments examined for their gender implications.
- 20 countries/states where CCAFS priority setting used to target and implement interventions to improve food and nutrition security under a changing climate.
- USD 450 million of new investments by state, national, regional, and global agencies, informed by CCAFS science and engagement.
- 20 national/state organizations and institutions adapting their plans and directing investment to increase women's access to, and control over, productive assets and resources.
- 11 policy decisions taken (in part) based on engagement and information dissemination by CCAFS.

FP1 impact pathway **assumptions** are as follows: i) scientific knowledge is a desired input into decision-making and decision makers recognize the need for both evidence and soft skills to use the former effectively; ii) innovative tools / mechanisms can support national decision-making processes and women's participation in them, when scaled up through meaningful engagement with farmers, community organizations, policy makers, and ministry staff; iii) possible to work with decision makers who have competing interests and priorities for investments; iv) assume that investment decisions can be moulded by learning from research on enabling policy environments and not only by providing technological solutions for CSA; v) countries' adaptation needs (and mitigation targets) will attract climate finance, with mechanisms in place that allow CCAFS to inform donor decisions and strengthen country capacity to successfully compete for funding.

The **hypotheses linking the FP1 impact pathway to the program-level ToC are:** i) CCAFS projections, scenarios methods and priority setting tools will help decision makers target and implement policies and programs at various scales that improve food and nutrition security and reduce poverty; ii) Improved policies and programs, and increased investments can facilitate the scaling of CSA, which will contribute to food and nutritional security and reduced poverty under a changing climate.

A **critique** of the FP Impact Pathway is that it does not clearly set out the anticipated outputs. At the outcome level there is insufficient articulation of the causal steps leading from the anticipated outputs to early and later outcomes (which do not need to be limited to the sub-IDOs and IDOs). In constructing the impact pathway, FP 1 leader indicated that it was necessary at program design to select sub-IDOs from those shared across CGIAR system, but unfortunately this means that the outcome level is somewhat

unclear, with mixed types of outcomes covered by the sub-IDOs (e.g. 'increased capacity for innovation in partner development organizations' sits at the same level as optimized consumption of diverse nutrient-rich foods', yet it is most likely that the former would lead to the latter.

Further, the impact pathway does not show *how* change is anticipated to occur, e.g. through stages of capacity strengthening, practice change, impact, and scaling. There is no clear articulation of the multi-scale processes of science-policy engagement and capacity strengthening which are so core to the FP 1 approach in this regard, with a clear analysis of how actors and rules are anticipated to alter to catalyze wider change. Nor is the way in which FP 1 is nested within and contributes to the program ToC set out clearly – the hypotheses are simple statements, which again do not clearly explain how change happens. Assumptions are not set out in any detail and are not linked to specific causal steps. All combined, the design of the impact pathway makes it hard to use the ToC to track and learn about change achieved. From interviews it is also clear that the ToC is not used in a proactive sense by FP1 to support on-going learning and decision-making based on evidence. All these limitations arose, at least in part, due to challenges in the wider SRF, which affects all integrating CRPs. This includes the IDOs and sub-IDOs which have inherent flaws, plus there was a lack of support for program design based on a coherent ToC when phase 2 proposals were developed and limited leeway on what could be included in the program proposal (2016) (interview).

The **evidence** available to test the theory of change is being gathered to a certain extent, but due to the weaknesses in the impact pathway outlined above, the sheer scale of the program (e.g. number of activities on-going) and the way in which data is collected, this means that it is challenging for a reviewer to identify and map the relevant evidence to the impact pathway and to interrogate the associated assumptions. Further, such an analysis has not been carried out by the program itself.

Cumulative **quantitative** data for achievement compared with planned outcome targets is not regularly gathered by the program. However, on request, CCAFS generated the evidence below (See Annex Table 10.2). The data indicate that on some outcome indicators, FP1 has significantly exceeded its targets. For example, it achieved 273% of the target to inform 11 policy decisions based on CCAFS science and engagement, influencing 30 policies. Similarly, the quantity of investment influenced exceeded the target by 111%. However, targets relating to nutrition and gender are lower than anticipated:

- Outcome indicator on the number of countries or states where CCAFS priority setting is used to target and implement interventions to improve food and nutrition security under a changing climate' – 50% of the target has been achieved.
- Outcome indicator on 'the number of national / state organizations adapting their plans etc.,' only 40% has been achieved so far of the target.
- Outcome indicator on the 'number of organizations in selected countries adapting plans …to optimize consumption of diverse nutrient rich foods etc.,' only 29% of the target has been reached.

However, it is important to note that there is still one year of the programme to go, and these targets were originally set for 2022, but the programme has been curtailed by one year. Further, it may also be noted that the indicators do address proportions of policies or investments influenced, for example, so it is challenging to assess overall magnitude of shifts, and the indicators do not track the next level of impact (i.e. how far the policies and investments are implemented in practice and with what effect and for whom). It is likely that more work will be done to assess this in the future, as many of these changes may occur post-program.

Annex Table 10.2: Flagship 1 - outcome targets and achievements

FP1	Outcome Target Value	Achieved value	Achieved value	Achieved value	Achieved total	Achieved total to target #
	2022	2017	2018	2019		
# of policy decisions taken (in part) based on engagement and information dissemination by CCAFS.	11	17	6	7	30	273%
$ USD new investments by state, national, regional, and global	n/a (450 m)	n/a	500 m USD	n/a	500 m USD	111%

FP1	Outcome Target Value	Achieved value	Achieved value	Achieved value	Achieved total	Achieved total to target #
agencies, informed by CCAFS science and engagement.						
# of countries/states where CCAFS priority setting used to target and implement interventions to improve food and nutrition security under a changing climate.	20	1	2	7	10	50%
# of national/state organizations and institutions adapting their plans and directing investment to increase women's access to, and control over, productive assets and resources.	20	n/a	1	7	8	40%
# of organizations and institutions in selected countries/states adapting plans and directing investment to optimize consumption of diverse nutrient-rich foods, with all plans and investments examined for their gender implications.	14	4	n/a	n/a	4	29%

Qualitative data are collected on a diverse array of outcomes by the program, written as 'Outcome-Impact Case Studies' or OICRs. A sub-set are selected by program management and reviewed by independent evaluators. These are then presented in the Annual Report each year. Annex Table 10.3 presents an analysis of the main Outcome-Impact Cases that are reported in the Annual Reports 2017 – 19, which have been approved by independent evaluators, and provide a selection of deep dive OICRs. The level of maturity of each of these is assessed on a scale, with 2 indicating policy influenced, and 3 indicating impact on people / environments. For FP 1, for one OICR there is evidence for impact on people / environments, while 5 have achieved level of maturity 2 and two have achieved level 1 maturity.

Annex Table 10.3: A table showing selected outcome-impact cases as reported in ARs 2017, 2018 and 2019 - Flagship 1

No of OICR / FP / Year of reporting	Title of OICR	Contributing to Sub-IDO	Evidence statement	Level of Maturity
2119 N.B. FP1 (and says FP 2) 2017	Implementing the ITPGRFA in Bhutan, Burkina Faso, Costa Rica, Côte d'Ivoire, Guatemala, Nepal, Rwanda, and Uganda: highlights	Enabled environment for climate resilience	With technical support of Bioversity International, government organizations in eight countries developed policies/laws, introduced these into national policy processes to create policy/legal space for Treaty implementation, identified genetic resources within their country to be included in the multilateral system, designated national competent authorities capable to consider requests for access to plant genetic resources for food and agriculture and sharing of those resources with users worldwide. The eight countries are implementing the Treaty and Nagoya Protocol in a mutually supportive way.	3
2050 FP 1 (and an OICR from FP 2) 2017	Informing UNFCCC decision on agriculture at COP23 African Group of Negotiators submissions play significant role in achieving the Koronivia Joint Work on Agriculture] (2 OICRs on this).	Enabled environment for climate resilience	The African Group of Negotiators (AGN) submissions significantly contributed to Koronivia Joint Work on Agriculture at COP23. Since 2012, CCAFS East Africa has continuously supported agriculture and climate change negotiators and experts from Africa to prepare submissions for UNFCCC negotiations. More recently, the roadmap developed during SBSTA48 builds heavily on AGN submission. Over 10 technical working sessions have been convened with AGN, where CCAFS and CGIAR knowledge outputs provided scientific evidence to articulate vulnerability of African agriculture to climate change.	1
2163 FP 1 (and 2) 2017	Cauca leads climate smartness for agriculture in Colombia.	Enabled environment for climate resilience	Municipal and State authorities in Cauca are promoting and investing in CSA practices aiming to reach approximately 150.000 farmers, due to the implementation of the CSV approach, using evidence generation and local empowerment. In addition, the State Government of Cauca approved USD$66 million from the Royalties National Fund to give to CRC (Cauca Environmental Authority) to scale CSA in at least 8 municipalities of the State.	1
581 FP1 (and 2) 2018	World Bank agricultural investments for improved climate change resilience in the ag sector and reduced contributions to GHG emissions rise from 28% (2016) to 45% (2018) of committed budgets of new agriculture projects.	Reduced net greenhouse gas emissions from agriculture, forests, and other forms of land-use	Three years ago, a CCAFS researcher was embedded within the agriculture group at WBG headquarters. The role of the researcher has been to strengthen the linkages and collaborative actions between the WBG and CGIAR, resulting in the following outcomes as reported by high-level Bank officials to an independent consultant (see Ref 1). - (1) Teams in the Agriculture Global Practice which design agricultural projects and programs; (2) plus governments/local partners–incorporating activities addressing climate change challenges; (3) behavioral change in many WB (low-income) country clients/governments towards adoption of CSA approaches, policies, actions; (4) Directors and regional managers at WB incorporating climate smart approaches and the scientific evidence base supporting them as part of their corporate strategy and in international climate and food system negotiations.	2
2628 FP1	Inputs on Land Productivity for	Enabled environment	CCAFS-CIAT consortium provided technical and policy recommendations on Land Productivity and	2

No of OICR / FP / Year of reporting	Title of OICR	Contributing to Sub-IDO	Evidence statement	Level of Maturity
2018	the Long-Term Green Growth Policy of Colombia	for climate resilience	Agricultural Performance for the Colombian Green Growth Policy, which was launched in July 2018. Current National Development Plan states the focus on financial instruments for sustainable agricultural activities that include climate-smart innovation processes and technologies in line with the Green-Growth-Policy. The goal is to increase by 3%, the agricultural production share under green-growth criteria. CCAFS is supporting policy implementation through technical support in developing the indicator for agricultural production.	
611 FP1 2019	Providing a framework for the Myanmar government's policies, programs, and investments on climate-smart agriculture	Enabled environment for climate resilience	In 2015, the Ministry of Agriculture, Livestock, and Irrigation (MOALI), together with CCAFS, developed the Myanmar Climate-Smart Agricultural Strategy (MCSAS) to guide the implementation of climate actions in Myanmar. To date, MCSAS has been referenced in at least 19 government and NGO programs, 4 policy documents, and 19 investment projects (worth approximately USD 1B investments). Furthermore, other CSA technologies and approaches were mainstreamed by various stakeholders as recommended in the MCSAS, such as the Climate-Smart Villages (CSV) and climate-smart rice production.	**2**
2042 FP1 2019	CCAFS research informs several gender and agriculture submissions of the Africa Group of Negotiators (AGN) to the United Nations Framework Convention on Climate Change (UNFCCC)	Gender-equitable control of productive assets and resources Improved capacity of women and young people to participate in decision-making	CCAFS facilitated and contributed text to the Africa Group of Negotiators (AGN) submission on the UNFCCC Gender Action Plan at the 46th Subsidiary Body for Implementation (SBI46) in May 2017 and country submissions from Ghana and Kenya; support was provided to the AGN Expert Support (AGNES) gender facilitator at the Gender Action Plan negotiations at COP25; technical support and text provided in the AGNES submission on Good Practices in Gender Mainstreaming of National Adaptation Plans and Nationally Determined Contributions (NDCs).	**2**
2362 FP1 2019	Vietnam's Ministry of Agriculture and Rural Development adopts CCAFS' outputs and inputs on its major climate-smart agriculture-related policies and programs	Enabled environment for climate resilience Reduced smallholder production risk.	Through CCAFS outputs and capacity building activities, the key officials, and staff of at least eight offices under the Ministry of Agriculture and Rural Development (MARD) enhanced their knowledge, skills, and favorable attitude towards climate-smart agriculture (CSA). This has enabled the mainstreaming of CCAFS outputs and inputs in the national policies (e.g. Resolution-120, Nationally Determined Contributions(NDC), UNFCCC-SBSTA submissions) and key programs (i.e., New Rural Development Program, National Adaptation Plan in Agriculture (NAPAg), Sustainable Agricultural Transformation, and the Rice Master Plan).	**2**

Drawing on the OICR analysis, as well as interviews with program leadership, next users, and through iteration on significant outcomes with FP leaders and Science Officers, a set of 'significant outcomes' have been identified by the review team.

- **Capacity strengthening for key CSA stakeholders:** Work undertaken with the African Group of Negotiators (AGNES) in UNFCCC processes, advancing the recognition of agriculture-climate at COP 23, as well as work on gender transformative change, thereby improving the enabling environment

for climate resilience: This has strengthened the capacity of members on understanding the vulnerability of African agriculture to climate change, food security and gender implications, with particular support for the preparation of submissions, for example, the UNFCCC Subsidiary Body for Scientific and Technological Advice. Other related capacity strengthening work includes activities such as 3-day training workshops undertaken on NDC processes in West Africa, East Africa, SE Asia; training in foresight and visioning in SADC; and priority setting training workshops in South Asia, for example; training over several months with parliamentarians in Cambodia in relation to climate change impacts and adaptation, for national adaptation planning.

- **Fostering science-policy engagement through multi-stakeholder approaches:** for example, work undertaken by the West Africa team to support science-policy platforms, IITA's work with their Learning Alliances in Uganda, facilitation of Kenya CSA Multi-Stakeholder Platform, and a CSA multi-stakeholder platform in Ethiopia. The support to AGNES is part of this broader agenda of science-policy engagement, strengthening linkages in co-writing submissions to the UNFCCC.
- **Priority setting, Foresight Analysis and Scenarios Research have informed relevant policy processes:** Co-creation and testing of participatory scenarios in all CCAFS regions informing an array of national policies. Foresight mechanisms used in relation to gender and youth issues and the potential differentiated impacts of climate change. Work was done to extend the International Model for Policy Analysis for Agricultural Commodities and Trade or IMPACT[16] (IFPRI) the analysis of livestock, fish, and nutrition. Work was also done with IIASA and the GLOBIOM model on quantifying some of the scenarios. Scenarios were used in several countries to "stress test" national CSA and adaptation plans. In collaboration with Utrecht University FP1 has supported the development of innovative games and use of those games in climate negotiations (in COP 24) and of gaming as a way to engage youth to address the complexities of future global change.
- **National and regional policy design and implementation, including gender and social inclusion:** there are multiple examples of this. At national level, Myanmar's Climate-Smart Agricultural Strategy has been informed by CCAFS science and engagement, and this has shaped associated investment projects and support for the development of Colombia's Green Growth Policy and influencing various Vietnamese MARD policies and programmes to mainstream CSA. Regional level examples include support for the Central American Agricultural Council's (CAC) implementation of their CSA strategy for the Central American region, and work with the Southern African Development Community (SADC), with whom CCAFS continues to collaborate on climate change. Initial support provided to a new GIZ-funded Southern African Development Community (SADC) initiative for prioritizing agriculture and natural resource management investments in the members states, with the recommendation to mainstream climate change in the SADC Regional Indicative Strategic Development Plan 2020-30 was approved. Several Flagship initiatives have worked on strengthening the focus on gender and social inclusion in different policy processes, e.g. working with national and local women's groups to better articulate GSI issues in policy formulation and implementation activities in several countries of Central America.
- **Promotion of investments for climate-smart agriculture in LMICs:** for example, this has occurred through participation in the Global Commission on Adaptation report, which has catalyzed a new food action track. Additionally, close collaboration and secondment of a FP1 scientist for 4 years with the World Bank (WB) has supported mainstreaming of climate in their investment projects, including inputs to a CSA investment plan for Bangladesh (WB and other partners) informing loans of value at least USD 500m.
- **CC and nutrition studies have informed food system planning and investment:** FP1 has partnered with A4NH and with WUR and their MAGNET model to quantify future scenarios from a nutrition perspective. This work has focused on Bangladesh (and Ethiopia, hopefully, in 2021). Other activities to help inform food system planning and investment under a changing climate include deliverables on the impacts of climate change on nutrition and on equity considerations (with A4NH). Collaboration has also been undertaken with IFPRI's Gender-responsive and Climate-resilient Agriculture for Nutrition (GCAN) project, resulting in several high-profile publications and policy briefs on this issue.

These significant outcomes are mapped in Annex Figure 10.1 below, to show where they sit in the impact pathway of FP1 and the overall program ToC (the latter highlights CSA implementation and policy and institutional change as key change areas). The visualization indicates the significant outcomes in green

[16] http://tools.foodsecurityportal.org/impacts-alternative-agricultural-investments-version-9

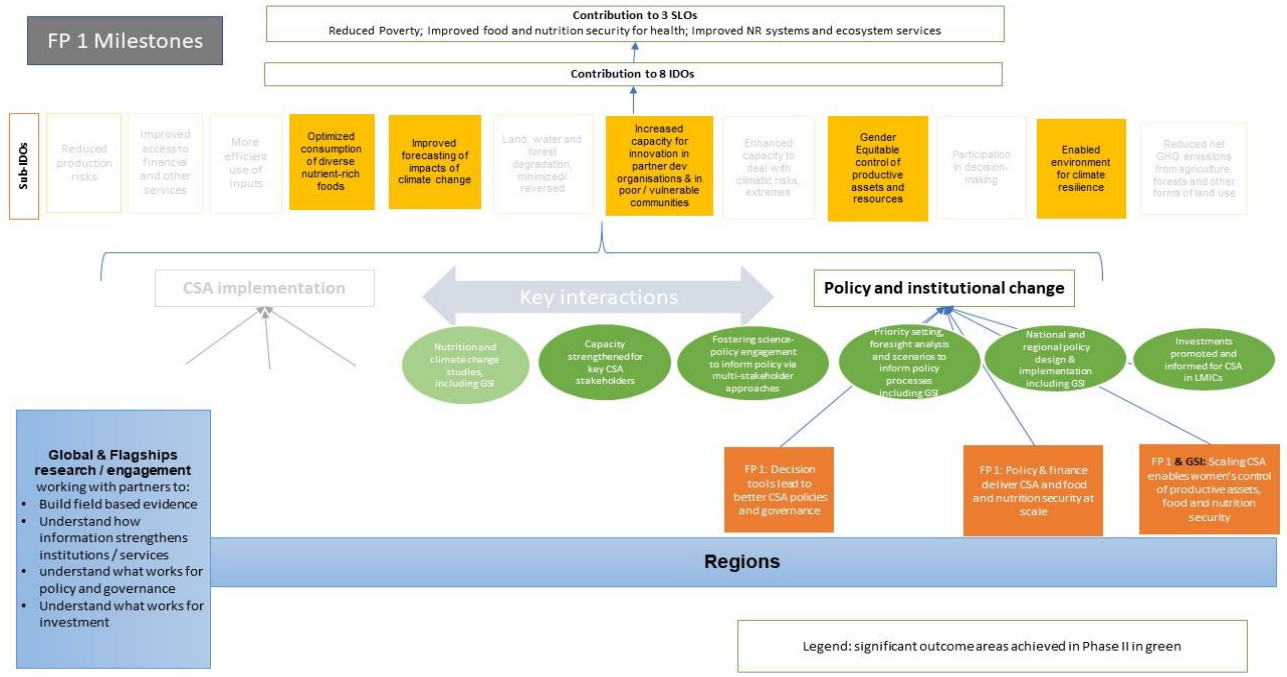
circles – although the nutrition and climate change studies are shown in lighter green, indicating less strong achievement compared with the other areas, such as capacity strengthening for CSA stakeholders or fostering science-policy engagement. While the evidence indicates a strong contribution to capacity of certain key actors, it is not clear how far all relevant actors in a policy space have been reached hence it is difficult to gain a sense of the proportion or magnitude of difference achieved by CCAFS.

The assumptions have largely held true, e.g. that there is demand from decision-makers for evidence and soft skills, and that innovative tools and analyses can support decision-making processes, and women's participation in them, via meaningful cross-scale participation (e.g. via learning alliances). Further, FP1 has successfully worked with diverse decision-makers (OICRs and stakeholder interviews) and there have been opportunities to influence investment decisions using policy environment research (not only technological solutions) and in climate finance flows.

The significant outcomes confirm the hypotheses that CCAFS science and engagement by FP1 can inform decision-maker decisions and encourage scaling. However, more could be done to track stakeholder ownership of policies, the relevance of the policies and the likelihood that the policies and investments will be effectively implemented to achieve desired goals. One study commissioned by CCAFS on investment pathways and evidence will provide a contribution to this work, as will another focused on building evidence on attitude change. While some of the changes indicate shifts in more than broad policy statements, and also to implementation strategies and investment *plans*, it is not yet documented how far this has fed into broader change on the ground.

There are areas where the qualitative and quantitative data indicate that more could have been done, such as in the area of climate change and nutrition, although a strong partnership is emerging with A4N on this topic. However, budget cuts affected work in this area.

Annex Figure 10.1: Flagship 1 significant outcomes compared to theory of change



Flagship 2: Significant Outcomes

The overall **vision** for FP2 is that 'all farmers and livestock keepers, including women and marginalized groups, are resilient and food secure despite a variable and changing climate'. The impact pathway causal pathway is described below. The **objectives** of FP2 are 'to address the challenge of how to transition to CSA at scale, FP2 will work with partners to test, evaluate, promote and scale-up CSA technologies and practices that meet the needs of farmers – including women and marginalized groups. Its purpose is to build adaptive capacity and resilience to climate variability and change, while increasing food availability and generating mitigation co-benefits. FP2 will achieve these goals and objectives by: 'integrating and applying the best and most promising methods, tools and approaches for equitable local adaptation planning and governance and developing innovative incentives and mechanisms for scaling up. The primary target beneficiaries of FP2 are climate vulnerable, food insecure and poor groups (smallholder

farmers and women in particular), and development agencies and institutions across scales involved in agricultural planning and private sector will benefit and support scaling.

Four **Clusters of activity** (CoA) include: i) Participatory evaluation of CSA technologies and practices in CSA Villages; ii) Evidence, investment planning and application domains for CSA technologies and practices; iii) Equitable sub-national adaptation planning and implementation; iv) Business models, incentives, and innovative finance for scaling CSA. These lead to a set of **outputs**, but these are not included in the impact pathway diagram. See Annex Table 10.4 below.

Annex Table 10.4: Flagship 2 clusters of activity and research outputs

Clusters of Activity	Research Outputs
Participatory evaluation of CSA technologies and practices in CSA Villages	On-farming testing and evaluation of scalable, gender sensitive and specific CSA options, including transformative options and models of integrated crop-livestock-tree systems. Improving understanding of farmer's and stakeholders' perceptions along value chain of CSA options and success/failure conditions. Simulation of CSA options under different climate and socio-economic scenarios for informed decision-making. Empirical and big data analysis of climate-specific advisory systems (including precision agriculture) for farmers Farmer citizen science approach for adapting CSA options to local context and scaling up
Evidence, investment planning and application domains for CSA technologies and practices	Expansion of compendium of CSA practices and technologies (information on costs, benefits, constraints, gender impacts). Understanding farming systems' diversity and prioritization and decision-support tools for guiding CSA investments, including spatial models to understand application domains in space and time of promising CSA options. Information notes on benefits of a particular CSA practice or technology, with associated information on trade-offs, application domains and evidence of gender-related impacts. Country and county climate-smart profiles that help identify priority CSA practices and technologies within a given country / region.
Equitable sub-national adaptation planning and implementation	Research on institutional arrangements for CSA promotion in and around CSVs Evaluation of LAPAs in South Asia (e.g. Nepal) and their efficacy in promoting adaptation and gender-equitable CSA adoption. Evaluation of scaling up strategies and their efficacy across a range of contexts and regions.
Business models, incentives, and innovative finance for scaling CSA	Synthesis of research on business models and approaches to business modelling across different biophysical and socio-economic contexts to find out which models and approaches are most useful, for whom, and under what conditions. Establishment of public-private-partnerships with value chain actors to develop evidence-based certification schemes that facilitate entry points for CSA investment through commodity chains. Research on CSA certification feasibility in West Africa and Central America (coffee, cocoa value chains), and SE Asia (rice) Research on the reach and efficacy of impact investment and other novel financial instruments, including those originating from climate finance Awareness raising on and preparation for innovative climate funds at multiple levels.

Achievement of these outputs is anticipated to lead to 2022 FP outcomes (sub-IDOs) are as follows, with their associated targets via different causal connections: Reduced production risks; Improved access to financial and other services; Improved forecasting of impacts of climate change and targeted technology development; Gender-equitable control of productive assets and resources; Increased capacity for innovation in partner development organizations and in poor and vulnerable communities:

The achievement of the sub-IDOs contributes to four of CCAFS' Intermediate Development Outcomes (IDOs), namely: Improved resilience of the poor to climate change and other shocks (via reduced production risks); Enhanced smallholder market access (via improved access to financial and other services); Mitigation and adaptation achieved (via improved forecasting of impacts of CC and targeted technology development); Equity and inclusion achieved (via gender-equitable control of productive assets and resources); National partners and beneficiaries enabled (via increased capacity for innovation in partner development organizations and in poor and vulnerable communities). Ultimately, this is anticipated to contribute to SLO 1: Reduced Poverty, and SLO 2 Improved food and nutrition security for health.

Key **assumptions** articulated in the program proposal (2016) for FP2 are as follows:

- CSA requires capacity to implement flexible, context-specific solutions supported by innovative policy and financing actions beyond 'business as usual'.
- Better information and evidence, packaged and communicated through appropriate channels, will not only increase investment, but also increase the quality of that investment towards the delivery of CSA related outcomes.
- CSA practices and technologies will be attractive to young people and have the potential for gendered impacts above and beyond a 'business as usual' approach (risks relating to increased labor inputs noted).
- CSA is attractive as a concept to international and national agricultural development agencies (some regions and countries prefer not to use the term).

The FP impact pathway **links to the overall CRP Flagship** through two hypotheses:

- Context-specific knowledge on the impacts of practices, technologies, business models and information systems on CSA-related outcomes and on cost-effectiveness advantages compared to current practice, leads to adoption of CSA at the local level.
- Improving and applying knowledge on socio-economic, technical, financial and political barriers to incentives for investment in and adoption of CSA technologies and practices will lead to adoption of CSA at scale.
- Context-specific knowledge increases women's control of productive assets.

Critique of the FP2 impact pathway is the same as for FP1, pertaining to insufficient articulation of the causal steps and associated assumptions, with clarification of the actors and rules involved that are anticipated to change and a mixture of levels/types of sub-IDOs etc. See analysis for FP 1 above.

The **evidence** available to test the theory of change is being gathered to a certain extent, but due to the weaknesses in the impact pathway outlined above, the sheer scale of the program (e.g. number of activities on-going) and the way in which data are collected, this means that it is challenging for a reviewer to identify and map the relevant evidence to the impact pathway and to interrogate the associated assumptions. Further, such an analysis has not been carried out by the program itself.

Cumulative **quantitative** data for achievement compared with planned outcome targets is not regularly gathered by the program. However, on request, CCAFS generated the evidence below (See Annex Table 10.5). The data indicate that on two outcome indicators, FP2 has significantly exceeded its targets, and for two others it has met or nearly met the target. For example, achievement was 178% compared to the target for 50 site specific targeted CSA options tested and examined for gender implications. Only for one indicator has there been under-achievement, and this is with respect to the number of sub-national public and private initiatives providing access to novel financial services and supporting innovative CSA business models. However, analysis of the Annual Reports and FP 2 Flagship Lead/Science Office indicates that much more has been achieved:

- Outcome indicator target, '15 development organizations, with a focus on investments for CSA activities, adapting their plans…etc.,'), 24 organizations have been reached by 2018 (AR, 2018).[17] Additionally, in 2019, the narrative reports that there was significant influence achieved in Central America at a regional level through the development of a Climate Smart Agriculture Strategy and mainstreaming of gender considerations18, in the Myanmar Ministry of Agriculture, Livestock and Irrigation's Climate Smart Agriculture National Strategy, and in East Africa, where CCAFS science informed the IUCN and Government of Tanzania Green Climate Fund Proposal (approx. USD 100m) (AR, 2019).

[17] CCAFS science/engagement influenced: the governments of Cote d'Ivoire and Mali which developed plans to guide investments into CSA, including gender and youth inclusion concerns; the US$ 2 billion investment by African Development Bank (ADB) into CSA; the Tanzania CSA Guidelines; the Kenya CSA Framework Programme; West Africa development institutions (CORAF/WECARD, ECOWAS, UEMOA) initiatives in four countries (Burkina Faso, Ghana, Niger and Senegal) for large investments for 1.5 million farmers that increase women's (at least 30% women) and youth control over productive assets and resources.

[18] Support for the regional CSA strategy, in collaboration with the Central America Agricultural Council or CAC (a regional entity), the Council of Ministers of Women (COMMCA), the Gender and Climate Change Units at the Ministry of Agriculture in Guatemala, and 22 other organizations from the Central American region. A step-by-step guide to mainstreaming gender in CSA programs, investments and policies was produced.

- Outcome indicator target (i.e. '50 site-specific targeted CSA options…etc.,), the Annual Reports report that for 2018, 94 CSA Practices have been tested and/or evaluated across the Climate-Smart Village Network), for which the gender dimensions were assessed for 63, and the mitigation potential of 45 were assessed. There are diverse outputs communicating the results. A South Asia publication assesses the effects of combinations of practices. In 9 CSV sites, there was monitoring of the gender dimensions of 30+ practices, in collaboration with the Gender LP/FP. For some of the practices, there has been significant outscaling, such as crop residue management solutions in India and the large-scale investment of INR 1150 crores for in-situ management using the Happy Seeder technology (see deep dive), which increases incomes for 2 million farmers. 64 practices tested/evaluated across the CSV network are also reported for 2019. It is not clearly stated, but these appear to be additional practices tested just for the 2019 calendar year. The gender dimensions of 20 were assessed and the mitigation potential of 14 was assessed. Further, expansion of the CSA Monitoring Framework was undertaken[19].
- Outcome indicator target (i.e. '10 policy decisions taken, in part, based on engagement and information dissemination by CCAFS'), this has been exceeded. 27 policy decisions have been taken informed by CCAFS science (AR, 2018), of which 22% are considered Level 2 maturity, and one is Level 3[20]. In 2019, 14 policy decisions were reported – it appears that this is just for the calendar year 2019, but it is not clearly stated. 35% of these policy decisions are considered Levels 2 and 3[21].
- Outcome Indicator Target: '6 million farm households receiving incentives…etc.,': Annex Table 10.5 indicates that this has been exceeded with 6.44 m farmers receiving incentives. AR 2018 reports 2 million farmers are benefitting in multiple ways in India (crop residue management and Happy Seeder Technology). In Latin America, 500,000 farmers are estimated to be benefiting from actionable advice and 2.3 m farmers receive incentives for CSA adoption via a collaboration with UTZ certification scheme [= 4.8 m]. For 2019, the AR reports: 706,000 farmers receiving incentives, but it is not clear where these farmers are. An example is given for 82,000 potato growers accessing community seed banks in Kenya and Uganda, but it is unclear if these are additional or part of the 706,000. In other words, it is difficult to trace these figures.
- Outcome indicator target - '15 sub-national public-private initiatives providing access to novel financial services and supporting innovative CSA business models', CCAFS program data report 8. However, an analysis of the AR indicates that the number is somewhat higher. 8 initiatives are reported in AR 2018[22], especially in cocoa and coffee in Ghana, Ivory Coast, Peru, and Guatemala. FP 2 Science Officer identifies 24 initiatives in the AR 2019 and from OICRs, including: state governments (India, Nepal) and private sector companies (India) scaling the CSV approach (453 Villages); two state governments in Nepal allocating funds (700+m NPR investments) with a plan to reach 196 CSVs in 2020; contribution to the design of the USAID

[19] It includes gender specific indicators and provides gender disaggregated information on adoption, access to climate information services and perceived impacts of CSA implementation on productivity, income, access and diversity of food and climate vulnerability.

[20] CSA concepts incorporated into development plans at national level (Kenya Climate Smart Agriculture Implementation Framework and Philippine Medium-Term Development Plan), and local levels (e.g. Guinayangan, Quezon Comprehensive Development Plan Municipal Agriculture Office Banner Programs). Level 3 maturity in Root Capital's Expected Impact Rating system, which has been used to review and close 251 loans, including 199 loans totaling US$ 146 million to coffee and cocoa businesses.

[21] Level 3 maturity: Myanmar Climate-Smart Agriculture Strategy developed by CCAFS and the Ministry of Agriculture, Livestock, and Irrigation (MOALI) provides the national framework for the implementation of technical, policy, and investment initiatives to cope with climate change in Myanmar. Level 2 maturity: co-development with the Department of Science, Technology and Environment of Vietnam's MARD of a study for the implementation of Vietnam's AgINDC (agriculture Intended Nationally Determined Contribution) component, which served as the basis of the action plan adopted by MARD; development of the Uganda National Seed Policy 2018 to ensure availability, accessibility and affordability of safe and high quality seeds and the Strategy 2018/2019–2022/2023 that elaborates actions and plans to implement the policy; gender support to AGNES with policy outcomes at global and national levels. Level 1 maturity: two departmental climate change plans developed in Colombia for Boyaca and Orinoquia respectively; support to Nông Thôn Mới (NTM), a national target program under the New Rural Development in Vietnam; and the Climate Smart Agriculture Policy of El Salvador developed.

[22] Training materials for both cocoa and coffee climate risk assessment are in use by voluntary certification agencies (Rainforest Alliance) in Ghana and Ivory Coast (cocoa) and Peru (coffee and cocoa), private sector extension teams (Ghana and Ivory Coast, cocoa; Uganda, coffee), other projects (Alliance for Resilient Coffee, Honduras, Guatemala, Uganda). Training materials for Council on Smallholder Agricultural Finance developed in 2018 and piloted connecting CSA practice implementation with producer organization finance in Guatemala (Root Capital). Extension apps used by private sector in Ghana (cocoa) and Uganda (coffee).

supported Athelia Biodiversity Fund for Brazil, an environmental impact investment fund; informing climate-smart agriculture investment plans (Mali, Cote d'Ivoire, Ghana, Burkina Faso) which each exceed 250m informing the IUCN and Government of Tanzania Green Climate Fund Proposal

It is important to note that the targets are set for 2022. More progress is anticipated in 2021, but also the program has been curtailed by a year.

Annex Table 10.5: Outcome achievements compared to targets for Flagship 2

	Outcome Target Value	Achieved value	Achieved value	Achieved value	Achieved total	Achieved total to target #
	2022	**2017**	**2018**	**2019**		
15 development organizations, with the focus on investments for CSA activities, adapting their plans or directing investment to increase women's access to, and control over, productive assets and resources.	**15**	**n/a**	**28**	**n/a**	**28**	**187%**
50 site-specific targeted CSA options (technologies, practices, and services) tested and examined for their gender implications	**50**	**n/a**	**86**	**n/a**	**86**	**172%**
# policy decisions taken (in part) based on engagement and information dissemination by CCAFS	**10**	**n/a**	**9**	**1**	**10**	**100%**
6 million farm households receiving incentives (training, financial, programmatic, policy-related) for adopting CSA related practices and technologies that potentially reduce production risks with increased benefits for women	**6**	**0.54**	**3.9**	**2**	**6.44**	**98%**
# sub-national public/private initiatives providing access to novel financial services and supporting innovative CSA business models	**15**	**n/a**	**8**	**n/a**	**8**	**53%**

Qualitative data collected on the range of outcomes achieved is produced via the OICRs. For FP2 22 OICRs were evaluated as good or excellent and hence included in the Annual Reports for FP 2 (2017-19), of which 20 have been identified from MARLO / CAS Secretariat excel file. See Annex Table 10.6 below which shows the different OICRs and levels of maturity achieved – a spread of 1, 2 and 3.

Annex Table 10.6: Flagship 2–led outcome-impact cases

Outcome-Impact Cases [Independently Evaluated]	Sub-IDO	Level of Maturity
2039: Scalable CSA business models drove a USD 170 million national policy investment in India to curb crop residue burning.	Reduced smallholders production risk. Improved access to financial and other services	**1**
2099: Scaling up climate information services in LAM, engaging over 200 institutions in four countries, realizing benefits for at least 100,000 farmers.	Enhanced capacity to deal with climatic risks and extremes	**1**

Outcome-Impact Cases [Independently Evaluated]	Sub-IDO	Level of Maturity
2103: Scaling out Solar Pump Irrigators Cooperate Enterprise (SPICE) model in India	Reduced smallholders production risk	**1**
2115: World Food Programme uses mobile-based monitoring tools to guide programming in three countries, affecting up to 2.6 m persons.	Gender-equitable control of productive assets and resources	3
2119: Implementing the plant genetic resources treaty in Bhutan, Burkina Faso, Costa Rica, Cote D'Ivoire, Guatemala, Nepal, Rwanda and Uganda.	Enabled environment for climate resilience	3
2163: Cauca leads climate smartness for agriculture in Colombia.	Enhanced institutional capacity of partner research organizations Enabled environment for climate resilience	1
571: Root Capital uses CCAFS data to evaluate 251 loans including 199 for coffee worth 146 million USD.	Increased capacity for innovation in partner development organizations and in poor and vulnerable communities	1
581: World Bank agricultural investments for improved climate change resilience in the ag sector and reduced contributions to GHG emissions rise from 28% (2016) to 45% (2018) of committed budgets of new agriculture projects.	Reduced net greenhouse gas emissions from agriculture, forests, and other forms of land-use Enabled environment for climate resilience	2
2161: Ghana's COCBOD incorporates CGIAR science into training materials for climate resilient cocoa production (targeting a potential 800,000 farmers).	Reduced smallholders production risk Increased capacity for innovations in partner research organizations	1
2600: 600,000 hectares of rice planted earlier in Vietnam to avoid risk to salinity intrusion brought by the 2019 El Nino.	Enabled environment for climate resilience	2
611: Providing a framework for the Myanmar government's policies, programs and investments on climate-smart agriculture.	Conducive agricultural policy environment	1
2272: Public and private sector takes Climate-Smart Village scaling to next level in India and Nepal.	Enabled environment for climate resilience	2
2362: Vietnam's Ministry of Agriculture and Rural Development adopts CCAFS' outputs and inputs on its major climate-smart agriculture-related policies and programs.	Reduced smallholders production risk Enabled environment for climate resilience	2
3083: Climate-Smart Village approach mainstreamed in the Philippines, Vietnam, Myanmar, Laos, and Cambodia	Enabled environment for climate resilience	2
3162: Evidence for Resilient Agriculture informs more than USD 1 billion in investment plans and three subnational adaptation plans.	Improved access to financial and other services Increased capacity of partner organizations Enabled environment for climate resilience	2
3188: CCAFS science backs-up a US$45million IADB loan for the Government of El Salvador to implement the National Policy of Agriculture and increase climate resilience.	Enhanced institutional capacity of partner research organizations Enabled environment for climate resilience	1
3189: Community-based seed systems increases access/availability of high-quality adapted seeds for 189,000 farmers in East Africa.	Enabled environment for climate resilience	2
3251: CCAFS and CIAT, with support from USAID, successfully co-designed, developed and established the Althelia Biodiversity Fund to protect, restore, improve biodiversity and ecosystems.	Diversified enterprise opportunities Enhanced conservation of habitats and resources Land, water and forest degradation (Including deforestation) minimized and reversed	1

Outcome-Impact Cases [Independently Evaluated]	Sub-IDO	Level of Maturity
3347: The adoption of Happy Seeder technology by 0.5 million farm-households on 1.3 million hectares in north-west India contributed to increased yields, profits, water, and nutrient saving.	More efficient use of inputs Reduced net greenhouse gas emissions from agriculture, forests, and other forms of land-use	3
181: Investment by two Nepalese states in the 'Chief Minister's Climate-Smart Agriculture Village Model Program'	Reduced smallholder production risk	2

Drawing on the OICR analysis, as well as interviews with program leadership, next users, and through iteration on significant outcomes with FP leaders and Science Officers, a set of 'significant outcomes' have been identified by the review team as follows:

- **Extensive participatory evaluation of CSA practices and technologies:** A Research for Development approach involving Participatory Action Research (PAR) and field testing of technologies and practices in Climate-Smart Villages (CSVs), has produced significant outcomes. At least 94 climate smart technologies and practices have been tested in 2018 and 64 in 2019. 'Best bets' for CSA practices have been identified for differing contexts, with the information being used to inform diverse CSA investments (see below). The compendium of CSA practices has been published and is being used to inform investments and sub-national adaptation plans.
- **Developing and scaling the CSV approach:** The Climate-Smart Village approach was developed to support the testing of CSA practices and technologies. 36 Climate-Smart Villages were in existence in 20 countries at the high point, and 11 CSVs still operating in terms of testing, while others have moved from research to scaling (FP leader/Science Officer interview). On the ground presence of the CSVs has been important for CCAFS as it has facilitated stakeholder coordination, collaboration actions between the FPs, collaboration with other CRPs and linkages and information to influence key policies and investment decision-making processes at higher scales. It has led to the identification of best bets. A 2018 quasi-experimental study in East Africa, found that for the CSVs studied, results show an increase in uptake of CSA technologies and institutional innovations, plus improved agronomic and livestock management practices and for some combinations – greater household asset building than for non-participating households[23].
- The Climate-Smart Village approach has been mainstreamed in the Philippines, Vietnam, Myanmar, Laos, and Cambodia, as well as in India and Nepal.
    - **India and Nepal:** For example, state governments in the latter two countries, as well as private companies in India, are currently scaling CSVs. In 2019, the CSV program included an additional 453 villages. In Nepal, two state governments have made investment commitments (700+m NPR) to scale the program to reach 196 villages in 2020. Key partner organizations include ITC Limited, Reliance Foundation (which has broad reach across 12 Indian states) and the Sonalika Foundation.
    - **Myanmar:** The Myanmar CSA strategy provides a framework for the establishment of CSVs in the country and has informed a USD 500,000 project by IIRR and IDRC, which has established 4 CSVs. More evidence is needed on the impact of the CSV approach. IDRC has invested USD 600,000 in a study to assess the economic, inclusion and gender effectiveness of CSVs in Myanmar, the Philippines, and Cambodia.
    - **Philippines:** CSV adopted in the Adaptation and Mitigation Initiative for Agriculture (AMIA), the government flagship program on climate resilience in agriculture. 21 AMIA villages established and more planned (AR, 2019).
    - **Laos:** 5 CSVs established (Phongasli Province) in collaboration with the World Food Programme (Strategic Support for Food security and Nutrition Project).
    - **Vietnam:** The CSV approach has been adopted as part of the Vietnam New Rural Development Programme, amongst others.
    - **Cambodia:** 37 villages supported through CSV approach (supported by IIRR) to support learning on climate-resilient sustainable forest ecosystem management.

[23] Radeny M, Ogada MJ, Recha J, Kimeli P, Rao EJO, Solomon D. 2018. Uptake and Impact of Climate-Smart Agriculture Technologies and Innovations in East Africa. CCAFS Working Paper no. 251. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

- **Improving the capacity of a wide range of public-private commodity initiatives advancing the uptake of CSA practices with potential benefits for smallholder farmers.** The reach of FP2 in terms of influencing/support diverse organizations in this regard is impressive. Particularly in the cocoa and coffee sectors in certain countries, including Ghana, Cote d'Ivoire, Peru, Uganda, Honduras), FP2 has variously contributed to the capacity strengthening of sustainability standards and certification bodies, private sector extension services, and an NGO network project. Extension apps have been developed and are now in use in Ghana (cocoa) and Uganda (coffee). It is reported (AR, 2018) that these practices are being promoted / now in use by these agencies, although it is not exactly clear how far smallholders are adopting some or all these practices. Cocoa or coffee national sector transformation analysis would be helpful to demonstrate the role and importance of the CSA initiatives influenced in the wider sector sustainability context. Collaboration with Root Capital has enabled FP2 to generate and pilot training materials for the Council on Smallholder Agricultural Finance linking CSA practice implementation and producer organization finance in Guatemala (AR, 2018). It is not clear how far improved access to finance has led to changes in farmer practice, or how such approaches compare to others in the field.
- **Improving sub-national government capacity on CSA:** In 2019, CCAFS work informed an impressive variety of organizations (approximately 24), for example, including state governments (India, Nepal) and private sector enterprises (India). Evaluation of these different initiatives would provide evidence of positive outcomes. In East Africa, FP2 compiled data and synthesized in Evidence for Resilient Agriculture (ERA) to design subnational adaptation plans in three Kenyan counties.
- **Success in informing policies, investments, and CSA business models to facilitate scaling of CSA practices:** The uptake of the CSV approach and its backing through investments in diverse countries has been outlined above. In addition:
    - **Examples of national CSA policy and strategies:**
        - **Myanmar:** FP2 has facilitated the development of Myanmar government policies, programmes, and investments on climate-smart agriculture. By establishing a strong relationship with the Ministry of Agriculture, Livestock, and Irrigation, FP2 has informed the Myanmar Climate Smart Agriculture Strategy (MCSAS). In turn, this strategy is now guiding government and civil society programming. 19 government and NGO programs have referenced the strategy, and 4 further policy documents reference it as well. 19 investment projects (USD 1b investments) have been informed. It is not clear how far such programmes and investments would have occurred without CCAFS inputs, or how far they have been influenced. Actions promoted in the national strategy (e.g. CSVs and climate-smart rice production) have also been mainstreamed by other stakeholders, but no details are given (AR, 2019).
        - **Kenya:** FP2 has supported national level climate capacity strengthening with the Ministry of Agriculture, supporting the development of a National Climate Smart Agriculture Strategy. More implementation is still required at the devolved county levels and impact assessment of the policy (stakeholder interview).
        - **Vietnam:** The Ministry of Agriculture and Rural Development (MARD) has specifically promoted Alternate Wetting and Drying technologies tested by FP 2 in the Mekong River Delta and in investment planning. The CSV concept, interpreted in Vietnamese as '*Thuận Thiện Farm Villages',* has supported a shift in approach to agriculture, with a greater focus on farming in balance with nature, especially in the Mekong River Delta (MRD) area (under Resolution120). The latter was supported by investment of USD 1.2b and another USD 800,000. CCAFS work enabled the testing of CSMAP in the MRD, as an early warning system to inform farmers' crop calendars and improve farm management and there is interest to scale this up in other deltas (stakeholder interview). The CS MAP has been used by the Department of Crop Production to guide early rice planting to avoid salinity intrusion. The Department report a saving of 200,000 ha of rice in 2019 and a similar avoidance of damage in 2020. The government is keen to expand the CS MAP use in other deltas (Red River and South-Central Coast) (stakeholder interview).
    - **Examples of public sector-based engagements:**
        - **Ghana:** FP2 has worked with Ghana's COCBOD providing training materials for inclusion in climate resilient cocoa production, i.e. the entry point is the cocoa

sector (this links with the public-private initiatives capacity strengthening noted above).

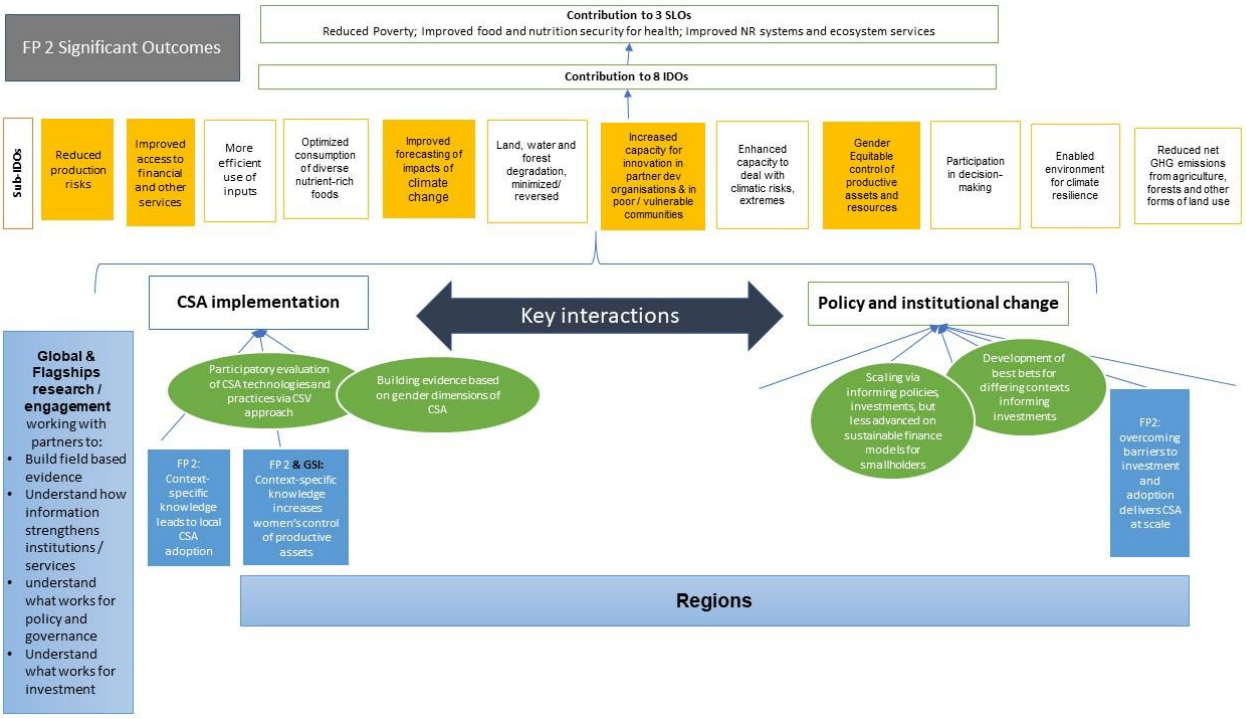
- **Examples of investments at different scales informed or catalyzed: Overall, FP2 provides impressive figures on investments.** However, more analysis is needed of the relative contribution of CCAFS science to different investments, how far the investments catalyzed are additional and what is the scale of the overall investment flows that need to be redirected from degenerative to regenerative ends. The FP and CCAFS as a whole have increased its focus on investment and sustainable finance in recent years, but a stronger critical lens is required of what the investments entail in terms of developmental and environmental trajectories.
    - **National CSA investment plans:** FP2 via the Evidence for Resilient Agriculture initiative or ERA – a meta-dataset and analytical engine using the last 30 years of agricultural research in sub-Saharan Africa (hosted by ICRAF) developed cost-effective climate-smart agriculture investment plans for Mali, Cote d'Ivoire, Ghana, and Burkina Faso – each worth 250 M USD (OICR 3162). Also using the ERA, FP2 supported an IUCN and Government of Tanzania Green Climate Fund Proposal (approximately 100m USD). In El Salvador, the government has obtained a USD 45m loan from the Inter-American Development Bank, to increase climate resilience in coffee areas and for the implementation of digital climate-smart agriculture (to implement the national policy), informed by FP2 science in the development of the proposal
    - **Technology oriented investments to solve specific challenges:** The Happy Seeder technology was promoted through engagement with government, unlocking a key Indian government investment and promotional campaign.
    - **One investment model innovation supported**. FP2 reports playing a role in the design of a major impact investment fund (Althelia Fund, Brazil), which aims to catalyze conservation finance to reduce deforestation and GHG emissions, protect biodiversity and promote resilient livelihoods. It is not completely clear what the actual role of CCAFS has been in the design and its relative contribution vis-à-vis other actors. The fund is 'targeting USD 100 m' of investment, but it is not reported yet how much has been invested to date (more information is likely in the 2020 AR). However, it is also not clear what the amounts already or to be catalyzed represent in terms of wider financial flows which have degenerative effects to give a sense of the ambition of the investment vehicle.
- **Legislative innovations facilitated:** CCAFS has played a significant role advancing the implementation of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) plant genetic resources treaty in different countries, including Bhutan, Burkina Faso, Costa Rica, Côte d'Ivoire, Guatemala, Nepal, Rwanda, and Uganda. This treaty, which aligns with the Convention on Biological Diversity, entered into force in 2004, and aims to guarantee food security via the conservation, exchange and sustainable use of the world's plant genetic resources for food and agriculture, as well as the fair and equitable benefit sharing arising from is use, and recognition of farmers' rights. Key to FP2's work on the treaty is training on policy analysis, strategy development, documentation and implementation. The multi-stakeholder and multi-sector approach is reported (AR, 2018) to have improved awareness, strengthened trust and enabled sustained collaboration between institutions and countries leading to an advancement of national efforts to implement the Treaty and the Multilateral system (MLS). Eight countries have developed relevant policies and laws, creating policy and legal space for effective implementation. Examples include: An approved interim Access and Benefit Sharing or ABS policy and a Biodiversity Bill, 2016, submitted for parliamentary approval (Bhutan); A new law on access to plant genetic resources for food and agriculture and benefit sharing prepared and submitted for parliamentary approval (Burkina Faso); Memorandum of Understanding on procedures and agency tasks on the MLS (Cost Rica); A new ABS law drafted and under review (Cote d'Ivoire). 7 of the 8 countries also notified the Treaty Secretary about PGRFA in their countries under the MLS and established 7 national competent authorities to consider requests for PGRFA access and to facilitate sharing with users globally (not Cote d'Ivoire). This represents a contribution to harness the power of the treaty by embedding it in national laws and building national policy actor capacity, although more time and capacity strengthening may be needed for enforcement and sustained implementation.

- **Examples of CSA business model innovations and scaling:** The Happy Seeder technology was promoted through engagement with government and the private sector, with testing of business models for enhancing farmer access to equipment

- **Developing understanding of the gendered impacts of CSA and approaches to effective gender-sensitive monitoring.** FP2 and the Gender Flagship/LP have collaborated on building capacity to understand gender relations in agriculture in a climate context. They have explored the use of mobile phones in collecting data on the impacts of CSA practices, and have created an evidence base on gendered impacts of CSA, by collated 100+ publications with sex-disaggregated data on CSA. It is not clear how far this work has led to more gender-sensitive CSA implementation in practice.

The significant outcomes are mapped against the theory of change – see Annex Figure 10.2 below – which gives a visual overview of the significant outcomes identified (green circles) and how they contribute to the sub-IDOs (orange boxes indicate the sub-IDOs that the FP is seeking to contribute to) and overall goals.

Annex Figure 10.2: Flagship 2 significant outcomes compared to theory of change



The evidence suggests that, as per the impact pathway assumption, CSA does require capacity for context-specific approaches, supported by enabling policy and finance. Improved evidence and engagement with stakeholders responds to national and international demand, and has led to CCAFS science and engagement informing of the quality of policies and investments. Investments have been improved by FP2, although more analysis of how far new investments are catalyzed would be helpful, for example, as opposed to informing investments that might have occurred anyway and the role of other actors. One quasi-experimental study provides evidence on the adoption of CSA practices and technologies in East Africa. More evidence is needed and may have been delayed by COVID-19. Further, evidence is lacking to test the assumption that CSA practices and technologies are attractive to young people, but work on gender has been extensive in terms of promoting analysis of the gender dimensions of CSA and unpacking the assumptions involved, e.g. relating to labor-saving technology and women's empowerment. The concept of CSA has currency in many of the target countries, although interest in how CSA aligns with other concepts, such as regenerative agriculture, Nature-Based Solutions, sustainable intensification, and agroecology, was noted (stakeholder interview). Also, there are differing perceptions of how far mitigation is integral to the CSA concept and a priority in LMICs. Overall, in terms of the hypotheses linking the FP to the overall CRP Flagship: Firstly, there is evidence that context-specific knowledge can lead to CSA at the local level (the target has very nearly been met), but the

evidence is somewhat fragmented and should be brought together; Secondly, CCAFS work has been valuable on scaling with an increasing focus on sustainable finance as a route to scaling, but other aspects of the enabling environment and levers for change have received less attention.

Flagship 3: Significant Outcomes

The **vision** for FP3 is that low emissions development (LED) reduces agricultural greenhouse gas (GHG) emissions while ensuring food security at large scales. Its **goal** is to 'test the feasibility of reducing agricultural GHG emissions at large scales while ensuring food security in developing countries. The key **objectives** are: 'to provide evidence and tools for i) improved estimates of emissions from LED in smallholder farming, ii) impacts of LED on emissions, food security and other outcomes and resulting priorities, and iii) conditions enabling LED at large scales among smallholder farmers and in major supply chains. Intended primary beneficiaries are smallholder farmers for whom LED practices can contribute to food security and climate resilience by increasing yields, reducing inputs, and improving natural capital. Research will also benefit national LED efforts through better emissions estimates, technical capacities to implement and monitor LED and policy development.

There are three **Clusters of Activity**, namely: Quantifying GHG emissions from smallholder systems; Identifying priorities and options for low emissions development; and Policy, incentives, and finance for scaling up low emissions practices. These are anticipated to lead to sets of outputs – see Annex Table 10.7 below.

Annex Table 10.7: Flagship 3 - anticipated outputs delivered by implementation of clusters of activities

Cluster of Activity	Anticipated Outputs
Quantifying GHG emissions from smallholder systems	• Improved emissions factors and Tier 2 and 3 emissions estimates for key source categories and mitigation practices (e.g. reducing ruminant emissions through improved feeding) for smallholder production systems and consolidated on a single website. • Improved GHG estimation models for smallholder conditions in the tropics (e.g. N2O emissions model for agriculture soils), including linkages with crop-soil models to better estimate productivity. Training of NARES scientists in use of models in CCAFS regions. • Verified low-cost methods for monitoring. "Big data" spatial data sets and emissions factor platforms with the IPCC and the GRA, integrating results with existing data platforms and building on available data, feeding into FP4 and AgMIP. Comparison and improvement of tools, such as the Ex-ACT tool to assess mitigation co-benefits from a wide range of agricultural activities (with FAO). • Metrics and systems for national and subnational monitoring and evaluation of impacts of LED on livelihoods, gender equity, food security and mitigation. • Improved accounting for GHG and soil C uncertainty and analysis of trade-offs among competing objectives (e.g. cost, scale, and accuracy) to inform measurement and LED policy, with WLE. • Strengthened capacity of young scientists, 50% of which will be women, using the CLIFFLAMNET Network. • Impact assessment of changes in capacity in NARES.
Identifying priorities and options for low-emissions development	• Global and country targets across all CCAFS regions for mitigation in agriculture and comparison with INDCs. • Identification of global hot spots for emissions and mitigation opportunities across all subsectors in developing countries, especially among smallholders. • Ex-ante analysis of LED pathways needed to meet targets based on scenarios using global data sets, RCPs and shared SSPs (in coordination with FTA, PIM). • Policy scenario tool to simulate impact of low emission strategies at the level of a region or a value chain, based on GHG coefficients per ha or per ton (with FAO). • Comparison of promising LED technical options and their trade-offs, including emerging options such as BNI, based on multi-year field-trials. • LED options for women in dairy value chains and identification of livelihood benefits and safeguards for women. • User-friendly tool and training for mitigation planners to compare mitigation options and priorities. Current tools focus on emissions rather than mitigation options and lack smallholder data. • Global information platform synthesizing LED agricultural practices and evidence.
Policy, incentives, and finance for scaling up low emissions practices	• Scaling up LED. • Responsible finance and standards for supply-chain governance. • Reducing food loss and waste.

Achievement of sets of outputs is anticipated to contribute to five sub-IDOs, namely: More efficient use of inputs; Reduced net GHG emissions from agriculture, forests and other forms of land use; Participation in decision-making; Enhanced capacity for innovation in partner development organizations and in poor and vulnerable communities; Land, water and forest degradation (including deforestation) minimized and reversed. In turn these are anticipated to contribute to five IDOs (Mitigation and adaptation achieved; Natural capital enhanced and protected, especially from climate change; increased incomes and employment; Equity and inclusion achieved; and National partners and beneficiaries enabled). Ultimately, to contribute to SLO 1 Reduced Poverty and SLO 3 Improved natural resource systems and ecosystem services.

The **assumptions** relating to the impact pathway are that: i) suitable agricultural development programs and policies exist in the focus country; ii) programs and policies will implement LED to help meet mitigation targets, access climate finance, or better compete in global markets; iii) LED implementers require information on which practices reduce GHG emissions, viable business models, enabling conditions and tools to set priorities and assess feasibility of new practices and their potential impact on food security; iv) improved evidence for the compatibility of LED practices with food production in diverse production systems and through demonstration in CSVs will lead to scaling up. The FP3 impact pathway is linked to the wider program theory of change via two **hypotheses**: a) LED practices for agricultural landscapes and value chains significantly reduce GHG emissions while ensuring rural food security and improved livelihood options; b) Improved evidence, incentives, technical capacity, social mobilization and other enabling conditions for LED will support farmers, governments, the private sector and donors to implement LED policies and programs at large scales (> 250,000 farmers or 1 million ha per program).

A **critique** of the FP Impact Pathway is that it does not clearly set out the anticipated outputs and how these link to different stages of outcome achievement. There is insufficient articulation of the causal steps leading from the anticipated outputs to early and later outcomes (which do not need to be limited to the sub-IDOs and IDOs). The sub-IDOs are not all clearly formulated or at the same level in the theory of change, (e.g. 'increased capacity for innovation in partner development organizations' sits at the same level as forest degradation minimized', but clearly these are different stages of the theory of change. The impact pathway does not show *how* change is anticipated to occur, e.g. through stages of actor capacity strengthening, practice change, impact, scaling. It is not well articulated how FP 3 is nested within and contributes to the program ToC – the hypotheses are simple statements, which again do not clearly explain how change is anticipated to occur. Assumptions are not set out in any detail and are not linked to specific causal steps. All combined, the design of the impact pathway makes it hard to use the ToC to track and learn about change achieved. From interviews it is also clear that the ToC is not used in a proactive sense by FP3 to support on-going learning and decision-making based on evidence.

The **evidence** available to test the theory of change is being gathered to a certain extent, but due to the weaknesses in the impact pathway outlined above, the sheer scale of the program (e.g. number of activities on-going) and the way in which data are collected, this means that it is challenging for a reviewer to identify and map the relevant evidence to the impact pathway and to interrogate the associated assumptions. Further, such an analysis has not been carried out by the program itself.

Cumulative **quantitative** data for achievement compared with planned outcome targets is not regularly gathered by the program. However, on request, CCAFS generated the evidence below (See Annex Table 10.8). The data indicate that on some outcome indicators. The data demonstrate that the FP3 has exceeded its targets in terms of low emissions plans developed, number of agricultural development initiatives influenced, and millions of hectares targeted by research informed initiatives for restoring degraded land or preventing deforestation. However, on two indicators achievement is far below the targets in terms of the policy decisions taken (in part) based on engagement and information dissemination by CCAFS, and the number of organizations adapting their plans or directing investment to increase women's participation in decision-making about LED in agriculture.

Annex Table 10.8: Flagship 3 - achievement of outcomes compared to targets

FP3	Outcome Target Value	Achieved value			Achieved total	Achieved total to target #
		2017	2018	2019		
# of low emissions plans developed that have significant mitigation potential for 2030, i.e. will contribute to at least 5% GHG emissions reduction or reach at least 10,000 farmers, with all plans examined for their gender implications	10	4	12	1	17	170%
# of agricultural development initiatives where CCAFS science is used to target and implement interventions to increase input efficiency.	20	27	0	2	29	145%
# of million hectares targeted by research-informed initiatives for restoring degraded land or preventing deforestation	0.8	0.005	1	n/a	1.005	126%
# of policy decisions taken (in part) based on engagement and information dissemination by CCAFS	15	n/a	2	n/a	2	13%
# of organizations adapting their plans or directing investment to increase women's participation in decision-making about LED in agriculture	15	n/a	0	n/a	0	0%

Qualitative data collected on the range of outcomes achieved are produced via the OICRs. For FP3 11 OICRs were evaluated as good or excellent and hence included in the Annual Reports for FP 2 (2017-19), of which 8 have been identified from MARLO / CAS Secretariat excel file. See Annex Table 10.9 below which shows the different OICRs and levels of maturity achieved – a spread of 1, 2 and 3.

Annex Table 10.9: Flagship 3-led outcome-impact cases

Outcome-Impact Cases [Independently Evaluated]	Sub-IDO	Level of Maturity
CCAFS evidence on scalable CSA business models drove USD 170million national policy investment in India to curb crop residue burning	Reduced smallholder production risk Improved access to financial and other services	1
Scaling out Solar Pump Irrigators Cooperate Enterprise (SPICE) model in India	Reduced smallholder production risk	1
Sustainable livestock policy of Colombia's national livestock producer organization (FEDEGAN) included information on improved pasture nutrition and methane emissions, which is informing livestock options in the development of the Government of Colombia's Nationally Appropriate Mitigation Action policy	Reduced net greenhouse gas emissions from agriculture, forests, and other forms of land-use	1

Outcome-Impact Cases [Independently Evaluated]	Sub-IDO	Level of Maturity
15 million Euro invested for mitigation action in Thailand's rice sector	Improved access to financial and other services Reduced net greenhouse gas emissions from agriculture, forests, and other forms of land-use	1
Promotion of coffee-based agroforestry and women's livelihoods in Vietnam	- Reduced net greenhouse gas emissions from agriculture, forests, and other forms of land-use (More sustainably managed agro-ecosystems) - Enhanced individual capacity in partner research organizations through training and exchange - Improved capacity of women and young people to participate in decision-making	1
Alternate wetting and drying technology outscaled on 180,000ha of rice production in Vietnam, reducing over 1 million tCO2-eq/yr	- Reduced net greenhouse gas emissions from agriculture, forests, and other forms of land-use (More sustainably managed agro-ecosystem - Increased capacity for innovation in partner development organizations and in poor and vulnerable communities - More efficient use of inputs	3
37,000 smallholders implementing low emissions agriculture resulting in 1 Mt CO2e verified mitigation in East Africa	- Enhanced individual capacity in partner research organizations through training and exchange - Reduced net greenhouse gas emissions from agriculture, forests, and other forms of land-use	2
The adoption of Happy Seeder technology by 0.5 million farm-households on 1.3 million hectares in north-west India contributed to increased yields, profits, water, and nutrient saving.	- More efficient use of inputs - Reduced net greenhouse gas emissions from agriculture, forests, and other forms of land-use	3

Two of the OICRs achieve level 3 maturity, i.e. impacts at scale or beyond the direct CGIAR sphere of influence – the first, Alternate Wetting and Drying technology scaling, and the second, the adoption of the Happy Seeder technology which contributes to GHG reductions. One OICR achieved level 2 maturity, i.e. impacts on policies or practices within the sphere of influence (e.g. at project level).

Drawing on the OICR analysis, as well as interviews with program leadership, next users, and through iteration on significant outcomes with FP leaders and Science Officers, a set of 'significant outcomes' have been identified by the review team as follows:

- **CCAFS analysis of the potential of agroforestry for mitigation, informing revised Nationally Determined Contributions**. Agroforestry has become more accepted as a mitigation option, a pre-condition for catalyzing large-scale investment.
- **Advancement of mitigation in livestock sectors.** In Colombia, CCAFS and CIAT did model validation and produced data on livestock feed strategies informing the Nationally Appropriate Mitigation Action (NAMA) and the Colombian livestock federation (FEDEGAN) sustainable livestock strategy, which covers improved pasture nutrition and methane emissions**.** In Kenya, CCAFs have supported a national action plans on mitigation in livestock: CCAFS research and support informing the development of a Nationally Appropriate Mitigation Action Plan (NAMA) by the Kenya State Department of Livestock for the dairy sector, catalyzing investments of USD 223m.
- **Provision of tool to assess GHG emissions in agricultural supply chains and engagement with investors to promote changes in corporate supply chains**. Collaboration with CERES, an organization advising investors and advocating for environmental responsibility via emissions reduction in supply chains. This has led to new private sector commitments, but it is not clear how far corporate practices and supply chain relationships have changed as a result.
- **Data, model validation and training enabled the estimation of methane emissions from livestock**, including productivity improvement effects, as part of the national GHG inventory communicated to the UNFCCC in 2017, informing policy and attracting climate finance for the livestock sector NAMA, Colombia.

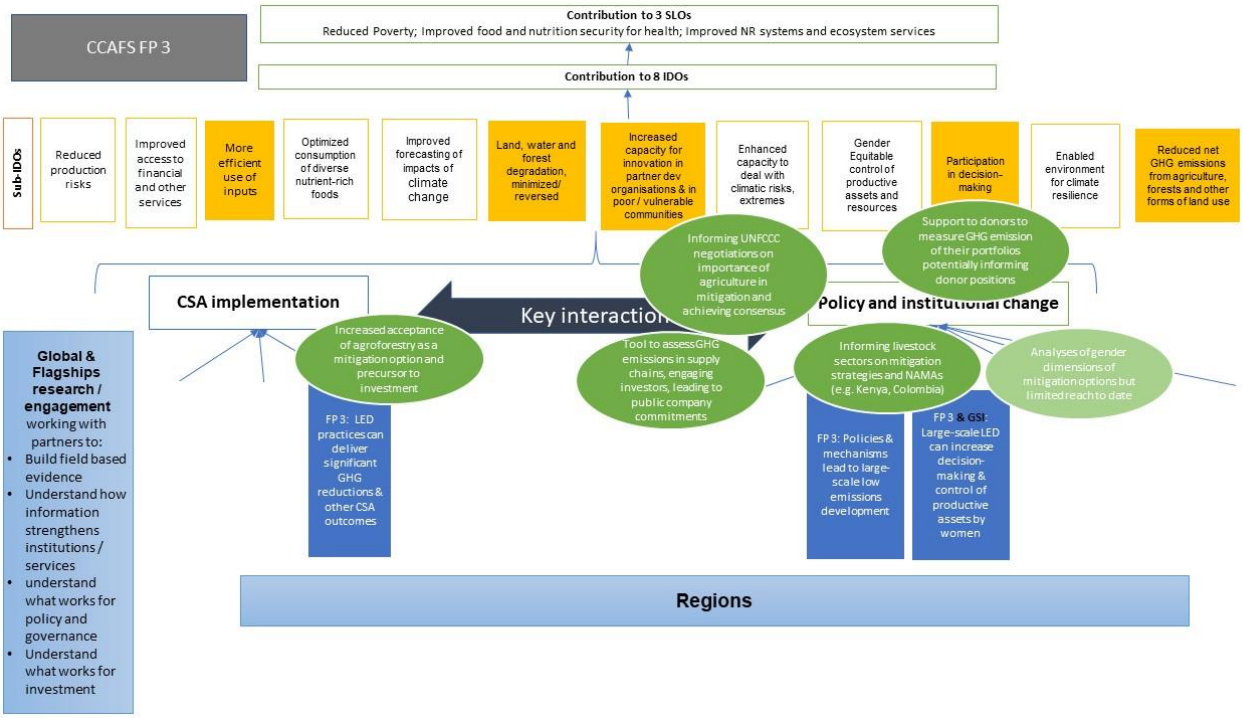
- **Informing the UNFCCC negotiations in relation to facilitating a consensus on agriculture**: CCAFS demonstrated the importance of agriculture to the Paris Agreement mitigation goals, provided NDC mitigation and adaptation analysis, outlined technical and policy options, and convened workshops. This facilitated consensus agreement at UNFCCC COP 23 on the Koronivia Joint Work on Agriculture.
- **Combinations of technological innovations tested on yields, economics, adaptation, and mitigation effects:** Work on Happy Seeder and crop residue burning and business models in India, plus work on Alternate Wetting and Drying and engagement with Vietnamese Ministry of Livestock led to large-scale uptake.
- **Support to donors to assess the GHG emissions of their own portfolios**. For example, support to DFID to understand when sustainable intensification works or not in its commercial agriculture initiatives.

Challenges have arisen with respect to addressing gender relations and efficient achievement of GHG emissions, but some studies have been undertaken to unpack gender roles (e.g. in dairy intensification in Kenya; gender and youth issues in rice production in Vietnam). In Kenya, work is still on-going on the Kenya NAMA to integrate gender and in the Dairy Board's gender strategy.

The significant outcomes are mapped to the theory of change. Evidence suggests that the internal assumptions of the impact pathway relating to the existing of appropriate agricultural development programs and policies in target countries and the willingness of relevant decision-makers to implement LED have largely held true. Stakeholder interviews also indicate that the FP, with regions and partners, has delivered highly relevant information (e.g. to donors and World Bank, and to national policymakers) about which practices reduce GHG emissions, present viable business models and the facilitating enabling conditions. In terms of the hypotheses linking the FP to the program theory of change, FP3 now has coherent evidence across different agricultural and supply chain practices, but there are still gaps in certain regions, such as sub-Saharan Africa. More evidence is also needed in practice from farmers' fields and supply chain actors. Adoption incentives may not relate to emissions-reductions for farmers – as in the Vi-agroforestry case, uptake is based on perceived other food security and yield benefits. Reducing demand for emissions-intensive foods may have more impact than expected (FP 3 leader).

Overall, the FP is contributing to growing understanding of the potential mitigation as part of low emissions agricultural development, with a growing focus on finance to enable scaling. More emphasis on private sector and World Bank during Phase II. The cost of measuring GHG emissions of specific crops and locations has meant that instead the focus has shifted towards the use of simple calculators and tools, but the uncertainties remain high which holds back action in practice. Program has experienced challenges with respect to the relative focus given to mitigation compared with adaptation by donors and, to some, extent internally within the program. More impact evaluation evidence is forthcoming. Future priorities focus on MRV and updating the NDCs.

Annex Figure 10.3: Flagship 3 significant outcomes compared to theory of change



Flagship 4: Significant Outcomes

The **vision** of FP4 is that 'farmers across Asia, Africa and Latin America are supported by effective climate services and protected by well-targeted safety nets, enabling transition toward climate-smart agricultural systems, and resilient livelihoods.' The objectives are that FP4 will work with partners to 'develop climate information and advisory services that support farmers, weather-related insurance that protects farmers and increases investment in CSA, food security early warning and safety net systems that protect livelihoods from extreme events, and climate informed planning by governments and by development organizations. These services will provide an enabling environment for smallholder farmers to transition towards more climate-smart production systems and climate-resilient livelihood strategies, while protecting them from climatic extremes. Research will develop the knowledge, methods, capacity and evidence needed to design, target and implement these interventions effectively at scale' (Program Proposal, 2016).

There are four **Clusters of Activity**, namely: Climate information and early warning for risk management; Climate information and advisory services for farmers; Weather-related agricultural insurance products and programmes; and Climate services investment planning and policy. These are anticipated to lead to sets of outputs – see Annex Table 10.10 below.

Achievement of sets of FP4 outputs is anticipated to contribute to 5 sub-IDOs, namely: Improved access to financial and other services; Enhanced capacity to deal with climatic risks and extremes; Enabled environment for climate resilience; Gender equitable control of productive assets and resources; Enhanced capacity for innovation in partner development organizations and poor and vulnerable communities.

In turn these are anticipated to contribute to four IDOs, namely: Enhanced smallholder access; Mitigation and Adaptation achieved; Equity and Inclusion achieved; National partners and beneficiaries enabled. Ultimately, FP4 will contribute to SLO 1 Reduced Poverty, and SLO 2: Food and Nutrition Security.

Annex Table 10.10: Flagship 2 anticipated outputs delivered by implementation of clusters of activities

Cluster of Activity	Research Outputs
Climate Information and Early Warning for risk management	• Validated methods for seasonal and sub-seasonal prediction of agriculturally-relevant information • Methods and tools to improve agricultural monitoring systems, forecast impacts of seasonal climate and extreme events on crops and biological threats, and extend teh lead time and accuracy of food security early warning systems • Guidance on interpretation and appropriate use of climate change projections • Efficient methods to tailor historic and forecast climate information to farmers' needs • Facilitated access to available historic and seasonal climate information and related tools.
Climate information and advisory services for farmers	• Evidence and insights from CSVs (with FP1), climate service pilots, and national implementation initiatives • Scalable communication channels based on ICT and radio • Methods and curricula to equip intermediary organizations to deliver services to rural communities (with FP1) • Methods to identify and meet particular climate service needs of women and youth • Institutional arrangements that foster sustainable co-production of services with relevant agencies and targeted rural communities.
Weather-related agricultural insurance products and programmes	• Evidence of benefits of agricultural insurance on smallholder livelihoods and adoption of CSA and factors that determine benefit • Tools and indexes that better cover important risks and raise satisfaction of farmers insurers, including atlases of risk and triggers for weather index insurance in target countries. • Science-based schemes for targeting and scaling insurance as an effective risk management option. • Communications and capacity-building approaches including South-South learning • Sustainable public-private partnership and business models
Climate services investment planning and policy	• Synthesized ex-post evidence of impacts of climate services on agricultural livelihoods and security. • Improved methods for ex-ante evaluation of climate services investments • Strategy guidance to identify bottlenecks and target investments across the chain of services. • Analyses of alternative climate services investments at national to regional scales. • Strengthened capacity to integrate climate services within national adaptation policy and access climate finance. Analysis of the potential benefit of national open data policies, and the cost of restricting access to raise revenue by selling data

A **critique** of the FP4 impact pathway is that the vision, goal, and outcome stages to achieving these (or contributing to them) is not clearly set out. The key causal connections are only articulated in the TOC visual to a limited extent, and the logical sequence is often not very clear, especially when the relationship to indicators is taken into consideration. A clearer articulation would consider how research and science-policy engagement by CCAFS leads to changes in rules, attitudes, capacity, and practices to create desired changes amongst small-scale farmers and other actors in the agri-food system. In the text of the program proposal (2016) the following explanation is provided which fits more closely with a clear set of causal linkages. To summarize (proposal, p151): FP4 research and engagement leads to quality climate services + innovative insurance schemes means small-scale farmers can intensify production, adopt improved technologies and practices, invest in their soils in climatically favorable seasons and protect scarce assets in unfavorable ones. Improved climate related information will improve food system actor decision-making, as these decisions affect rural food and livelihood security. Research will also seek to improve the quality of safety nets – which support small-scale farmers when climate-shocks exceed their capacity to cope and encourage greater security for investment in CSA and require multi-stakeholder engagement. This set of changes could be much better represented in a FP impact pathway and used to better guide strategic reflection on progress.

Impact pathway **assumptions** are: a) interest in climate services and index-based agricultural insurance, by governments, development organizations and funders will continue to grow; b) effective partnerships with relevant major organizations and initiatives working in climate services, agricultural insurance and food security information and response will be maintained and expanded; c) investments

in these interventions will be responsive to evidence and will not be disrupted by major economic or political changes.

The **hypothesis** linking the impact pathway to the overall CCAFS theory of change is: a) Effective use of relevant climate-related information by farming communities, and by the insurance providers, agricultural planners, food security safety net interventions that serve them, enables more climate-smart agricultural systems and climate-resilient farmer livelihoods; b) Overcoming key gaps in available climate information, in knowledge and methods to effectively target and implement climate-informed services and interventions, and in the evidence of their benefits, leads to more effective use of climate information by farmers and by the institutions that serve them.

The **evidence** available to test the theory of change is being gathered to a certain extent, but due to the weaknesses in the impact pathway outlined above, the sheer scale of the program (e.g. number of activities on-going) and the way in which data are collected, this means that it is challenging for a reviewer to identify and map the relevant evidence to the impact pathway and to interrogate the associated assumptions. Further, such an analysis has not been carried out by the program itself.

Cumulative **quantitative** data for achievement compared with planned outcome targets is not regularly gathered by the program. However, on request, CCAFS generated the evidence below (See Annex Table 10.11). The data show that the FP has significantly exceeded the number of institutions using CCAFS research outputs for services supporting farm households' management of climatic risks. It has made good progress on two indicators – development organizations adapting plans/directing investments to increase women's access to and control over productive assets etc., and millions of farm households with improved access to capital. The program has another year to go, so it is feasible that the FP will achieve the targets, although it should be noted that the targets are set for 2022, with one year cut from the end of the program. Policy decisions have been influenced by CCAFS, although only 60% of the target has been achieved to date. Data have not yet been made available on the new investments.

Annex Table 10.11: Flagship 4 - achievement of outcomes compared to targets

FP4	Outcome target value	Achieved value			Achieved total	Achieved total to target #
	2022	2017	2018	2019		
40 of institutions or major initiatives that use CCAFS research outputs for services that support farm households' management of climatic risks	40	3	70	15	88	220%
20 of development organizations adapting their plans and directing investment to increase women's access to, and control over, productive assets and resources through gender-sensitive climate-based advisories and safety nets	20	n/a	16	n/a	16	80%
8 million farm households with improved access to capital, with increased benefits for women (millions)	8	n/a	3	n/a	3*	75%
# of policy decisions taken (in part) based on engagement and information dissemination by CCAFS	15	n/a	8	1	9	60%
$ USD new investments by state, national, regional, and global agencies, informed by CCAFS science and engagement	150	2.4	3.6	7.5	13.5	9%

**Not gender disaggregated.*

Qualitative data collected on the range of outcomes achieved is produced via the OICRs. For FP4, 11 OICRs were evaluated as good or excellent and hence included in the Annual Reports (2017-19). See Annex Table 10.12 below which shows the different OICRs and levels of maturity achieved – a spread, but mostly at level 2.

Annex Table 10.12: Flagship 3 - OICRS, sub-IDOs contributed to, and level of maturity

Outcome-Impact Cases [Independently Evaluated]	Sub-IDO	Level of Maturity
African meteorological institutions provide new high-resolution seasonal climate analyses for agricultural decision-making across 5 countries and regionally	Enhanced adaptive capacity to climate risks (More sustainably managed agro-ecosystems)	2
Rwanda's national agricultural extension service facilitates 75,000 Rwandan farmers to access, understand and use climate services through participatory processes	Enhanced adaptive capacity to climate risks	2
Implementation of novel agro-climatic services help more than 500,000 farmers in Colombia, Honduras, Guatemala, and Nicaragua better plan their crops	Reduced smallholder production risk Enhanced adaptive capacity to climate risks (More sustainably managed agro-ecosystems	2
Investment by two Nepalese states in the 'Chief Minister's Climate-Smart Agriculture Village Model Program'	Reduced smallholder production risk	2
Delivery of climate services through Rwanda's national agricultural extension service extended to 106,000 farmers, and deepened through climate service Radio Listening Clubs	Enhanced adaptive capacity to climate risks (More sustainably managed agro-ecosystems)	2
600,000 hectares of rice planted earlier in Vietnam to avoid risk to salinity intrusion brought by the 2019 El Nino	Enabled environment for climate resilience Conducive environment for managing shocks and vulnerability, as evidenced in rapid response mechanisms	2
CGIAR Climate change West Africa Program informs the adoption of a public-private partnership business model for climate information services in Ghana	Increased resilience of agro-ecosystems and communities, especially those including smallholders Enabled environment for climate resilience	1
CCAFS involvement in the Global Commission on Adaptation puts 300 million small-scale farmers on the pathway towards enhanced resilience	Enabled environment for climate resilience Enhanced capacity to deal with climatic risks and extremes	1
Rwanda district agricultural officers use national climate services to match seed to local conditions for 88,000 farmers and provide supplemental irrigation water	Enhanced capacity to deal with climatic risks and extremes	1
Innovative public-private partnership ensures access to climate information services-(CIS) for 500,000 farmers and fisherfolks in Senegal	Improved access to financial and other services Diversified enterprise opportunities Enhanced adaptive capacity to climate risks (More sustainably managed agro-ecosystems)	2
Use of CIS in Senegal led to 10-25% increases in household income, whilst improving action planning of national and local stakeholders	Increased household capacity to cope with shocks Enabled environment for climate resilience Increase capacity of beneficiaries to adopt research outputs	3

Drawing on the OICR analysis, as well as interviews with program leadership, next users, and through iteration on significant outcomes with FP leaders and Science Officers, a set of 'significant outcomes' (but not exclusive) have been identified by the review team as follows:

- Improved climate information services to Rwandan farmers via capacity strengthening of national agricultural extension services. Agricultural extension officers have increased capacity to use national climate services to match seeds to local conditions and provide supplemental irrigation water. Radio Listening Clubs and participatory processes facilitated to improve reach and quality of extension services to farmers so that they can access, understand, and use climate services. The Participatory Integrated Climate Services for Agriculture (PICSA) combines historical climate data and forecasts with farmers' knowledge of what works in their own contexts and uses participatory planning processes to support more informed farmer decision-making. This tool was developed by the University of Reading and promoted by Africa RISING (USAID) in West Africa, has been supported for use by 75,000 farmers in Rwanda, by CCAFS, with USAID support via the national agricultural extension service. Monitoring data indicate significant influence over management decisions, perceptions of household welfare benefits, improved gender equity and farmer-to-farmer sharing. In Rwanda, 111,835 farmers received climate information, 81% subsequently using the information to improve crop management, with income from crops increasing by 30% [AR, 2019; Rwanda evaluation.[24] The approach developed in Rwanda is seen by FP leader as the most comprehensive approach to climate services to which CCAFS has contributed, because it focuses on providing tailored solutions to farmers, and covers information provision, outreach and policy engagement (FP interview). A national policy framework for climate services under the UN Global Framework for Climate Services was initiated by the Rwandan government, supported in part by CCAFS via a World Bank Project, and building on the work of IRI, achieving capacity strengthening to tailor forecasts and downscale information so that it is valuable for agricultural decision-makers (FP interview). The World Bank has indicated interest to support scaling of this work in several countries across sub-Saharan Africa through further funding.
- **Developing sustainable climate service business models in Senegal.** Work in Phase I resulted in over 7 million farmers receiving climate advisories through rural radio. In some regions the advisory process was steered by Multidisciplinary Working Groups (MWGs) composed of diverse stakeholders which could translate the climate science into "timely advisory services...that help guide farmers into making informed decisions (Chiputwa et al. In press). A study conducted during phase II demonstrated that in a region with an MWG farmers accessing climate services experienced 10–25% increases in crop income. The challenge then identified was to find a sustainable finance model for CIS post-project. Under bilateral USAID funding (the CINSERE project), four alternative models have been identified and validated with stakeholders, and are being tested, of which a model using decentralized local government funding is generating considerable interest. The Ministry of Agriculture uses climate information in planning agricultural policies. The Sectoral Development Policy Letter of the Directorate of Water Resources management and Planning includes climate information. Civil Protection Department uses climate information in their newsletter [AR, 2019].
- **Expansion of Local Agroclimatic Committees in Latin America informing farmer decision-making for livelihood benefits.** Over the past 6 years, CIAT, CCAFs and partners have supported the expansion of Local Agroclimatic Committees, inspired by an exchange visit to Senegal and the work conducted there (Interviews, Outcome Harvesting report, 2019).[25] The LTACs were developed in Phase I, building on earlier experiences in Senegal and a South-South regional CCAFs exchange, and testing of the approach in Colombia in two Colombian regions (mountainous Andean region of Cauca, and the coastal plan of Córdoba). Building on work in Phase I, the LTACs enable dialogue drawing upon scientific knowledge (seasonal climate forecasts and outputs from crop modelling) and local knowledge of farmer indigenous groups and technicians) leading to the co-production of tailored recommendations for farmers (when to plant, varieties to plant, management practices, water and fertilizer use, etc.,) provide in local agroclimatic bulletins. Colombia, as part of its NDC commitments agreed as part of the Paris Agreement in 2015, undertook to create a network of Agroclimatic Committees across 15 departments. Colombian goals (formally known as "Nationally Determined Contributions" or NDCs) were agreed upon in the Paris Agreement in 2015, under the United Nations Framework Convention on Climate Change (UNFCCC), in which Colombia committed to create an MTA

[24] https://hdl.handle.net/10568/108052
[25] Giraldo, Diana C., Camacho, K., Navarro-Racines, C., Martinez-Baron, D., Prager, S., Ramirez-Villegas, J. 2019. Outcome Harvesting: Assessment of the transformations generated by Local Technical Agroclimatic Committees in Latin America. CCAFS Working Paper No. 299 CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

network with the participation of 15 departments, and one million of producers receiving agroclimatic information. Implementation has occurred through trade unions, National Meteorological Services, the FAO and partners (Outcome harvesting report, 2019). Scaling in Latin America, supported by FP4 amongst other FPs, and the regional team, via support for the development of the Regional Strategy for Disaster Risk Management in the Agriculture Sector and Food and Nutrition Security in Latin America and the Caribbean (2018-30)[26](interviews). The latter prioritized Agroclimatic committees in four countries – Colombia, Nicaragua, Honduras, and Guatemala, leading to the creation of 22. CCAFS has provided additional support to analyze capacity strengthening seasonal forecast modelling skills, and provided capacity strengthening to enable the use of novel climate and crop prediction tools[27]. Policy changes have occurred in all 4 countries but is most pronounced in Colombia and Honduras (OICR, 121), and farmer behavior change has been identified through an Outcome Harvesting study (2019). The latter found that approximately 510,000 farmers mostly in Colombia, but also with some farmers in Honduras, Guatemala and Nicaragua), receiving more tailored information, using it in their decision-making to improve management practices, such as changing planting dates to make the most of good climatic conditions and avoid crop losses, or to use more adaptive varieties. An impact assessment is planned for 2021. CCAFS reports that the approach has now been scaled in other countries in the region (El Salvador, Nicaragua, Chile, and Panama) (Regional lead interview).

- **Improving climate forecasting for agriculture in Africa.** In partnership with IRI, CCAFS has facilitated capacity strengthening of African meteorological institutions leading to increased use of new high-resolution seasonal climate analyses for agricultural decision-making across five countries of Africa and at the regional level. The Maproom tools of IRI[28] are used by four national meteorological services (Rwanda, Senegal, Ethiopia Madagascar and Mali) and two regional climate centers (ICPAC and AGRHYMET) in Africa to analyze relevant climate risks for agriculture and to increase the utility of downscaled seasonal forecasts.
- **Improving understanding of gender-responsive climate information services (CIS):** Work on gender has become stronger during Phase II from a slow start. A post-doctoral researcher and Gender LP/FS has supported FP4 development of inclusion of gender equality in monitoring and evaluation of climate services[29], a checklist of gender considerations for climate services and safety nets[30], and produced a peer-reviewed review of gender-responsive CIS.[31] There is also an innovative research study of gender and insurance in Ghana, but it lacks clear relevance to policy-making.

FP4 is working to advance insurance approaches on the international agenda, which tackle risk for smallholder farmers as part of a broader portfolio of risk management strategies. There are challenges with index-based insurance for smallholder farmers, and scaling has also been an issue. FP4 collaborated with the Global Commission on Adaptation (GCA) to raise the profile of digital advisory services, providing guidance for investors and exploring value chain contexts, and the role of public and private sectors in delivery. FP4 has also provided guidance to climate service investors in India and Africa (AR, 2019). FP4 supported the testing of flood insurance technology and schemes in Bihar, India, with uptake by the national government (Ministry of Agriculture and Farmers' Welfare policy), a World Bank Project in Assam, India and by the Sri Lankan insurance industry. In Nigeria, the Federal Ministry of Agriculture and Rural Development launched a strategy with inputs from CCAFS to expand agricultural insurance coverage nationwide. These are all significant influences on policy and in investments, but more evidence is needed on how far such policies and investments lead to positive outcomes on the ground.

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[26] A. M. Loboguerrero, F. Boshell, G. León, D. Martinez-Baron, D. Giraldo, L. Recaman Mejía, E. Díaz, J. Cock, 'Bridging the gap between climate science and farmers in Colombia'. Climate Risk Management, Volume 22, 2018, pp 67-81, https://doi.org/10.1016/j.crm.2018.08.001.

[27] Agro-climate modeling: CPT (Climate Predictability Tool) and R-CPT (seasonal forecasting), RClimTool, and AClimateColombia (pronosticos.aclimatecolombia.org). Crop modeling: includes ORYZA* rice model, AquaCrop*, CROPWAT*, DSSAT* (containing more than 20 crops, including our very own MANIHOT model for cassava), GLAM, species distribution models, and agro-climatic index models.

[28] http://iridl.ldeo.columbia.edu/maproom/index.html

[29] Gumucio T, Huyer S, Hansen J, Simelton E, Partey S, Schwager S. 2018. Inclusion of gender equality in monitoring and evaluation of climate services. CCAFS Working Paper no. 249. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

[30] https://cgspace.cgiar.org/bitstream/handle/10568/99172/Gender%20Checklist%202019.pdf

[31] Tatiana Gumucio, James Hansen, Sophia Huyer & Tiff van Huysen (2020) Gender-responsive rural climate services: a review of the literature, Climate and Development, 12:3, 241-254, DOI: 10.1080/17565529.2019.1613216

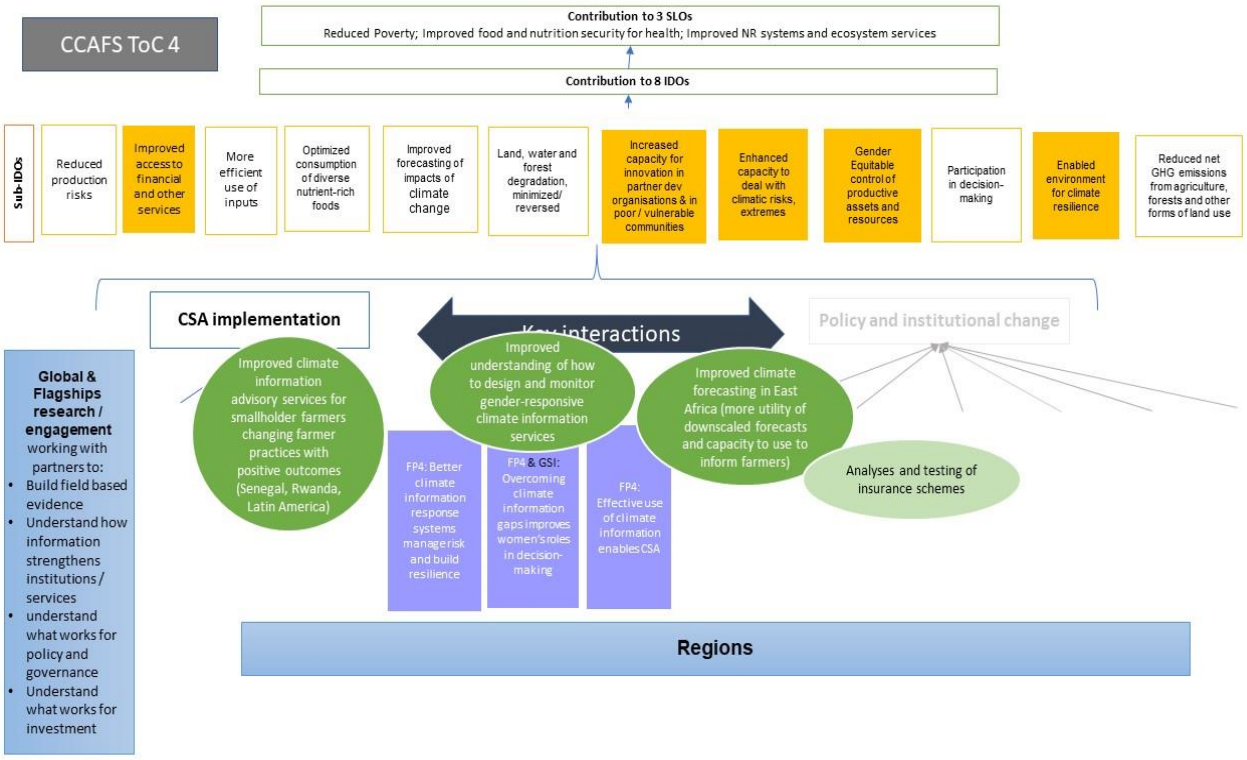
The significant outcomes achieved have been visualized against a diagram representing the FP impact pathway and its connection to the sub-IDOs (shown in orange) and the overall program TOC (CSA implementation and policy and institutional change). The significant outcome areas are shown in green circles as they map to the Flagship, but it is also the case that different areas are more advanced than others – impact evidence, for example is strongest for climate advisory services for Senegal. For other areas, e.g. gender responsive approaches, achievement appears to be an earlier outcome stage.

Further, work on insurance has been less strong than for other areas. FP4 focuses on generating and synthesizing rigorous high-quality evidence of costs and benefits and developing tools that major insurance initiatives need to optimize the impacts generated through their programs. FP4 is currently partnering with India's national insurance scheme (R4 Rural Resilience Scheme) and ACRE, Africa, which both reach large numbers of farmers. The team are synthesizing available evidence and conducting randomized control trials on different approaches for scaling insurance. It takes time to generate findings as farmers need to have been insured for multiple agricultural seasons in a row, to quantify the impacts both in good years (when no insurance payout was triggered) and in the aftermath of a shock.

Overall, FP4 has supported a wide range of institutions (40) in their use of CCAFS science to support farm household management of climate risks, influenced 26 policies (mainly level 2 of maturity), and reports 23 innovations (8 of which have reached stage 4, i.e. uptake by next user, 7 achieving level 3 – availability for uptake). Climate information services have been improved, especially in Senegal, but also in Rwanda and Latin America. In particular, the approach in Rwanda is reported by FP4 as being highly comprehensive, addressing different systemic challenges and opportunities. There is diverse ongoing work, such as contribution to the establishment of a Digital AgroClimate Advisory Platform (EDACaP) in Ethiopia. The Ministry of Agriculture is working to improved weather- and climate-based advisory services using an automated agro-meteorological advisory generation, communication, and feedback system. The information will be used both by agricultural extension personnel to support smallholders and pastoralists, but also those with mobile phone access are anticipated as being able to gather information directly. To unlock the transformative potential of this approach with respect to resilient agricultural systems will require improvements in digital connectivity, sustaining of tailored data services to smallholders, creating strong business cases, building enabling environments, scaling digital models and evaluation[32]. CCAFS science has been used in the development of this advisory platform. The COVID-19 pandemic has created delays, but also refocused minds on the delivery of services to farmers with the potential to bundle health and agricultural extension services. Work on insurance has tended to involve pilot studies and participatory processes, which have not lent themselves to scaling, but new approaches are being considered such as through ICTs and smart phones (FP leader interview). FP4 has collaborated with the Global Commission on Adaptation to generate an investment blueprint for Climate-Informed Advisory Services and with national governments. In general, technological developments have the potential to transform delivery of climate services to farmers with appropriate enabling environments, so there is significant potential for future scaling.

[32] Info Note: Launch of the Ethiopian Digital AgroClimate Advisory Platform (EDACaP) https://cgspace.cgiar.org/bitstream/handle/10568/107770/CCAFS%20Info%20Note%20EDACaP_2019_KT_13032020.pdf

Annex Figure 10.4: Flagship 4 significant outcomes compared to theory of change



The major assumptions outlined by FP 4 have held true: a) interest in climate services and insurance by governments, development organizations and funders has grown significantly globally during the program and there are strong indications this will continue – with the FP contributing to this rise up the agenda; b) Partnerships have been sustained with diverse organizations – globally, regionally and nationally; c) the investments being made are responsive to evidence. In terms of the overall hypotheses linking the impact pathway to the overall program theory of change for CCAFS, the evidence is positive. Especially, when digital technological innovation is being harnessed to scale up, there is evidence that farmers are benefitting from climate information services in terms of improving their farm management practices, with livelihood benefits (Senegal, Rwanda, and Latin America). The evidence is in Senegal is the most robust – other impact assessments are planned but have been delayed due to COVID-19. The available evidence indicates that overcoming gaps in climate information, and ensuring services are effectively tailored, including mainstreamed consideration of gender, is leading to enhanced uptake by farmers and climate service institutions and systems, but more consolidated evidence is needed as to whether sustainable solutions can be found to sustain climate information services at scale. Business models have been delineated but need further testing.

Annex 11: Most Significant Outcomes - Gender

Below we identify the most significant outcomes related to work on gender and CSA under CCAFS. This is not an exhaustive list, but rather the highlighted outcomes identified from Annual Reports, stakeholder interviews based on the review team's judgment, but iterated with the GSI lead for error checking and comment:

- **Advancing conceptual frameworks and understanding of gender and CSA**: CCAFS has explored conceptual frameworks for gender and climate-smart agriculture (CSA), advanced the measurement of empowerment of women and men in CSVs, and developed gender indicators for CSA; and analyzed climate policies from a gender perspective[33]. Further, gender and climate hotspot analyses have been undertaken in collaboration with FP1 in Southern Africa, Latin America and West Africa. This work culminated in a Special Issue in the Journal of Climatic Change[34]. An upcoming chapter in a CGIAR Gender Platform Book explores gender equality in agricultural and environmental research. A recent brief, in collaboration with FAO, provides evidence and guidance for gender-responsive approaches in CSA for practitioners.[35]
- **Monitoring and Learning on gender and CSA**: GSI and the FLs have developed a monitoring system for CCAFS to assess the gender dimensions of different aspects of CSA and CIS, to better understand if and how a climate-smart agriculture practice impacts the gender division of labor, control over resources and benefits, and participation in decision-making (F2, F4). As part of this work, the GSI team also analyzed the feasibility of using mobile phones for data collection in monitoring of gender indicators relating to CSA practices (F2).[36] A list of CCAFS publications was compiled which includes sex-disaggregated data on CSA[37]. GSI has also produced a working paper on gender-sensitive M&E of CIS (F4)[38].
- **Research on specific emerging questions and themes, such as CIS and gender:** As well as the overall work on gender and CSA outlined above, there has been specific achievement on newly emerging research questions. For example, a substantial body of work on Gender monitoring and evaluation of Climate Information Services (CIS) involves production of a range of outputs (resource materials, checklists, working papers[39] and journal articles), co-produced with the joint GSI-FP4 post-doctoral researcher on Gender and CIS[40]. A qualitative evaluation of Rwanda CIS using a gender lens assessed differences and trends in women's and men's access to weather and climate information, use of the information in their farm and non-farm livelihood decision-making, and benefit from their climate-informed decisions made, and took account of the farmer's length of exposure to intervention(s)[41].
- **Informing donors, government policies and global investments:** GSI has collaborated with donors and international agencies, such as (in collaboration with FP1 and EA RPL) support to the

[33] Review of gender and global climate policy based on CCAFS national and global level reviews, by FP4 and FP1 has been submitted to Gender and Development.
[34] Huyer, S., Partey, S. Weathering the storm or storming the norms? Moving gender equality forward in climate-resilient agriculture. Climatic Change 158, 1–12 (2020). https://doi.org/10.1007/s10584-019-02612-5
[35] Nelson S, Huyer S. 2016. A Gender-responsive Approach to Climate-Smart Agriculture: Evidence and guidance for practitioners. Climate-Smart Agriculture Practice Brief. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
[36] García M; Orentlicher N; Twyman J; Eitzinger A; Bonilla O. 2019. Reflection on the use of mobile phones for monitoring gender indicators related to climate-smart agriculture practices. Working Paper. CIAT Publication No. 487. International Center for Tropical Agriculture (CIAT). Cali, Colombia. 24 p.
[37] https://ccafs.cgiar.org/sex-disaggregated-data-climate-smart-agriculture-ccafs-publications#.X32vL1KSk2y
[38] Gumucio T, Huyer S, Hansen J, Simelton E, Partey S, Schwager S. 2018. Inclusion of gender equality in monitoring and evaluation of climate services. CCAFS Working Paper no. 249. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
[39] Gumucio, T, and S. Schwager (2019) 'Checklist: Gender Considerations for Climate Services and Safety Nets'.
[40] Tatiana Gumucio, James Hansen, Sophia Huyer & Tiff van Huysen (2020) Gender-responsive rural climate services: a review of the literature, Climate and Development, 12:3, 241-254, DOI: 10.1080/17565529.2019.1613216
[41] Gumucio T, Hansen J, Nsengiyumva G, Birachi E, Kagabo D, Rose A, Munyangeri Y. 2020. Rwanda Climate Services for Agriculture: Qualitative Evaluation through a Gender Lens. CCAFS Working Paper no. 315. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

African Group of Negotiators (AGNES) since 2016, including technical support to submissions[42] and inputs to AGNES workshops and to parliamentarians[43]. This has advanced gender in the UNFCCC negotiations and supporting implementation in national policy frameworks in East and West Africa including National Gender and Climate Action Plans and currently informing the Kenya Agriculture Gender Policy (see Deep Dive). GSI has also informed the design of donor projects and programs, including IFAD and DFID. In Ghana, GSI has supported the development of a gender agricultural profile. GSI has also informed the African Development Bank[44]. Government policies: More evaluative evidence is needed to trace how the influence achieved catalyzes change in practice. GSI has also informed the Canadian government, via participation in a closed consultation meeting on gender and climate with the international development minister, and technical support to IDRC on programming and their new strategy process. In Kenya, with FP3 and the partner, UNIQUE, gender was integrated into the Kenya Dairy NAMA (not yet published) and promote uptake by the Kenya Dairy Board (finalizing a gender strategy). Recently initiated, CCAFS is collaborating with UNDP, and the Papua New Guinea Focal Point and WISAT on integrating gender into forestry and energy NDCs (on-going).

- **Synthesizing lessons learned on gender and climate change to build a research agenda.** In 2019, CCAFS undertook an exercise to review what had been learned on climate change and gender, to inform the future research agenda[45]. Key findings included, *inter alia*: the need for robust M&E of gender outcomes at different scales of CCAFS work (household, farm, community, landscape/region, national and global), with country-level tailoring of indicators; Guidance is needed for non-gender specialists to conduct sex-disaggregated data collection and gender analysis; Policy impact assessments are needed, to better understand the gender-related outcomes of CCAFS policy work; CSA country profiles which integrate GSI are a strategic opportunity to influence governments and development partners and requires coordination with international bodies is important; Integrating gender and safeguards into climate service business models are being developed in West Africa and have broader applicability; More research is needed on institutional innovations that can underpin equitable CSA; CCAFS should use evidence on GSI to better inform partnership development and for scaling; Significant research gaps exist on rural transformation (e.g. migration impacts on gender and youth in context of increasing climate variability and change; closing digital gender gaps in agricultural services; role of mobile finance for women's empowerment; gender-sensitive finance/investment lacking); more research needed on gender-sensitive agricultural insurance.

[42] Draft Submission with AGNES on Gender in National Adaptation Plans and NDCs, through the Adaptation Programme Office; Inputs to the Uganda NDCs on forestry, transportation and water which is due for publication end 2020).
[43] E.g. Awareness Creation Workshop on Gender and Climate Change with Tanzanian Parliament Members, September 2019; AGNES Brief on Closing the Gender Gap in Agriculture under Climate Change; Gender implications of the Koronivia Joint Work on Agriculture.
[44]Co-lead of the Inclusive Climate Change Adaptation for a Sustainable Africa (ICCASA) program with AfDB, AGNES, WISAT and World University Service Canada. Activities included training workshops for policy makers on gender in national and global policy and negotiations; training of Parliamentarians in Tanzania; a gender and climate hotspot analysis for Africa; and 10 East Africa country assessments
[45]https://cgspace.cgiar.org/bitstream/handle/10568/105556/Learning%20and%20action%20for%20gender%20transformative%20CSA.pdf

Annex 12: Significant Outcomes - Youth

- **Research on youth, climate, and migration nexus East Africa:** Research by GSI in collaboration with CIFOR on the links between climate change, agriculture, and youth international migration in East Africa has been undertaken. This connects trends of climate extremes in East Africa with youth issues and migration. A working paper and journal article in process, although it is not yet clear what influence this has had and so is more of a successful output. It is anticipated that the findings of the review will inform the refinement of CCAFS' own youth strategy. Key insights are that climate-induced migration trends will require employment and business development responses for young women and men in rural areas in and off farms, and legal migration flows should also be facilitated (AR, 2019).
- **Youth participation in global and national climate policy processes:** Support was provided to youth delegates to attend UNFCCC Conference of Parties (COPs) 24 and 25, as well as to participate in meetings of the African Group of Negotiators (AGNES) in East Africa and West Africa. The value of gaming as a means of engaging youth in climate-related policy and technical debates has been demonstrated at high-level events (e.g. UNFCCC COP 25; 5th Global Science Conference on CSA) (AR, 2019). While valuable, it is not clear in what way and to what extent (differentiated) youth voices have been better heard in such debates and with what outcomes. The potential of gaming in exploring food consumption is proposed for future research. The recent Transforming Food Systems report notes the critical role of youth and social movements. Another example is the CLIFF-GRADS program supporting PhD Fellows to do research on mitigation, especially to generate new data. 170 fellows (all youth) have been supported since 2011, 50% of which are women[46].
- **Analysis of gender and youth issues in rice production in North, Central and South Vietnam.** Two journal articles for 2020, including A comparative analysis of gender and youth issues in rice production in North, Central, and South Vietnam.
- **Young women and men's opportunity spaces in dairy intensification in Kenya:** Research has been undertaken with the CSA Youth Network on young women's and men's current and emerging roles in dairy intensification in Kenya. A conceptual framework has been developed drawing on concepts of opportunity space, intersectionality, and agency and research focused in Nakuru and Kiambu. A journal article has been submitted. The project has advised the World Bank on Inclusion strategies for CSA in Kenya. Engaging youth through value chain development will be a key entry point, because of potential co-benefits of meeting financial needs, the potential for employment and abilities to adapt to changing climatic conditions (AR, 2019). Additional youth work has been conducted in Colombia involving engagement of youth in LED livestock capacity building. Preliminary findings were presented at the Tropentag 2020 conference[47].

Significant outcomes on youth (identified from the Annual Reports)

These largely relate to the facilitation of individual and collective youth agency and livelihood benefits from climate-smart agriculture, through participation in CSV processes and their scaling through mainstreaming processes:

- In Colombia, municipal and state authorities in Cauca, are promoting and investing in CSV practices, with CCAFS support. CCAFS (OICR 2163) reports that youth involvement in the CSV process in Cauca facilitated the implementation and articulation of two national policies on education and environment through the establishment of the Rural Node of Youth for the Environment. This encourages CSV young farmers to show how they are increasing their climate resilience and improve their livelihoods. Before the CSV, the Nodes of Youth had only been established in urban areas, so CCAFS support has extended its reach. The follow-on outcomes, i.e. the difference made by the Nodes of Youth is not reported and could be explored.
- CCAFS and CIMMYT collaboration in CSVs in India and the building of a coalition led to prioritization by the Government of crop residue management solutions, a significant investment of INR 1150 crores for in-situ burning, targeting 2 million farmers, with co-benefits for soil health, reduced water use, GHG emissions reductions, and reduced air pollution. As part of the capacity strengthening that has been undertaken, training was provided to seek to empower youth as service providers and champions of the new technologies and business model (OICR 2039) (see

[46] https://cgspace.cgiar.org/bitstream/handle/10568/103424/http://WP276.pdf
[47] https://www.tropentag.de/abstract.php?code=TVGLzUk0

deep dive). More evidence is desirable on the impact on youth empowerment of this policy and investment change process.

- In the CSV approach which is being mainstreamed in the Philippines, Vietnam, Myanmar, Laos, and Cambodia, the CSVs have provided platforms for the youth to participate in community-based climate actions. For instance, in Vietnam, the Youth Union were engaged as a key partner organization in various CSV-based activities. Youth groups have been supported to participate in communication and engagement activities, such as Photovoice in Ma, My Loi, and Phailom CSVs. Selected young farmers were also able to participate in CSV roving workshops. More evidence is desirable on whether youth participation and benefits have increased, with disaggregation along other lines of difference.
- In two states in Nepal, the CSV approach is being implemented with a significant investment (Rs 368m per year), with opportunities created for youth involvement in agricultural production and business development (OICR, 181).
- In Ghana, a public-private partnership business model has been developed for CIS, and this is reported to have facilitated youth empowerment pathways through CIS services employment opportunities (OICR, 2561).
- CCAFS has supported the development of the Althelia Biodiversity Fund (with CIAT and USAID), which aims to restore biodiversity and ecosystems in Brazil. The fund's strategy targets tech innovation platforms in the Amazon, including a focus on youth-oriented initiatives, and investments have already begun). More evidence will be helpful to understand the outcomes and impacts generated by the investments in this mechanism that CCAFS has helped to establish

Annex 13: Outcome Targets and Achievements

SLOs, IDOs, and sub-IDOs	Outcome	FP			
		1	2	3	4
SLO Reduced poverty	11 m farm HH that have adopted improved varieties, breeds, or trees, and/or improved management practices		6.44		
	9 m people, of which 50% are women, assisted to exit poverty				3 m
IDO: Increased resilience of the poor to climate change and other shocks			x		
Sub-IDO: Reduced production risk	6 million farm households receiving incentives (training, financial, programmatic, policy-related) for adopting CSA related practices and technologies that potentially reduce production risks with increased benefits for women		6.44		
IDO: Enhanced smallholder market access			x		x
Sub-IDO: Improved access to financial and other services	15 sub-national public/private initiatives providing access to novel financial services and supporting innovative CSA business models		8		
	8 of million farm households with improved access to capital, with increased benefits for women (millions)				3 m
IDO: Increased incomes and employment				x	
Sub-IDO: More efficient use of inputs	20 agricultural development initiatives where CCAFS science is used to target and implement interventions to increase input efficiency			29	
SLO: Improved food and nutrition security for health	6 mio more people, of which 50% are women, without deficiencies of one or more essential micronutrients	x	x		x
IDO: Improved diets for poor and vulnerable people		x			
Sub-IDO: Optimized consumption of diverse nutrient-rich foods	14 organizations and institutions in selected countries/states adapting plans and directing investment to optimize consumption of diverse nutrient-rich foods, with all plans and investments examined for their gender implications	4			
SLO: Improved natural resource systems and ecosystem services	160 Mt CO2e yr-1 reduction of agriculturally related GHG emissions (4%) compared with 2022 BAU 0.8 million ha of forest saved from deforestation			52.66 MtCo2 expected over next 10-20 years	
	0.8 m ha of forest saved from deforestation			x	

SLOs, IDOs, and sub-IDOs	Outcome	FP			
		1	2	3	4
IDO: Natural capital enhanced and protected, especially from climate change				x	
Sub-IDO: Land, water, and forest degradation (including deforestation) minimized and reversed	0.8 m hectares targeted by research-informed initiatives for restoring degraded land or preventing deforestation			1,005 mio ha	
CROSS-CUTTING					
IDO: Mitigation and adaptation achieved		x	x	x	x
Sub-IDO: Improved forecasting of impacts of climate change and targeted technology development	20 countries/states where CCAFS priority setting used to target and implement interventions to improve food and nutrition security under a changing climate	10			
	50 site-specific targeted CSA options (technologies, practices, and services) tested and examined for their gender implications		86		
Sub-IDO: Enhanced capacity to deal with climatic risks, extremes	40 of institutions or major initiatives that use CCAFS research outputs for services that support farm households' management of climatic risks				88
Sub-IDO: Enabled environment for climate resilience	600 m USD new investments by state, national, regional, and global agencies, informed by CCAFS science and engagement	750 mio			
Sub-IDO: Reduced net GHG emissions from agriculture, forests, and other forms of land use	10 low emissions plans developed that have significant mitigation potential for 2030, i.e. will contribute to at least 5% GHG emissions reduction or reach at least 10,000 farmers, with all plans examined for their gender implications			17	
IDO: Equity and inclusion achieved		x	x	x	x
Sub-IDO: Gender-equitable control of productive assets and resources	55 organizations adapting their plans and directing investment to increase women's access to, and control over, productive assets & resources:				
	35 development organizations, with the focus on investments for CSA activities, adapting their plans or directing investment to increase women's access to, and control over, productive assets and resources	8	28		
	20 of development organizations adapting their plans and directing investment to increase women's access to, and control over, productive assets and resources through gender-sensitive climate-based advisories and safety nets				16

SLOs, IDOs, and sub-IDOs	Outcome	FP			
		1	2	3	4
Sub-IDO: Participation in decision-making	15 organizations adapting their plans or directing investment to increase women's participation in decision-making about LED in agriculture			0	
IDO: National partners and beneficiaries enabled		x	x	x	x
Sub-IDO: Increased capacity for innovation in partner development organizations and in poor and vulnerable communities	51 policy decisions taken (in part) based on engagement and information dissemination by CCAFS	30	10	2	9

Annex 14: OICR Analysis and Templates

The theory of change analysis in section 2.2.4 provides a rapid 'most significant outcomes' assessment which provides broader insights into the demonstrated importance of outcomes. From the deep-dive analyses of the OICRs, some issues arise with respect to the quality of the underpinning evidence in some cases, but all the OICR deep-dive studies demonstrate substantive outcomes achieved. This Annex presents findings on the three OICRs examined in depth during the Review.

- **Senegal Climate Information Services** - we have concerns about the provenance of the coverage figure of 7.4 million people and the methodology used to identify impacts on yields and crop income. We also note that important work on making farmer-targeted CIS more financially sustainable is ongoing (though OICR 3200 which reports this is very much a report on work in progress). Despite these reservations, the two OICRs taken together undoubtedly demonstrate the vibrancy of the workstream on CIS in Senegal, and its progress towards an impactful, farmer-friendly and sustainable model.
- **Capacity strengthening in East Africa smallholder carbon projects (Kenya; Uganda):** CCAFS has a long history of engagement in this area. Earlier scientific research enabled measurement of the carbon sequestration potential of sustainable agricultural land management (SALM) practices, representing an important public good. In Phase II, support focused on farmer training provision and generation of a manual, which is still in use today. There is complementary ICRAF evidence for Western Kenya validating the positive impacts on livelihoods from the wider project, but the specific difference made by the manual/training is still being studied (an impact evaluation has begun but was delayed by the pandemic). There are already major scaling effects in other major carbon funds, where CCAFS science informed the approach, and CCAFS reports engagement at the county level in Kenya on implementation plans, which would advance scaling.
- **Happy Seeder -** Earlier work by CCAFS and partners in validating and developing Happy Seeder technology led to the contribution of CCAFS researchers to key syntheses of evidence on the profitability of different seeding systems, which were disseminated by various methods. This added strong impetus to Government of India initiatives to promote Happy Seeder technology, as evidenced by a report by the Dept. Of Agriculture, Cooperation & Farmers Welfare showing impact up to 2018, and an IARI press release in February 2020. The latter uses remote sensing data to identify an 18.8% reduction in residue burning across seven districts of Northwest India. We find it a good example of the wide partnerships, convening power and influence of CCAFS on policy and indirectly on farmer practice in India.

Review of OICR number 3313: Use of CIS in Senegal led to 10-25% increases in household income, whilst improving action planning of national and local stakeholders

Why this OICR was selected

This OICR was selected to ensure coverage of Flagship 4, 'Use of CIS in Senegal led to 10-25% increases in household income, whilst improving action planning of national and local stakeholders', and this OICR also covers West Africa, and achieved maturity level 3.

Overview of Case

CCAFS researchers have collaborated with the National Civil Aviation and Meteorology Agency of Senegal (ANACIM) since the beginning of CCAFS Phase I in 2011. The aims of the collaboration included a) developing downscaled climate information services (CIS) b) building capacity for partners communicating climate information to farmers and c) enhancing the transmission of climate information to farmers. ANACIM has been responsible for producing seasonable forecasts which are translated into agricultural advice for farmers by a national-level Multidisciplinary Working Group (MWG) composed of governmental agencies concerned with agricultural research and development, insurance and environmental monitoring. ANACIM also produces 10-day forecast during the growing season, daily forecasts and alerts on extreme events. Through the Union of Rural Community Radios, local radio stations were recruited and journalists from them trained – 82 stations in 2015 growing to 107 currently. In addition, three local-level MWGs were set up at local (Department or District Level), comprising decentralized government technical services, local authorities, farmer organizations, local media and NGOs. Their number has subsequently grown to 37. The local MWGs are responsible for channeling forecast from ANACIM both to rural radio stations and to (depending on the exact model which varies between locations) either to local government rural development services or to unions of farmer organizations. While communication through rural radio received most attention, large numbers of

farmers were also receiving climate information through SMS, generally to lead farmers and then disseminated onwards. This OICR presents a) a population estimate of 7.4 million people for the number of farm households having access to CIS through these systems, b) an identification of increases in farm income of 10-25% that can be attributed to them, and c) an account of the stakeholder processes involved and resulting empowerment. We find some problems in the derivation of the population estimate, while the attribution of income increases, and stakeholder empowerment are more robust.

The OICR is based largely on studies funded and carried out under CCAFS Phase II, relating to work mainly done under CCAFS Phase I. Important work on CIS has continued in Phase II, notably on sustainable funding models for CIS after the end of donor funding, which is reported in OICR 3200, and is further discussed below.

Contribution to SRF and IDOs, including Policies and Innovations
The OICR states that the project has contributed to the following Sub-IDOs:

- Enabled environment for climate resilience
- Enhanced capacity to deal with climatic risks, extremes
- Increase capacity for innovation in partner development organizations and in poor and vulnerable communities

And to the SRF 2022/2030 target:

- # of people, of which 50% are women, assisted to exit poverty.

The outcomes reported in this OICR can be seen to have contributed to these sub-IDOs and targets, and therefore to the following IDOs:

- Mitigation and adaptation achieved
- National partners and beneficiaries enabled.

Assessment
By 2015 the rural population estimated to have access to climate information through channels created by the channels described above was an estimated 3.9 million people in five Regions (Lo and Dieng 2015), an estimate almost double CCAFS' own estimate at the time. A CCAFS outcome study of 2015 increases this estimate to 7.4 million people (740,000 rural households) but the provenance of this figure is unclear.[48]
Largely independent of arguments about the scale (which even at the lower estimates is significant) were significant efforts to identify the impact of CIS, and in particular the model of CIS based on local MWGs, on household income. The paper by Chiputwa et al. (in press) uses a sample of 596 farm households from Kaffrine Region (which benefitted from local-level MWGs) and Kaolack Region (which did not), in a two-time balanced panel surveyed in 2017 and 2019. The econometric procedures adopted in this paper are opaque and, in our view, subject to serious concerns, particularly about the appropriateness of a Kaffrine/Kaolack comparison when the latter has significantly lower rainfall.[49]
Awareness, access and use of CIS were significantly greater in MWG locations than in non-MWG locations, although differences between the two groups decreased in the second wave of the survey. Farmers in MWG locations also made significantly more management decisions based on CIS than those in non-MWG locations. Qualitative findings helped the authors to derive diagrams of causal pathways from CIS messages through farmer behavior to yields and increased food availability. Comparing those who used CIS in MWG locations with those who *either* did not use *or* used in non-MWG locations, the likelihood of planting the major crops (peanuts, maize and millet), number and area of crops, yields and monetary value of crops were all greater. These results were highly significant ($p<0.01$) in the second wave survey for: number of peanut plots, peanut yields and value, number of maize plots, area under maize, maize yields and value, the likelihood of planting millet, total number of plots and total crop value. All these variables increased for the MWG/user group between the two waves. Regression analyses to account for difference in the underlying socio-economic, institutional, and biophysical factors between users and non-users and by MWG access give significant results. Access to MWG and use of CIS in daily forecast gives 9.3% higher cop incomes compared to either non-access to MWG or non-use, increasing to a 25.4% increase with a model using lagged temperature and rainfall. Similar values are obtained for a comparison of users and non-users within an MWG location. The same comparisons for use of both

[48] The document cited is CCAFS. 2015. The impact of Climate Information Services in Senegal. CCAFS Outcome Study No. 3. Copenhagen: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) available at https://cgspace.cgiar.org/rest/bitstreams/59295/retrieve . The figure of 7.4 million people is sourced to "CCAFS 2015" but this is a shorter outcome study (available at https://cgspace.cgiar.org/bitstream/handle/10568/67903/05outcomecase.pdf?sequence=3) which does not contain a basis for the figure.
[49] A view supported by two senior economists specializing in impact evaluation who informally reviewed the paper for us.

seasonal and daily forecast lead to increases of 12.5% and 25.3% for non-lagged and lagged models, respectively. Use of seasonal forecasts does not have a significant impact on crop income for households in a non-MWG location. However, reservations about the appropriateness of the design for identifying differences between MWG and non-MWG groups remain.

Blundo-Canto et al. (in press) use an "outcome harvesting" methodology to create a qualitative but structured account of stakeholder engagement in the scaling of CIS[50] in Senegal, and communication and its outcomes in terms of capacity-building and empowerment. They found that 161 actors had been involved in the network associated with the scaling process. By compiling impact pathway diagrams based on actor testimony, they identify outcomes and impacts that can be classified as: improvement of CIS, emergence of CIS facilitators, ownership of CIS, mobilization of new actors, and empowerment of actors. Outcomes that were particularly supported by triangulation between different informants and documentary evidence included at the local level: increased collaboration with other actors by government agencies. At the national level they included: improved production of CIS by government agencies; increased visibility and empowerment for NGOs, and increased collaboration with other actors by producer organizations. CIS projects 'triggered' these and a range of other (less well-evidenced but real) outcomes through creation of knowledge-sharing and action platforms, capacity strengthening, and provision of equipment. The projects sustained the best-evidenced outcomes, through: experience sharing and a consultation and dissemination framework; and other outcomes through training of trainers, capacity-strengthening, sharing of knowledge and experience, support for interaction opportunities, advocacy, and methodological improvement. The years of emergence of the different outcomes as assessed by actors mainly fall within Phase I, though some were emerging up to 2019.

It is worth quoting the paper at length:

> *This analysis revealed a complex network of actors involved in the production, transmission, use of and feedback from WCS beyond sector and administrative boundaries, often filling these multiple roles simultaneously in formal and informal ways … The boundary crossing of [CIS] was characterized by widespread use of the information, horizontal fluxes (for instance between farmers, fishers, local populations for security purposes) and vertical fluxes (between scales). Networks of collaboration and capacity building emerged, while the few diverging interests did not become obstacles to the process and were quickly absorbed.*

It can be concluded that empowerment of and improved networking between stakeholders has been a "systemic but overlooked effect"[51] of CCAFS funding to CIS in Senegal.

OICR 3313 should be considered in conjunction with OICR 3200 "Innovative public-private partnership ensures access to climate information services for 500,000 farmers and fisherfolk in Senegal", which refers to ongoing work, and has been assigned a maturity level of 2. This reports to further work with ANACIM and other agencies, funded bilaterally under the USAID CINSERE program, disseminating CIS messages through SMS and voice messages to 500,000 farmers. Additional work addresses the important question of how appropriate CIS for farmers could be funded after the end of international donor support and sustainably, ongoing support from central government budgets being deemed impossible. To this end, a report entitled Options de Modèles d'Affaires pour Assurer la Durabilité de l'Utilisation des Services d'Information Climatique au Sénégal (Ouedraogo et al. 2020) identified and described four possible business models, which were subsequently validated by meetings of stakeholders. They comprise:

1. Supporting local MWGs (see above) through mixed funding from central government, decentralized local government and NGOs
2. Sponsorship from private companies, parastatals and apex farmer organizations
3. Cost recovery through insurance premiums, credit costs and input prices
4. Cost recovery through individual subscription by farmers.

These models are now being piloted and systematically evaluated (by CCAFS' own MEL team) in an exercise that will last until December 2021. Informal opinion suggests the most sustainable models are 1) (which received enthusiastic support from local mayors at validation stage) and 4).

In conclusion, we have concerns about the provenance of the coverage figure of 7.4 million people and the methodology used to identify impacts on yields and crop income. We also note that OICR 3200 is very much a report on work in progress. However, the two OICRs taken together undoubtedly

[50] The authors use the terminology of WCS (weather and climate services) changed to CIS here for consistency.
[51] To quote the subtitle of Blundo-Canto et al. (in press).

demonstrate the vibrancy of the workstream on CIS in Senegal, and its progress towards an impactful, farmer-friendly, and sustainable model.

OICR Analysis template

CRP: CCAFS

OICR Number & Title: 3313 Use of CIS in Senegal led to 10-25% increases in household income, whilst improving action planning of national and local stakeholders		
Phases of report (new/updated same level/updated new level of maturity): New		
If for Innovations at Level 4 or Policies at Levels 2 and 3		
Year reported: 2019	Maturity level: 3	# Years of programmatic work: 9
Geographic location(s): Senegal		
Populations covered, estimated size and socio-demographic categories (e.g., subsistence farmers, women, adolescents, etc.,): Dryland farming households, estimates of numbers vary between 2 million and 7.4 million people		
Key contributors to the outcome		
CGIAR (FPs, other CRPs/Platforms and FPs, centers): Flagship 4, West Africa Regional Program		
External partners: National Civil Aviation and Meteorology Agency of Senegal (ANACIM) and multiple other stakeholders		
Links to the CGIAR Strategic Results Framework: (IDOs and sub-IDOs) SLO: Reduced poverty; Food and Nutrition Security IDOs: Mitigation and adaptation achieved; National partners and beneficiaries enabled Sub-IDOs: • Enabled environment for climate resilience • Enhanced capacity to deal with climatic risks, extremes • Increase capacity for innovation in partner development organizations and in poor and vulnerable communities		
[CRP] contributions to the outcome *(list any of the following)*		
Innovations: Contextually appropriate Weather and Climate Information Services, Multidisciplinary Working Groups		
Policies: 467 - Systematic use of Climate Information (CI) for developing strategies and planning policies in Senegal (Ministry of Agriculture, Directorate of Water Resources Management and Planning, Civil Protection Department)		
Key CRP publications supporting the OICR: Chiputwa, B. *et al.* 2020. Dynamic Uptake of CIS Use and Impacts on Agricultural Productivity and Incomes: Does co-production make a difference? Under submission to *Agricultural Systems* https://hdl.handle.net/10568/108054 Blundo-Canto, G. *et al.* 2020. Scaling Weather and Climate Services for agriculture: evaluating systemic but overlooked effects. Submitted to *Climate Services* https://hdl.handle.net/10568/108053 CCAFS. 2015. The impact of Climate Information Services in Senegal. CCAFS Outcome Study No. 3. Copenhagen: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) available at https://cgspace.cgiar.org/rest/bitstreams/59295/retrieve		
OICR relationship with CGIAR cross-cutting issues (YES/NO)		
Capacity development: YES. CIS and the Multidisciplinary Working Groups not only supported farmer's income but also enabled multiple national and local level stakeholders to better plan and coordinate their actions, making the overall system more resilient (Blundo-Canto submitted)		
Gender: NO		
Youth: NO		
Organization responsible for OICR (CGIAR/not CGIAR): CCAFS, in particular ICRAF; CIRAD		
External partners related: CIRAD (research on outcome harvesting		
Partnerships Key partners ([CRP]'s engagement with each partner, and extent to which partner expectations/needs were met or not): National Civil Aviation and Meteorology Agency of Senegal (ANACIM): ANACIM was strongly supported by CCAFS and subsequently by bilateral USAID-funded projects negotiated by CCAFS. They benefitted from the establishment of Multidisciplinary Working Groups which regularized the translation of weather advisories into agricultural messages for farmers.		
Brief reviewer's description of the outcome (based on OICR report, documents cited, original data collected/interviews and other references)		

The OICR reports on impact evaluations carried out under Phase II of work mainly carried out under Phase I to create a large-scale climate information service (CIS) for Senegalese farmers, and specifically one built on Multidisciplinary Working Groups (MWGs) at both national and local level to translate climate information into agricultural messages. The main outcomes cited are a) access to CIS for 740,000 farm households (7.4 million people), b) income from crops increased by between 10% and 25% and c) capacity-building and empowerment outcomes particularly: (at the local level) increased collaboration by government agencies with other actors; (at the national level): improved production of CIS by government agencies; increased visibility and empowerment for NGOs, and increased collaboration with other actors by producer organizations. We have concerns about the provenance of the coverage figure of 7.4 million people and the methodology used to identify impacts on yields and crop income. However, especially when taken in conjunction with OICR 3200 it demonstrates the vibrancy of the workstream on CIS in Senegal, and its progress towards an impactful, farmer-friendly and sustainable model.

Analysis

Mapping of the outcome to the CRP/Flagship ToC. How does it fit into the narrative of the ToC. Analysis of the reported outcome/impact, using the evaluation criteria of quality of science and effectiveness (also using findings from document review and/or interviews with key informants). Cross-referencing to the QoR4D Framework criteria of scientific legitimacy and credibility.

The OICR is fully in accord with the narrative of the ToC for Flagship 4. Because the climate information transmitted covered seasonal, ten-day, daily, and extreme event forecasts, the work can be considered as part of either of two Clusters of Activity: Climate information and early warning for risk management; and Climate information and advisory services. In both cases, contributions were made to most of the expected sub-IDOs:

- Enhanced capacity to deal with climatic risks and extremes (evidenced by farmer satisfaction and to some extent by the impact evaluation research.
- Enabled environment for climate resilience (evidenced by external investments in CIS by GoS and USAID, and potentially by Senegalese decentralized local government entities) and;
- Enhanced capacity for innovation in partner development organizations and in poor and vulnerable communities (evidenced by the outcome harvesting study).

However, it does not appear that the sub-IDO of gender-equitable control of productive assets and resources, which is associated in the Flagship 4 impact pathway with CIS, has been addressed (though there is other work on gender and CIS within the Flagship).

Through the above sub-IDOs, a contribution has been made to the corresponding IDOs.

By 2015 the rural population estimated to have access to climate information through channels created by the channels described above was an estimated 3.9 million people in five Regions (Lo and Dieng 2015), an estimate almost double CCAFS' own estimate at the time. A CCAFS outcome study of 2015 increases this estimate to 7.4 million people (740,000 rural households) but the provenance of this figure is unclear.

Largely independent of arguments about the scale (which even at the lower estimates is significant) were significant efforts to identify the impact of CIS, and in particular the model of CIS based on local MWGs, on household income. The paper by Chiputwa et al. (in press) uses a sample of 596 farm households from Kaffrine Region (which benefitted from local-level MWGs) and Kaolack Region (which did not), in a two-time balanced panel surveyed in 2017 and 2019. The econometric procedures adopted in this paper are opaque and, in our view, subject to serious concerns, particularly about the appropriateness of a Kaffrine/Kaolack comparison when the latter has significantly lower rainfall.[52]

Awareness, access and use of CIS were significantly greater in MWG locations than in non-MWG locations, although differences between the two groups decreased in the second wave of the survey. Farmers in MWG locations also made significantly more management decisions based on CIS than those in non-MWG locations. Qualitative findings helped the authors to derive diagrams of causal pathways from CIS messages through farmer behavior to yields and increased food availability. Comparing those who used CIS in MWG locations with those who either did not use or used in non-MWG locations, the likelihood of planting the major crops (peanuts, maize and millet), number and area of crops, yields and monetary value of crops were all greater. These results were highly significant ($p<0.01$) in the second wave survey for: number of peanut plots; peanut yields and value; number of maize plots; area under maize; maize yields and value; likelihood of planting millet; total

[52] A view supported by two senior economists specializing in impact evaluation who informally reviewed the paper for us.

number of plots; total crop value. All these variables increased for the MWG/user group between the two waves. Regression analyses to account for differences in the underlying socio-economic, institutional and biophysical factors between users and non-users and by MWG access give significant results. Access to MWG and use of CIS in daily forecast gives 9.3% higher cop incomes compared to either non-access to MWG or non-use, increasing to a 25.4% increase with a model using lagged temperature and rainfall. Similar values are obtained for a comparison of users and non-users within an MWG location. The same comparisons for use of both seasonal and daily forecast lead to increases of 12.5% and 25.3% for non-lagged and lagged models, respectively. Use of seasonal forecasts does not have a significant impact on crop income for households in a non-MWG location. However, reservations about the appropriateness of the design for identifying differences between MWG and non-MWG groups remain.

Blundo-Canto et al. (in press) use an "outcome harvesting" methodology to create a qualitative but structured account of stakeholder engagement in the scaling of CIS in Senegal, and communication and its outcomes in terms of capacity-building and empowerment. They found that 161 actors had been involved in the network associated with the scaling process. By compiling impact pathway diagrams based on actor testimony, they identify outcomes and impacts that can be classified as improvement of CIS, emergence of CIS facilitators, ownership of CIS, mobilization of new actors, and empowerment of actors. Outcomes that were particularly supported by triangulation between different informants and documentary evidence included at the local level: increased collaboration with other actors by government agencies. At the national level they included: improved production of CIS by government agencies; increased visibility and empowerment for NGOs, and increased collaboration with other actors by producer organizations. CIS projects "triggered" these and a range of other (less well-evidenced but real) outcomes through the following: creation of knowledge-sharing and action platforms, capacity strengthening, and provision of equipment. The projects sustained the best-evidenced outcomes through experience sharing and a consultation and dissemination framework; and other outcomes through training of trainers, capacity-strengthening, sharing of knowledge and experience, support for interaction opportunities, advocacy, and methodological improvement. The years of emergence of the different outcomes as assessed by actors mainly fall within Phase I, though some were emerging up to 2019. It is worth quoting the paper at length:

> *This analysis revealed a complex network of actors involved in the production, transmission, use of and feedback from WCS beyond sector and administrative boundaries, often filling these multiple roles simultaneously in formal and informal ways … The boundary crossing of [CIS] was characterized by the widespread use of the information, horizontal fluxes (for instance between farmers, fishers, local populations for security purposes) and vertical fluxes (between scales). Networks of collaboration and capacity building emerged, while the few diverging interests did not become obstacles to the process and were quickly absorbed.*

It can be concluded that, empowerment of and improved networking between stakeholders has been a "systemic but overlooked effect" of CCAFS funding to CIS in Senegal.

OICR 3313 should be considered in conjunction with OICR 3200 "Innovative public-private partnership ensures access to climate information services for 500,000 farmers and fisherfolk in Senegal", which refers to ongoing work, and has been assigned a maturity level of 2. This reports to further work with ANACIM and other agencies, funded bilaterally under the USAID CINSERE program, disseminating CIS messages through SMS and voice messages to 500,000 farmers. Additional work addresses the important question of how appropriate CIS for farmers could be funded after the end of international donor support and sustainably, ongoing support from central government budgets being deemed impossible. To this end, a report entitled Options de Modèles d'Affaires pour Assurer la Durabilité de l'Utilisation des Services d'Information Climatique au Sénégal (Ouedraogo et al. 2020) identified and described four possible business models, which were subsequently validated by meetings of stakeholders. They comprise:

1. Supporting local MWGs (see above) through mixed funding from central government, decentralised local government, and NGOs
2. Sponsorship from private companies, parastatals, and apex farmer organizations
3. Cost recovery through insurance premiums, credit costs and input prices
4. Cost recovery through individual subscription by farmers.

These models are now being piloted and systematically evaluated (by CCAFS' own MEL team) in an exercise that will last until December 2021. Informal opinion suggests the most sustainable models are 1) (which received enthusiastic support from local mayors at validation stage) and 4).

Conclusions

Example questions: To what extent does the OICR represent the application of the CRP's research to developmental outcomes? What further information would be useful to elaborate that logic, with reference to the CRP Theory of Change? What implicit assumptions are revealed by the OICR analysis? What lessons emerge for the CRP or the CGIAR more generally, based on this outcome?

The OICR (especially when taken together with OICR 3200) undoubtedly represents the strength and vibrancy of work on CIS in Senegal dating from the beginning of CCAFS Phase I, and its progress towards an impactful, farmer-friendly, and sustainable model. In this sense, it undoubtedly shows the application of CCAFS-derived knowledge and practice to development outcomes. In terms of the preparation of this OICR and the specific quantitative impact analysis from Phase II it is based on, we have concerns both about the provenance of the coverage figure of 7.4 million people and the methodology used to identify impacts on yields and crop income.

Review of OICR #3140. 37,000 smallholders implementing low emissions agriculture resulting in 1 Mt CO2e verified mitigation in East Africa

This was selected because it represents the work of Flagship 3 in East Africa region, achieving a maturity level of 2. The OICR from 2019 focuses on a research project involving EcoAgriculture Partners, Vi-Agroforestry in Kenya, and EcoTRUST in Uganda, with outputs produced pre-2016 (i.e. Phase I). The latter two organizations were already involving pioneering voluntary carbon market projects. The project covered by the OICR facilitated participatory action research (PAR) on improving local institutional sustainability, including technical training provision at scale to improve farmers uptake of Sustainable Agricultural Land Management (SALM) practices. Drawing upon the insights from the PAR, training manuals were developed to build the capacity of local actors in Uganda involved in the Trees for Global benefit project, and to train staff from the project, government, NGOs and community-based intermediaries in Kenya (Kenya Agriculture Carbon Project). The training manual was aimed at improving the extension provided and explored institutional innovations such as building local governmental partnerships to support carbon project management and facilitating a more active role for women in the project to increase their benefits. The practices promoted have been shown to have sequestered an estimated 344,000 t CO2e between 2010 and 2016, of which 24,788 tCO2e were sold to the BioCarbon Fund, with approximately 30,000 smallholder farmers participating in the Kenya Agriculture Carbon Project, via 1,730 farmer groups and 70% of participants being women (OICR). The manuals continue to be used by the project partners in both countries (Vi-Agroforestry stakeholder interview; UNIQUE interview). CCAFS has supported work to assess county-level implementation plans in Western Kenya. The manuals are also being used in Uganda.

The 2019 OICR does not present substantial new information on recent developments falling into Phase II of the program. The project itself is continuing (with the third round of verifications and payments made to farmers recently (Vi-Agroforestry interview). Complementary evidence from ICRAF substantiates the positive livelihood benefits from the project in Western Kenya, but the impact assessment which will isolate the training using the manual supported by CCAFS has been delayed by COVID-19 and is only now underway. Initial key informant interviews confirm that the carbon payments are small and so do not incentivize farmers to adopt the SALM practices, but that yield- and food security-benefits are the attractors. An interview with another project partner pointed to the impact of the earlier science on another private carbon fund – the Livelihoods Fund – which used the same (CCAFS-influenced and improved) model to pre-finance livelihood projects and SALM activities generating carbon credits. The OICR itself is not very clear and does not report against the theory of change of the program or of the Flagship in any meaningful way. This does not mean that the outcome is not highly important and there is strong evidence of GHG reductions, capacity strengthening and livelihood benefits – but the analysis of it in the OICR is poor and the impact evaluation has been delayed (beyond the control of CCAFS)

OICR Number & Title: #3140. 37,000 smallholders implementing low emissions agriculture resulting in 1 Mt CO2e verified mitigation in East Africa		
Phases of report (new/updated same level/updated new level of maturity): 2		
If for Innovations at Level 4 or Policies at Levels 2 and 3		
Year reported: 2019	Maturity level: 2	# Years of programmatic work:
Geographic location(s): Uganda, Tanzania, Ethiopia, Kenya (East Africa)		
Populations covered, estimated size and socio-demographic categories (e.g., subsistence farmers, women, adolescents, etc.,): Farmers, including small, marginal and women farmers.		
Key contributors to the outcome		
CGIAR (FPs, other CRPs/Platforms and FPs, centers): Flagship 3		

Contributing CRPs/Platforms: FTA - Forests, Trees and Agroforestry; Livestock CRP. Contributing Regional programs: East Africa
External partners ● ECOTRUST - Environmental Conservation Trust ● UNIQUE - Unique Forestry and Land Use GmbH ● EcoAgriculture ● Vi Agroforestry
Links to the CGIAR Strategic Results Framework: (IDOs and sub-IDOs) SLO: Cross-cutting. IDOs: National partners and beneficiaries enabled; Mitigation and Adaptation Achieved. Sub-IDOs: ● Increased above- and below-ground biomass for carbon sequestration ● Enhanced individual capacity in partner research organizations through training and exchange ● Reduced net greenhouse gas emissions from agriculture, forests, and other forms of land-use (Mitigation and adaptation achieved). And specifically, to these SRF 2022/2030 targets: ● Reduce agriculturally related greenhouse gas emissions compared to business-as-usual scenario 2022
[CRP] contributions to the outcome *(list any of the following)*
Innovations: Not defined.
Policies: Not defined.
Key CRP publications supporting the OICR: 1. Shames S, Wollenberg E, Buck LE, Kristjanson P, Masiga M and Biryahaho B. 2012. Institutional innovations in African smallholder carbon projects. CCAFS Report no. 8. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). http://tinyurl.com/ycenocx8 2. Development of a participatory action research approach for four agricultural carbon projects in east Africa: http://tinyurl.com/u68ttxo 3. Building local institutional capacity to implement agricultural carbon projects: participatory action research with Vi Agroforestry in Kenya and ECOTRUST in Uganda: http://tinyurl.com/qllufhs 4. Capacity Building for Stakeholders in Smallholder Agricultural Carbon Projects in Eastern Africa. Training Manual. Washington, DC: EcoAgriculture Partners. http://tinyurl.com/rr85yag 5. Sustainable Agriculture Land Management Practices for Climate Change Mitigation: A training guide for smallholder farmers. Washington, DC. EcoAgriculture Partners. http://tinyurl.com/s7vs8ox 6. Seth Shames, Krista Heiner, Martha Kapukha, Lillian Kiguli, Moses Masiga, Pauline Nantongo Kalunda, Annet Ssempala, John Recha, and Amos Wekesa. 2015. Implementing Smallholder Carbon Projects Building Local Institutional Capacity Through Participatory Action Research. EcoAgriculture Partner, Washington, DC. http://tinyurl.com/yb89732l 7. Seth Shames, Krista Heiner, Martha Kapukha, Amos Wekesa, and John Recha. 2015. Scaling up Sustainable Agriculture Land Management in Bungoma County, Kenya. EcoAgriculture Partner, Washington, DC. https://cgspace.cgiar.org/bitstream/handle/10568/68429/http://EcoagriculturePF11.pdf 8. Seth Shames, Krista Heiner, Lilian Kigulib, Annet Ssempala, Pauline Nantongo Kalunda, and Moses Masiga. 2015. Scaling up Agricultural Carbon Activities in Mbale Region, Uganda. EcoAgriculture Partner, Washington, DC. http://tinyurl.com/uu94h7t 9. E-mail correspondence, evidence of inclusion in the program https://www.dropbox.com/sh/aoudg1ahomlgdau/AAD39HfK37Zs2Qz5VGQoUcrWa?dl=0
OICR relationship with CGIAR cross-cutting issues (YES/NO)
Capacity development YES (2 – Principal): Training and capacity building activities have focused on gender inclusion, both women and men, in the agriculture carbon projects. The actions focused on building the capacities of community-based intermediaries, facilitating partnerships with local government and local non-governmental organizations, and supporting a more active role played by women. Results showed that women's roles in projects can grow if project benefits are aligned with their needs and training is made more accessible.
Climate change: YES (2 – Principal): About 70% of farmers involved in the agriculture carbon projects were women. This project targeted gender equality and empowerment in agriculture carbon projects and improve access to financial resources and market information.

Gender: YES (1 – Significance): About 70% of farmers involved in the agriculture carbon projects were women. This project targeted gender equality and empowerment in agriculture carbon projects and improve access to financial resources and market information.

Youth: NO

Organization responsible for OICR (CGIAR/not CGIAR):
Viagroforestry.org

External partners related

Links to CGIAR Strategic Results Framework: (IDOs and sub-IDOs)

Partnerships

- ViAgroforestry
- Unique
- MEL – Independent consultant
- Ex-Environmental Resources Management Center for Sustainable Development consultant (now part of CCAFS East Africa Regional Team).

Brief reviewer's description of the outcome (based on OICR report, documents cited, original data collected/interviews, and other references)
One paragraph summary

In 2014 CCAFS support participatory action research to identify how to improve local institutional sustainability, including provision of technical training at scale to farmers implementing sustainable agricultural land management practices. The farmers are part of projects supported by Vi-Agroforestry in Kenya and EcoTRUST in Uganda, with sales of carbon payments generating payments to farmers, although the most significant benefits relate to yield and food security improvements. CCAFS supported the development of a training manual to build the capacity of local actors and trained staff from the project, local government, NGO staff and community-based intermediaries. The manuals continue to be used in both Western Kenya and in Uganda, where projects have been underway for some years. ICRAF evidence on the project indicates positive effects. The impact assessment isolating the effects of the manual commissioned by CCAFS and currently underway was delayed by COVID 19, but initial qualitative findings from key informant interviews are positive, according to the independent evaluator. Broader scaling has been achieved through engagement with county level implementation plans and through influence of the science on the design of other large-scale carbon funds.

Analysis

Mapping of the outcome to the CRP/Flagship ToC. How does it fit into the narrative of the ToC. Analysis of the reported outcome/impact, using the evaluation criteria of quality of science and effectiveness (also using findings from document review and/or interviews with key informants). Cross-referencing to the QoR4D Framework criteria of scientific legitimacy and credibility.

A project partnering with EcoAgriculture Partners, EcoTRUST and Vi-Agroforestry) conducted participatory action research on how to improve local institutional sustainability, including provision of technical training at-scale to farmers implementing Sustainable Agricultural Land Management t (SALM) practices. These practices generate GHG reduction credits through soil and tree carbon sequestration. The project in Kenya has sequestered an estimated 344,000 t CO2e between 2010 and 2016, of which 24,788 tCO2e were sold to the BioCarbon Fund. Approximately 30,000 smallholder farmers are participating in the Kenya Agriculture Carbon Project, via 1,730 farmer groups. 70% of the participants are women. Training manuals were produced in 2014 to build the capacity of local actors (Trees for Global benefit, ECOTRUST, Uganda) and to train staff from the project, local government, and NGO staff, and community-based intermediaries or resource people (Kenya Agriculture Carbon Project, Vi-Agroforestry, Kenya). These innovations were used to (a) build the capacities of community-based intermediaries (CBIs) - individuals who mediate between community organizations and carbon projects- to provide training on sustainable agriculture land management (SALM) practices, recruit farmers, and mobilize resources; (b) build local partnerships to support carbon project management by engaging with local government and partnering with non-governmental actors, and (c) support a more active role of women in the project and increasing their benefits. The manuals continue to be used by the project partners in both countries (Vi-Agroforestry stakeholder interview; UNIQUE interview). CCAFS has also supported work to assess county-level implementation plans in Western Kenya. The manuals are being used in Uganda.

Although prepared and submitted in 2019, the OICR does not present new information on more recent advances in implementation and outcomes (e.g. in Phase II). The project itself is continuing. The project manager from Vi-Agroforestry reported that they have completed the third round of

verifications, three monitoring cycles, and the payments have been made. The OICR references provided are all 2015 or before. An ICRAF quasi-experimental impact evaluation investigated the immediate effects and household welfare outcomes of a 9-year intervention by Vi-Agroforestry and a Swedish NGO to promote agroforestry in Bungoma and Kakamega counties, Western Kenya. The study found variable program exposure and agroforestry uptake, but also modest, yet statistically significant, effects of Vi's program on intermediate outcomes, such as agroforestry product income, fuelwood access, and milk yields among dairy farmers. There were modest increases in asset holdings, particularly among households represented by female program participants[53].

CCAFS has commissioned a quasi-experimental impact assessment which will focus on farmers in Western Kenya exposed to the production training manual versus those in the same project who have not. Unfortunately, due to COVID-19 delays, the impact evaluation has been delayed for 9 months. The rigor of the impact evaluation methodology will need to be reviewed to check for issues such as selection bias. Qualitative stakeholder interviews have been undertaken. Initial findings are that the manual has been quite useful to better structure extension activities, including insights on how to mobilize farmers and facilitate their organization. There are noticeable changes in agricultural productivity and food security, however, the carbon payments are very small, and the main attractions are benefits such as increased yields (independent evaluator). The Ugandan model has also delivered benefits at the local level, but individual farmers receive lower carbon payments compared to those in Kenya, although the reasons are not clear (e.g. whether the carbon credits are more or different buyers paying higher carbon prices) (independent evaluator). Further, the model of benefit-sharing diverges between Kenya and Uganda, with the latter paying individual farmers, whereas the former distributes by groups.

Linked to this pioneer project in the voluntary carbon market, the original research funded by the World Bank and conducted by CCAFS provided a significant contribution to building the consensus on soil carbon sequestration on smallholder farms (Seebauer, 2014).[54] The approach was advanced (e.g. building new digital tools, improving extension approaches and monitoring and increasing attention to gender issues onto the original SALM approach of the VCS, with CCAFS testing and reviewing the methodology (partner interview). According to the partner interviewee, this research has played a key role in influencing the Livelihoods Fund, supported by Danone and Mars, the largest private carbon fund, which is financing local NGOs for sustainable land-use practices in Rwanda and India (stakeholder interview) and the approach is also being replicated in a Burkina Faso project, funded by the World Bank. These organizations pre-finance projects, which generate carbon credits[55].

The CCAFS work has contributed to all three target sub-IDOs, with measurement of GHG emissions being a core part of the offer, but also capacity strengthening being validated through stakeholder interviews, and complementary ICRAF evidence reflecting the strength of the overall model. However, the specific contribution of CCAFS as set out in this OICR (as opposed to earlier contributions) is not clearly articulated, in terms of the added value provided to the on-going project. Unfortunately, the planned impact evaluation will focus on the manual as the treatment effect, but it is still on-going.

Conclusions

Example questions: To what extent does the OICR represent the application of the CRP's research to developmental outcomes? What further information would be useful to elaborate that logic, with reference to the CRP theory of change? What implicit assumptions are revealed by the OICR analysis? What lessons emerge for the CRP or the CGIAR more generally, based on this outcome?

The OICR itself is not very clear and does not report against the theory of change of the program or of the Flagship in any meaningful way. This does not mean that the outcome is not highly important – but the analysis of it in the OICR is poor. Stakeholder interviews provide more information, but the OICR could be improved and the impact evaluation data generated.

[53] Assessing the Downstream Socioeconomic Impacts of Agroforestry in Kenya
Karl Hughes, Seth Morgan, Kathy Baylis, Judith Oduol, Emilie Smith-Dumont, Tor-Gunnar Vågen, Hilda Keg
[54] M. Seebauer (2014) 'Whole farm quantification of GHG emissions within smallholder farms in developing countries'. Environmental Research Letters. Vol, 9.
[55] https://www.livelihoods.eu/lcf/

Review of OICR 3347: The adoption of Happy Seeder technology by 0.5 million farm-households on 1.3 million ha in NW India contributed to increased yields, profits, water, and nutrient saving.

Why this OICR was selected

This OICR was selected to ensure coverage of the South Asian Regional Programme and because it achieved maturity level 3. While primarily marked as relating to FP3, it also relates strongly to FP 2. This assessment also covers aspects of the closely related OICR 2039: Scalable CSA business models drove a USD 170 million national policy investment in India to curb crop residue burning, which achieved maturity level 2, and an unnumbered OICR: Outcome case study of no-burning management solutions for rice crop residues.

Overview of Case

CIMMYT research has been successfully seeking crop residue solutions to ensure nutrients are recycled, to capture productivity gains, to tackle negative health impacts of air pollution, and achieve GHG reductions. It was estimated that less than 15% of the total rice residue in NW India was being productively used via on-farm recycling or for electricity generation (AR, 2017). CIMMYT research on crop residue solutions, focusing on the existing Happy Seeder Technology (developed in 2002) has 'been one of the core areas of CCAFS research in CSVs' (AR, 2017), with evidence generated over the preceding five years.

Building on this previous Phase I work, CCAFS, CIMMYT, and partners have continued to test the technology and generated evidence in the Climate-Smart Villages on the tractor-drawn Happy Seeder technology, which cuts and lifts rice straw, sows wheat directly into the soil, and deposits the cut straw as mulch over the sown area (Shyamsundar et al. 2019). In particular, the high-profile Policy Forum item in the journal *Science* (Shyamsundar et al. 2019) synthesizes evidence on the profitability of different systems. Use of the Happy Seeder, with but even without the straw management system, emerges as the most profitable of ten options. This evidence informed the Indian government (via policy briefing), enabling the government to prioritize crop residue management and investing on a large scale (INR 11.5 billion) for in-situ management using the Happy Seeder technology. The evidence was widely disseminated via a large, national-level joint media campaign (ICAR Indian Council for Agricultural Research) to promote stakeholder confidence to facilitate scaling. CIMMYT-CCAFS worked with two major companies to promote the technology in 7 districts, N.W. India. This led to enhanced stakeholder confidence and community awareness and catalyzed widespread adoption (1.3 million hectares) by 0.5 million farming households out of 2.5 million in the area. Remote sensing evidence confirms an 18.8% reduction in residue burning compared to 2018. Taking into consideration the impact on reduced air pollution, an estimated 50 million rural and urban people have positively benefited. A significant quantity of nutrients was recycled with the avoidance of burning using the Happy Seeder technology (most of 55 m Kg N, 25 mKg P, and 250 m Kg). In a context of serious groundwater depletion, >2000 million m3 of groundwater was saved. Changes in on-farm practices have resulted in increased yields, farmer profits and water and nutrient saving, reduced air pollution, and reduced GHGs (78% compared to all burning options, representing approximately 4 m Metric Tons of CO2-eq in 2019).

This outcome-impact case presents a clear contribution to Indian government policy and investment (Policy augmented scaling model for a fully validated CSA - the Happy Seeder technology to curb air pollution and build resilience; Informed investments of USD 170 million in India for scaling up the Happy Seeder technology) and to the development of an innovation (Policy augmented scaling model for a fully validated CSAP - the Happy Seeder technology to curb air pollution and build resilience).

Contribution to SRF and IDOs, including Policies and Innovations

This research-for-development work is anticipated to lead to the following sub-IDOs, under the IDO Mitigation and Adaptation Achieved:

- More efficient use of inputs
- Reduced net greenhouse gas emissions from agriculture, forests and other forms of land-use ().

The research contributes to these sub-IDOs by testing a technology (Happy Seeder no-till, no-burn) and providing evidence both within a high impact factor journal article and disseminating policy messages via a policy brief. Through a key partnership with government, a promotion campaign disseminating evidence on proven benefits of the technology to a diverse range of stakeholders, including potential investors and community level actors. The private sector was convinced to invest in the technology and adoption occurred at scale leading to significant environmental benefits. More efficient use of inputs also leads to increased incomes and employment.

The benefits are also anticipated to contribute to the sub-IDOs for which FP2 is accountable, namely: Reduced smallholder production risk; and Improved access to financial and other services, in turn contributing to the IDOs: Increased resilience of the poor to climate change and other shocks; and Enhanced smallholder market access.

The work reported in the OICR is also relevant to the following SRF targets for 2022:

- Reduce agriculturally related greenhouse gas emissions compared to business-as-usual scenario 2022
- Increase in water and nutrient (inorganic, biological) use efficiency in agro-ecosystems, including through recycling and reuse
- Increased rate of yield for major food staples from current <1%/year

Relevance of outcomes to ToC for Flagship(s)

The high-quality science and its publication on a proven, scalable CSA business model (tested in the CSVs under FP2), plus high-level stakeholder engagement with government and joint national media promotion with government, built stakeholder awareness and catalyzing public and private investment are aligned with the FP 2 and 3 impact pathway causal steps. The initiative targets increased incomes for 2m+ farmers, improving soil health, reducing water use and carbon footprints in 4 million hectares. There is a clear linkage to the anticipated sub-IDOs of FP 3 (more efficient use of inputs and reduced GHGs) and those of FP 2 (reduced smallholder production risk, improved access to financial and other services).

Assessment

CIMMYT developed the Happy Seeder Technology and it was robustly tested in CSVs and positively demonstrated both adaptation and mitigation benefits and positive effects on youth (AR 2017). Adoption does not only depend upon access to information – smallholder farmers require sufficient capacity and resources to change their practices. Incentives have been unlocked via the efforts of CCAFS and partners with the major investment by the Indian government to prioritize and promote crop residue management solutions in response to a severe public health challenge and productivity losses. In March 2018, the Prime Minister called for a 'Ban Crop Residue Burning', and the evidence disseminated in policy briefs and media, and high-level stakeholder engagements via facilitation of / participation in a series of policy and round-table dialogues and meetings, this created the political will to make the investment in in-situ management using the Happy Seeder technology. Continued multi-stakeholder consultations, in collaboration with government, created awareness amongst stakeholders and coalitions of private-NGO-farmer organization, national and international agencies catalyzing commercial scaling amongst private companies, such as Sonalika. Training has also been tailored to the needs and priorities of youth and women, encouraging social inclusion and equity objectives. Evidence on adoption is robust [check/add].

Limited additional detail was provided in 2018 (AR, 2018) except for an expansion in the area now covered, i.e.. It is reported that 0.8 million – up from 0.5 m in 2017 ha in NW India are now under no-till, no-burn wheat production.

In the 2019 AR, the adoption of the no-burn, no-till agriculture (using Happy Seeder technology) by approximately 0.5 million farm households on a larger area - now 1.3 million ha in north-west India is reported to have contributed to increased yields, farmer profits, and water and nutrient saving, as well as reduced burning, air pollution and emission reductions (approx. 4 million tCO2-eq).

FP 2 causal pathway

The primary outcome for FP2 'is to provide incentives (financial, technical and policy) to support 6 million farmers to adopt climate-smart practices and technologies, which explicitly contribute to increased resilience to climate shocks across a range of timescales' (CCAFS Proposal, 2016). This will be achieved via engagement with donors, governments, and local institutions to invest in projects and programs that incentivize adoption and FP2 will 'produce and appropriately disseminate evidence and information to support these investments, making the business case for the best-bet CSA options for target geographies and beneficiaries'.

The scaling achieved provides a significant contribution to Outcome Indicator/Target '50 site-specific targeted CSA options (technologies, practices and services) tested and examined for their gender implications'. By 2018, CCAFS reports that overall FP2 has tested or evaluated 94 practices across the CSV network – the Happy Seeder technology scaling is a key contribution to this target, and as it targets/benefits 2 million farmers [evidence it achieved that?], it clearly contributes to the primary outcome of supporting 6 million farmers to adopt climate-smart practices and technologies. It has also

contributed to gender equity through reduced exposure of women and children to smoke, and some involvement of women in supporting the adoption of the technology at the household level.

FP 2 hypothesis linking to CCAFS ToC and impact pathway assumptions

Two key hypotheses link the FP2 impact pathway to the CCAFS program ToC: i) Context-specific knowledge on the impacts of practices, technologies, business models and information systems on CSA-related outcomes, as well as on their cost-effectiveness advantages compared to current practice, leads to adoption of CSA at the local level; ii) Improving and applying knowledge on socio-economic, technical, financial and political barriers to incentives for investment in and adoption of CSA technologies and practices will lead to adoption of CSA at scale.

Testing and evaluation of the Happy Seeder technology and development of a scalable business model, has led to local-level adoption and to overcoming enabling conditions barriers for scaling

Impact pathway assumptions are: a) CSA is different from 'business as usual' approaches involving the capacity to implement flexible, context-specific solutions, supported by innovative policy and financing actions; b) better information and evidence, packaged and communicated through appropriate channels, will increase both investment and the quality of the investment vis-a-vis CSA related outcomes; c) CSA practices and technologies are attractive to young people and have the potential for gendered impacts above and beyond a 'business as usual' approach; d) CSA is attractive to international and national agricultural development agencies, recognizing that there is widespread buy-in, but some regions and countries prefer not to use the term.

FP 3 causal pathway

FP3's overall goal is to test the feasibility of reducing agricultural GHG emissions at large-scales while ensuring food security in developing countries. Change is anticipated to occur through generation of evidence and tools (improved estimates of emissions from LED in smallholder farming), impacts of LED on emissions, food security and other outcomes and resulting priorities, and conditions enabling LED at large-scales among smallholder farmers and in major supply chains. Primary beneficiaries are smallholder farmers. The key route to scaling of LED is via programs and policies for agricultural development (e.g. irrigation and energy infrastructure, fertilizer subsidies, private or public investments in sustainable intensification or climate change adaptation). Climate finance, policies, standards and infrastructure as well as consumer demand in some supply chains (e.g. oil palm, coffee) will catalyze the integration of LED into agricultural development programs, policies and practices, and gradually become the institutions shaping LED pathways to *reduce net GHG emissions from AFOLU, increase above- and below-ground biomass, minimize and reverse land, water and forest degradation* while ensuring *rural food security and improving livelihood options*.

The evidence demonstrates that this technology does contribute to GHG reductions and reduced air pollution, creating productivity increases etc.

FP 3 hypothesis linking to CCAFS ToC and impact pathway assumptions

The FP3 impact pathway assumptions are that there are i) suitable agricultural development programs and policies in the focal country; ii) programs and policies will implement LED to help meet mitigation targets, access climate finance or better compete in global markets; iii) LED implementers require information on which practices reduce GHG emissions, viable business models, enabling conditions and tools to set priorities and assess feasibility of new practices and their potential impact on food security; iv) Improved evidence for the compatibility of LED practices with food production in diverse production systems and through demonstration in CSVs will lead to scaling up.

The evidence shows that these assumptions have held true. There is government and private sector interest in this technology, which can be scaled and has a clear business case. Informed with CCAFS evidence, key actors have been convinced to invest and demonstration in CSVs/development of robust evidence has contributed to scaling.

The summarized hypothesis for FP 3 which links the whole FP3 impact pathway to the CCAFS ToC is that poor evidence on low emissions development, weak behavior change incentives and technical capacities constraints progress, so: a) LED practices for agricultural landscapes and value chains will significantly reduce GHG emissions while ensuring rural food security and improved livelihood options, b) Improved evidence, incentives, technical capacity, social mobilization and other enabling conditions for LED will support farmers, governments, the private sector and donors to implement LED policies and programs at scale. To test these two sub-hypotheses, FP3 focuses on high-mitigation impact practices relevant to smallholder development.

The evidence indicates that this link to the broader CRP ToC has held true, because of the partnerships developed, the creation of incentives for farmers, the provision of evidence and the success achieved in adoption.

<table>
<tr><td colspan="3">OICR Number & Title: 3347; The adoption of Happy Seeder technology by 0.5 million farm-households on 1.3 million hectares in north-west India contributed to increased yields, profits, water and nutrient saving.</td></tr>
<tr><td colspan="3">Phases of report: Updated at new level of maturity</td></tr>
<tr><td colspan="3">If for Innovations at Level 4 or Policies at Levels 2 and 3</td></tr>
<tr><td>Year reported: 2019</td><td>Maturity level: 3</td><td># Years of programmatic work:</td></tr>
<tr><td colspan="3">Geographic location(s): India; Punjab, Haryana, National Capital Region, Western UP</td></tr>
<tr><td colspan="3">Populations covered, estimated size and socio-demographic categories (e.g., subsistence farmers, women, adolescents, etc.,)</td></tr>
<tr><td colspan="3">Key contributors to the outcome</td></tr>
<tr><td colspan="3">CGIAR (FPs, other CRPs/Platforms and FPs, centers): CCAFS FP 2 and FP 3, South Asia Regional Program, Wheat CRP.</td></tr>
<tr><td colspan="3">External partners:
HAU - Chaudhary Charan Singh Haryana Agricultural University
TNC - The Nature Conservancy
Sonalika CRS
CSSRI - Central Soil Salinity Research Institute
BISA - Borlaug Institute for South Asia
PAU - Punjab Agricultural University
ICAR - Indian Council of Agricultural Research</td></tr>
<tr><td colspan="3">Links to the CGIAR Strategic Results Framework: (IDOs and sub-IDOs)
IDO: Mitigation and adaptation achieved
Sub-IDO: Reduced net greenhouse gas emissions from agriculture, forests and other forms of land-use
IDO: Increased incomes and employment
Sub-IDO: More efficient use of inputs</td></tr>
<tr><td colspan="3">[CRP] contributions to the outcome (list any of the following)</td></tr>
<tr><td colspan="3">Innovations: 16 – Policy-augmented scaling model for a fully validated CSAP-the Happy Seeder technology to curb air pollution and build resilience</td></tr>
<tr><td colspan="3">Policies: 2 – Informed investments of USD 170 million in India for scaling up the Happy Seeder technology</td></tr>
<tr><td colspan="3">Key CRP publications supporting the OICR:
Shyamsundar et al., 2019. Fields on fire: Alternatives to crop residue burning in India. Science. https://science.sciencemag.org/content/365/6453/536
National Academy of Agricultural Sciences (2017) Innovative Viable Solution to Rice Residue Burning in Rice-Wheat Cropping System through Concurrent Use of Super Straw Management System-fitted Combines and Turbo Happy Seeder. Policy Brief No.2

Additional publications listed in the OICR:
ICAR Press and Media Interaction. 2019. Dr. Trilochan Mohapatra addresses Press & Media on alternatives to crop residue burning in India http://tinyurl.com/ycwhg3cy
Government of India. 2019. Report of the committee review of the scheme "Promotion of agricultural mechanization for in-situ management of crop residue in states of Punjab, Haryana, Uttar Pradesh and NCT of Delhi". http://farmech.dac.gov.in/revised/1.1.2019/REPORT%20OF%20THE%20COMMITTEE-FINAL(CORRECTED).pdf
Press Release on IARI's 58th Convocation (February 13th , 2020). https://www.iari.res.in/files/Latest-News/PressReleaseEnglish_13022020.pdf
Article in Down to Earth Magazine. 2019. Here is a solution for crop residue burning problem. http://tinyurl.com/y7tfsjrw
Article in Down to Earth Magazine. 2019. Economic Survey 2019-20: What it says on stubble burning.https://www.downtoearth.org.in/news/agriculture/economic-survey-2019-20-what-it-says-on -stubble-burning-69067</td></tr>
<tr><td colspan="3">OICR relationship with CGIAR cross-cutting issues (YES/NO)</td></tr>
<tr><td colspan="3">Capacity development YES: this experience was very much about building the capacity of farmers to adopt the technology and broader stakeholders to promote its adoption</td></tr>
</table>

Gender YES: benefits to women's health and their role in promoting the activity are given (though not evidenced) in the OICR

Youth YES: the OICR states that 60% of the more than 4000 farmers, service providers, extension workers, other stakeholders involved in the training, traveling seminars, and awareness camps under the initiative were youth.

Organization responsible for OICR (CGIAR/not CGIAR): CIMMYT

External partners related

Partnerships

Key partners:

- The Nature Conservancy - participation in research – TNC staff member was the lead author of the *Science* paper
- Sonalika; a private company involved in the development and promotion of Happy Seeder technology
- The National Academy of Agricultural Sciences; convenors and publishers of the key 2017 policy brief on promoting Happy Seeder technology
- Research institutes and universities as listed above.

Brief reviewer's description of the outcome (based on OICR report, documents cited, original data collected/interviews, and other references)

Earlier work by CCAFS and partners in validating and developing Happy Seeder technology led to the contribution of CCAFS researchers to a key Policy Brief published by the National Academy of Agricultural Sciences in 2017 and a high-profile Policy Forum item in the journal Science (Shyamsundar et al. 2019) which synthesized evidence on the profitability of different systems and was in turn disseminated by press releases and coverage in agricultural magazines. This added strong impetus to Government of India initiatives to promote Happy Seeder technology, as evidenced by a report by the Dept. Of Agriculture, Cooperation & Farmers Welfare showing impact up to 2018, and an IARI press release in February 2020. The latter uses remote-sensing data to identify an 18.8% reduction in residue burning across seven districts of Northwest India.

Analysis

Mapping of the outcome to the CRP/Flagship ToC. How does it fit into the narrative of the ToC?

While there are significant ways in which the work reviewed fits the narrative of the *FP2* ToC, its main relevance is to FP3. The FP3 impact pathway assumptions are that there are i) suitable agricultural development programs and policies in the focal country; ii) programs and policies will implement LED to help meet mitigation targets, access climate finance or better compete in global markets; iii) LED implementers require information on which practices reduce GHG emissions, viable business models, enabling conditions and tools to set priorities and assess feasibility of new practices and their potential impact on food security; iv) Improved evidence for the compatibility of LED practices with food production in diverse production systems and through demonstration in CSVs will lead to scaling up.

The evidence shows that these assumptions have held true. There is government and private sector interest in this technology, which can be scaled and has a clear business case. Informed with CCAFS evidence, key actors have been convinced to invest and demonstration in CSVs/development of robust evidence has contributed to scaling.

The summarized hypothesis for FP 3 which links the whole FP3 impact pathway to the CCAFS ToC is that poor evidence on low emissions development, weak behavior change incentives, and technical capacities constrains progress, so: a) LED practices for agricultural landscapes and value chains will significantly reduce GHG emissions while ensuring rural food security and improved livelihood options, b) Improved evidence, incentives, technical capacity, social mobilization and other enabling conditions for LED will support farmers, governments, the private sector, and donors to implement LED policies and programs at scale. To test these two sub-hypotheses, FP3 focuses on high-mitigation impact practices relevant to smallholder development.

The evidence indicates that this link to the broader CRP ToC has held true, because of the partnerships developed, the creation of incentives for farmers, the provision of evidence, and the success achieved in adoption.

Analysis of the reported outcome/impact, using the evaluation criteria of quality of science and effectiveness (also using findings from document review and/or interviews with key informants). Cross-referencing to the QoR4D Framework criteria of scientific legitimacy and credibility.

CIMMYT developed the pre-existing Happy Seeder Technology and it was robustly tested in CSVs and positively demonstrated both adaptation and mitigation benefits and positive effects on youth (AR

2017). Incentives have been unlocked via the efforts of CCAFS and partners with the major investment by the Indian government to prioritize and promote crop residue management solutions in response to a severe public health challenge and productivity losses. CCAFS researchers contributed to a key Policy Brief published by the National Academy of Agricultural Sciences in 2017 and a high-profile Policy Forum item in the journal Science (Shyamsundar et al. 2019) which synthesized evidence on the profitability of different systems. Use of the Happy Seeder, with but even without the straw management system, emerges as the most profitable of ten options. These results were in turn disseminated by press releases and coverage in agricultural magazines. This added strong impetus to Government of India initiatives to promote Happy Seeder technology. In March 2018, the Prime Minister had called for a 'Ban Crop Residue Burning', and the evidence disseminated in policy briefs and media, and high-level stakeholder engagements via facilitation of / participation in a series of policy and round-table dialogues and meetings, created the political will to make the investment in in-situ management using the Happy Seeder technology. Continued multi-stakeholder consultations, in collaboration with government, created awareness amongst stakeholders and coalitions of private-NGO-farmer organization, national and international agencies catalyzing commercial scaling amongst private companies, such as Sonalika. Training has also been tailored to the needs and priorities of youth and women, encouraging social inclusion and equity objectives.

The campaign and its impacts are evidenced by a report by the Dept. Of Agriculture, Cooperation & Farmers Welfare showing impact up to 2018. Limited additional detail was provided in 2018 (AR, 2018) except for an expansion in the area now covered, i.e. It is reported that 0.8 million – up from 0.5 m in 2017 - ha in NW India are now under no-till, no-burn wheat production. In the 2019 AR, the adoption of the no-burn, no-till agriculture (using Happy Seeder technology) by approximately 0.5 million farm households on a larger area - now 1.3 million ha in north-west India is reported to have contributed to increased yields, farmer profits, and water and nutrient saving, as well as reduced burning, air pollution and emission reductions (approx. 4 million tCO2-eq). An IARI press release in February 2020[56] uses remote sensing data to identify an 18.8% reduction in residue burning across seven districts of Northwest India.
The OICR reports specifically on synthesis and dissemination of scientific findings, the relevant research findings generally dating back to Phase I. The synthesis by Shyamsundar et al. (2019) is credible, comprehensive, and persuasive, and publication in Science clearly gives it important esteem. We also note the prominence of Indian authors from a wide range of institutions, which has given it additional legitimacy. The promotion of Happy Seeder technology has been effective and as an instance of work, that accords with the theories of change of the CCAFS FP3 and FP2.

Conclusions

The OICR in isolation does not make it easy to follow the sequence of CCAFS' influence on residue burning in northwest India, but we find it a good example of the wide partnerships, convening power, and influence of CCAFS on policy and indirectly on farmer practice in India.

[56] Unfortunately, this was not available on the world-wide web through a secure connection during the period of the review.

Annex 15: Conflict of Interest Statements by the Review Team

Conflict of Interest Statement

1. Main employer and any other organization that provides you with remuneration (which may be named participants in the project/program/proposal you are being asked to review/evaluate)

   Please provide details: Natural Resources Institute, University of Greenwich

2. Are you aware whether a relative, close friend, close colleague or someone with whom you have financial ties is receiving funding from or giving advice to a project/program/proposal you are being asked to review/evaluate?

   Yes/**No**

   If Yes, please provide brief details:

3. Does any project/program/proposal you are being asked to review/evaluate cite any of your own current research?

   Yes/**No**

   If Yes, please provide brief details:

4. Does any project/program/proposal you are being asked to review/evaluate name researchers with whom you have active collaborations, recently published joint papers or are in regular email correspondence?

   Yes/No

   If Yes, please provide brief details:

- I have recently co-authored with an ILRI employee a paper based on an evaluative study funded by the Department for International Development (DFID) on social learning and sustainable agricultural intensification within a wider programme of which I was part – as a technical advisor. The study co-author from ILRI had been working to implement the research and learning programme (SAIRLA) and participated in the participatory assessment, and so was named as co-author, amongst many others.
- ILRI in Ethiopia hosted the National Learning Alliance for the SAIRLA programme for Ethiopia. I was involved in monitoring and evaluation for the programme, and as a technical advisor conducting a study on equity and another on social learning. DFID funded the programme, the contract was held by Wyg and NRI was a technical partner. I am not sure that this has relevance to the CCAFS programme, or if this constitutes CoI, as I nor NRI did not receive any CGIAR funds, but thought better to mention it.
- Under the DFID-funded CIRCLE programme, where NRI was under sub-contract to the Association of Commonwealth Universities, I acted as Specialist Advisor to two Early Career Researchers from African Universities who were each hosted in ILRI for a year. This resulted in the following publications on which I was a co-author:
- Mungai C., Opondo M., Outa G., Nelson V., Nyasimi M., Kimeli P. (2017) Uptake of Climate-Smart Agriculture Through a Gendered Intersectionality Lens: Experiences from Western Kenya. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. Climate Change Management. Springer, Cham. C. Mungai is the lead author. Neither I nor NRI received funds from or through the CGIAR system in connection with this work.

- The only instance in which I have received CGIAR funding is where I led a CCAFS project under the 'Farms of the Future' title focusing on Tanzania and Ghana-Burkina Faso (2011-2012) as mentioned in the interview, but I believe this pre-dates the period of consideration (last 5 years).

5. Does any project/program/proposal you are being asked to review/evaluate name any of your past PhD students are active participants?

   Yes/**No**

   If Yes, please provide brief details:

Declaration: I declare that the information provided on this statement is true and complete.

Name: Valerie Nelson

Signed: 

Date: 23.10.2020

Conflict of Interest Statement

1. During the last five years, have you personally been involved in the activities of a CGIAR Center, research program or partner receiving funds for a program, as an employee, consultant, adviser, Board or Advisory Committee member (i.e. in receipt of financial remuneration beyond expenses) or as a financial contributor to the CGIAR?

   Yes/~~No~~

Under the DFID-funded CIRCLE programme, where NRI was under sub-contract to the Association of Commonwealth Universities, I acted as Specialist Advisor to two Early Career Researchers from African Universities who were each hosted in ILRI for a year. This resulted in the following publications on which I was a co-author:

- Belay, A., Recha, J. W., Woldeamanuel, T., & Morton, J. F. (2017). Smallholder farmers' adaptation to climate change and determinants of their adaptation decisions in the Central Rift Valley of Ethiopia. *Agriculture & Food Security*, 6(1), 24.
- Ayanlade, A., Radeny, M., Morton, J. F., & Muchaba, T. (2018). Rainfall variability and drought characteristics in two agro-climatic zones: An assessment of climate change challenges in Africa. *Science of the Total Environment*, 630, 728-737.
- Ayanlade, A., Radeny, M., & Morton, J. F. (2017). Comparing smallholder farmers' perception of climate change with meteorological data: A case study from southwestern Nigeria. *Weather and Climate Extremes*, 15, 24-33.

Recha and Radeny are ILRI employees: the respective lead authors are not and were not. Neither I nor NRI received funds from or through the CGIAR system in connection with this work.

I am a co-author of the following article. Feleke, Alene, Abdoulaye and Manyong are IITA staff members. They were added to the authorial team by the lead author, a University of Greenwich PhD student, for additional assistance with analysis, and I have not dealt with them directly except on practical details around submission and acceptance. Neither I nor NRI received funds from or through the CGIAR system in connection with this work.

- Beine, Peter , Morton, John , Feleke, Shiferaw , Arega, Alene , Abdoulaye, Tahirou , Wellard, Kate , Mungatana, Eric , Bua, Anton , Asfaw, Solomon and Manyong, Victor (2020) The household welfare impacts of an agricultural innovation platform in Uganda. *Food and Energy Security*. ISSN 2048-3694 (In Press)

In 2015 I served as a member of the Independent Evaluation Team of the Livestock & Fish CRP. NRI was contracted by the IEA of the CGIAR to provide 52 days of my time for a fee of £stg29000.

2. During the last five years, has a family member or someone with whom you have financial ties been involved in the activities of a CGIAR Centre, research program, or partner receiving funds from a program as an employee, consultant, adviser, Board member?

   ~~Yes~~/No

3. Please give details of any other activity, engagement or relationship with the CGIAR during the last ten years:

- in 2013 I was contracted for five days for the Strategic Review of Livestock in the CGIAR
- in 2012 I was contracted for 15 days by ILRI, as host of the USAID-funded Technical Consortium for Building Resilience in the Horn of Africa, to produce a Technical Brief

NRI has carried out various work with and for CGIAR centres and programmes. The only piece of work for CCAFS was a sub-contract to CIAT in 2011-2012 to develop a methodology to explore climate futures using

a climate analogue tool and farmer to farmer exchanges, for a cost of £stg 64,000 (staff time and operational costs). I was at the time the line manager of the two NRI staff involved.

Declaration: I declare that the information provided on this statement is true and complete.

Name: John Morton

Signed:

Date: 24.06.20

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