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CCAFS outcomes evaluation report – Volume 1

An assessment of the influence of CCAFS' climate data and tools on outcomes achieved 2010-2016

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Preamble

This is Volume 1 complementing four further volumes of an evaluation report commissioned by the CGIAR Research Program on 'Climate Change Agriculture Food Security' (CCAFS). The evaluation was undertaken by the independent evaluators Kornelia Rassmann and Tonya Schuetz and supported by the CCAFS internal evaluation team led by Philip Thornton and Laura Cramer. It mainly used Outcome Harvesting (OH) but also elements from Impact Pathway thinking and Contribution Analysis to describe and analyze 'development outcomes' that were directly or indirectly influenced by one of three CCAFS' climate products – the GCM Climate Portal, MarkSimGCM, and the Climate Analogues tool.

Use of the report

The evaluation report comprises five volumes for different anticipated audiences
Volumes 1 to 4 are available from the CGIAR website (http://hdl.handle.net/10568/81536)

VOLUME / AUDIENCE	CONTENT
Volume 1 CCAFS governance and management, funders, partners, stakeholders	**Main evaluation results** – Executive summary; background to the evaluation, its design and methodology (Sections 1, 2, 3); an overview on the cases that were researched in more depth (Section 4); answers to the evaluation questions based on the outcomes data (Section 5); insights from the evaluation process (Section 6); and recommended discussion points and opportunities (Section 7).
Volume 2 CCAFS governance and management, funders	**Survey results and user perspectives** – Findings and conclusions from an online survey to the users of CCAFS climate data/tools, i.e. the potential contributors to development outcomes, conducted during the outcome harvest.
Volume 3 CCAFS governance and management, funders, partners, stakeholders	**Outcome stories** – The narratives developed together with our informants during this evaluation, describing who has been influenced to change in what way, and what contributed to these changes.
Volume 4 CCAFS management team	**Terms and coding book** – Definitions and classifications developed jointly by the internal and external evaluation teams to get a common understanding of terms; effectively organize and interpret the data; and potentially inform future CCAFS monitoring and evaluation.
Volume 5 Internal (not published)	**Databases, presentations, compiled secondary sources** – Excel databases developed during this study; PowerPoint presentations to guide discussions with the CCAFS evaluation team; interview data; researched literature.

The discussion of results is presented in blue in some sections. When referring to researched cases or outcome examples we provide the numbers that were used to tag these in the Excel outcomes database developed during this evaluation (see list of cases in Annex 9.2).

Acknowledgements and roles of evaluators and evaluation supporters

The external evaluation team, Kornelia (Konny) Rassmann and Tonya Schuetz, were responsible for developing the evaluation concept and design in an iterative, consultative process with the core evaluation management team at CCAFS. The overall evaluation was led by Konny, who contributed her Outcome Harvesting expertise and conducted most of the harvest, interviews and analyses; Tonya shared her deep understanding of the CGIAR/CCAFS structure and processes and supported data interpretation and reporting.

The CCAFS internal core evaluation team comprised Philip Thornton, leader of Flagship 1 "*Institutions and Policies for Climate-Resilient Food Systems*" and Laura Cramer, Science Officer for Flagship 1, both affiliated with the CGIAR Center 'International Livestock Research Institute' (ILRI). Philip and Laura committed a substantial amount of time and resources managing the evaluation internally, e.g. writing exploratory emails to potential informants in search of 'outcome leads', connecting the external evaluators to informants from specific outcome areas, reviewing outcomes data and classifications, and communicating the project within CCAFS. They also engaged in numerous Skype sessions with the consultants for planning, data interpretation, and feedback. We are immensely grateful to both for making space for this active support during the evaluation on top of their usual commitments.

The internal CCAFS evaluation team was further supported by Osana Bonilla-Findji, Science Officer, and Andrew Jarvis, Leader of the Flagship 2 "*Climate Smart Agricultural Practices*", both affiliated with the CGIAR Center 'International Center for Tropical Agriculture' (CIAT). To both we would like to express our sincere gratitude for supporting our harvesting efforts; and we extend our thanks also to several other CCAFS members, e.g. Hector Tobon and David Abreu, CIAT, who provided hints and screened CCAFS databases for useful information.

Indispensable was the cooperation we received from the 45 respondents to our online survey and the informants who were prepared to engage in Skype and/or email interviews including Amber Wright, Benjamin Ford, Charles Kigen, Danni Guo, Deissy Martínez Baron, Hannes Dempewolf, Husam El Algamy, Jason Samson, Ji Changyuan, Johny Rodríguez, José I. Barredo, Joyce Turk, Juan Cruz Colazo, Kindie Tesfaye, Liliana Paz, Luis Ortega Fernandez, Michael Jennings, Ousmane Ndiaye, Paul Wagstaff, Peter Jones, Prabhat Ojasvi, Rocío Ponce-Reyes, Roger Stern, Ronnie Vernooy, Samiha Ouda, Samuel Bacon, Uttam Shrestha; this evaluation would not have been possible without their contributions!

We appreciate especially the time invested by regional contacts supporting two detailed 'Climate Analogues' case studies: the 'Farms of the Future Africa' contribution was coordinated by Osana Bonilla-Findji (CCAFS/CIAT) who engaged with the East Africa team (Phillip Kimeli, Mary Nyasimi, Maren Radeny, Catherine Mungai, John Recha from CCAFS and the CGIAR Center International Livestock Research Institute, ILRI); and the West Africa team (Mathieu Ouedraogo, ILRI, Abdoulaye S. Moussa, CIAT). The 'Seeds for Needs India' informants were from the CGIAR Center Bioversity International and included Prem Mathur, Sarika Mittra, Arnab Gupta, Neeraj Sharma, and Sonal Dsouza. Their collaboration was hugely valuable and crucial to this evaluation.

Finally, we would like to thank Andrew Challinor, Professor of Climate Impacts at the University of Leeds, for an inspiring interview on the potential role and contribution of CCAFS and its climate products in today's climate change adaptation and mitigation landscape.

The external evaluators are solely responsible for the synthesis, analysis and interpretation of the outcomes data collected during this evaluation and for the development of this report. Their role was to ensure that the evaluation was a systematic, data-based inquiry resulting in a report that answers the evaluation questions and is as useful as possible for its primary intended users. Drafts of the report were submitted to the CCAFS core evaluation team who provided comments that were considered before submission of this final version. We highly value the close and intensive cooperation with Philip Thornton and Laura Cramer, which was essential for us to derive the evidence for this evaluation and develop our understanding of CCAFS and the contribution of their climate products to their goal: to catalyze positive change towards climate-smart agriculture, food systems and landscapes.

Acronyms

ACIAR	Australian Centre for International Agricultural Research
ANACIM	Agence nationale de l'aviation civile et de la météorologie, Senegal
ASA	Action for Social Advancement, India
Ashok	Ashok Sansthan, India
BHU	Banaras Hindu University, Varanasi, Uttar Pradesh, India
BRACED	'Building Resilience and Adaptation to Climate Extremes and Disasters' (DFID)
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
CC	Climate Change
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CGIAR	formerly the Consultative Group for International Agricultural Research
CIAT	International Center for Tropical Agriculture, Cali, Colombia, CGIAR Center
CIMMYT	International Maize and Wheat Improvement Center, CGIAR Center
CPT	Climate Predictability Tool
CRP	CGIAR Research Center
CS	Crowdsourcing trials
CSA	Climate smart agriculture
CSIR/SARI	Savanna Agricultural Research Institute, one of the 13 Research Institutes under the Council for Scientific and Industrial Research
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSO	Civil Society Organization
CSV	Climate Smart Village
DFID	Department for International Development
DRI	Deendayal Research Institute, India
DWR	Directorate of Wheat Research, ICAR, India
EC	European Commission
EQ	Evaluation question
FotF	Farms of the Future
GBIF	Global Biodiversity Information Facility
GCM	General Circulation Model
GIS	Geographic Information Systems
HPPI	Humana People to People, India
IARI	Indian Agricultural Research Institute
ICAR	Indian Institute of Soil and Water Conservation
ICRAF	World Agroforestry Centre, CGIAR Center
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, CGIAR Center
IDO	Intermediary Development Outcome
IER	Institut d'Economie Rurale, Mali
IFAD	International Fund for Agricultural Development
ILRI	International Livestock Research Institute, CGIAR Center
INERA	Institut de l'Environnement et Recherches Agricoles, Burkina Faso
INGO	International non-governmental organization
INRAN	Institut National de la Recherche Agronomique du Niger
INTA	Instituto Nacional de Tecnología Agropecuaria
IP	Impact Pathway
IPCC-AR5	5th Assessment Report of the International Panel of Climate Change
IPG	International Public Goods
IP-OH	Impact-Pathway related Outcome Harvesting, using also elements from Contribution Analysis, a methodology developed for this evaluation

IRI	International Research Institute for Climate and Society
ISRA	Institut Sénégalais de Recherches Agricoles
KALRO	Kenya Agricultural & Livestock Research Organization
KVK	Krishi Vigyan Kendra
MEL	Monitoring, evaluation and learning
NARC	Nepal Agricultural Research Council
NARES	National Agricultural Research and Extension Services
NBPGR	National Bureau of Plant Genetic Resources, ICAR, India
NEFORD	The Nand Educational Foundation for Rural Development, India
NGO	Non-governmental organization
NMS	National Meteorological Services
NRI	Natural Resources Institute of the University of Greenwich, UK
ODK	Open Data Kit
OECD-DAC	Development Assistance Committee' of the 'Organisation for Economic Cooperation and Development'
OH	Outcome Harvesting
OM	Outcome Mapping
P&R	CCAFS planning and reporting
PAU	Punjab Agricultural University, Ludhiana, Punjab, India
PGR	Plant genetic resrources
PMKSY	The Indian national program 'Pradhan Mantri Krishi Sinchayee Yojana'
PVS	Participatory Varietal Selection trials
R&D	Research and development
R4D	Research for Development
S4N	Seeds for Needs
SANBI	South African National Biodiversity Institute
SLO	System Level Outcomes
SMART outcomes	Outcomes described in a specific, measurable, achieved, relevant, and timely way
SoL	Seeds of Life, Timor-Leste
SRES	Special Report on Emissions Scenarios
SRF Phase II	CGIAR Strategy and Results Framework (2016-2030)
Sub-IDO	Sub-Intermediate Development Outcome
SWERI	Soil, Water and Environment Research Institute, Egypt
ToC	Theory of Change
UK	United Kingdom
UN	United Nations
UNFCCC	United Nations Framework on Conventions Climate Change
USA	United States of America
USAID	United States Agency for International Development

Important terms (see Volume 4)

Term	Description
Theory of Change (ToC)	Presents a hypothetical identification of the ways by which change is expected to occur from output to outcome and impact along an impact pathway. The ToC questions the assumptions about causality underlying the relationships between outputs, outcomes and impact. In TOC the assumptions present the mechanisms of change (from CGIAR MARLO glossary).
Impact Pathway (IP)	The causal pathway for a research project or program that outlines the expected sequence to achieve desired objectives beginning with inputs, moving through activities and outputs, and culminating in outcomes and impacts. Assumptions underpinning the causal chain and feed-back loops are usually included (from CGIAR MARLO glossary)
Outcome area	An area or theme where thematically related outcomes are harvested (e.g. within a specific program or project)
Outcome leads	Brief statements describing CCAFS results that potentially can be turned into SMART outcomes, but where specific, verifiable, plausible information is still missing.
Upstream outcome	Outcomes that are more activity/output-near, i.e. occur 'earlier' in the impact pathway and/or are more directly influenced by CCAFS' research products.
Downstream outcomes	Outcomes that are more impact-near, i.e. occur 'later' in the impact pathway and/or are indirectly influenced by CCAFS' research products (e.g. through other outcomes in the causal chain).
SMART outcome	Observable changes in the behavior, relationships, activities and actions of individuals, groups, organizations or institutions that were influenced in a small or large way, directly or indirectly, intentionally or not by actors producing or using research outputs based on CCAFS' climate data/tools. The descriptions need to be SMART: Specific (formulated in sufficient detail), Measurable (providing objective, verifiable quantitative and qualitative information), Achieved (establishing a plausible relationship between the outcome and contribution), Relevant (presenting a significant step towards the impact that is strived for), Timely (emerging within the time period being evaluated).
Umbrella outcome	A generalized outcome summarizing several SMART outcomes that were clustered by similar type of societal actor and change.
Development outcomes	Stakeholders doing something differently with respect to CC-related knowledge, attitude, capacity, relationships, policy or practice, being (partly) influenced by evidence generated with the help of CCAFS' climate data/tools; e.g. observed and/or documented changes in skills or in programming, investment, management, policy or agricultural practice relating to CC adaptation or mitigation; rather than the uptake of CCAFS' climate data/tools by researchers to produce evidence or improve the tools and methods needed.
Immediate level	Behavioral changes in stakeholders concerning their financial or in-kind support of research output delivery, their level of awareness or institutional/personal capacity, or their training or advocacy strategy with respect to CC and CCAFS climate products.
Intermediate level	Stakeholders using information influenced by CCAFS data/tools to take investment decisions, design, and/or implement new policies, plans and strategies furthering CCAFS goals with respect to CC adaptation and mitigation.
Ultimate level	Behavioral changes in the lives of beneficiaries contributing to the three SLOs (reducing poverty; improving food and nutrition security; improving natural resources and ecosystem services) that were influenced at some stage and to some extent by activities, outputs and/or outcomes involving CCAFS data/tools.
Key game changers (societal actors)	The target audiences, i.e. the individuals, groups, organizations, institutions, who did something differently (partly) influenced by the activities, research outputs or outcomes of interventions to which CCAFS' climate data/tools contributed to.
Contributor (change agents)	Individuals, groups of individuals or organizations who influenced in a small or large way the behavioral changes of the key game changers.
Primary next-user	Researchers using CCAFS' climate data/tools directly in their work to generate evidence or adapt the tools to better fit project needs.
Secondary next-user	Development partners using evidence generated by others with the help of CCAFS' climate products, creating an environment enabling CC adaptation or mitigation.
End-user	The beneficiary population, usually quite massive, making it unfeasible for a project or program to work with them directly (Westermann et al., 2015).

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Executive Summary

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) integrates climate change (CC) research across all CGIAR Research Centers and Research Programs. Part of CCAFS' delivery promise is the development of International Public Goods (IPGs) including high quality, accessibly, easy to use climate data and tools. In 2016/17, CCAFS has commissioned the present evaluation on the development effectiveness of three selected CCAFS climate data/tools (Box A).

We used mainly Outcome Harvesting (OH, Wilson-Grau & Britt, 2013) and for one particular outcome area also elements from Impact Pathways thinking (Douthwaite *et al*., 2008) and Contribution Analysis (Mayne, 2008) to describe and analyze development outcomes that were directly or indirectly influenced by one or more of the three CCAFS' climate products (Box B).

Three evaluation questions were addressed:

1: Are there emergent outcomes informed by CCAFS climate data/tools?

The outcome harvest resulted in eight GCM Climate Portal and six Climate Analogues outcomes complying with the criteria agreed in this study. In addition, 18 Climate Analogues outcomes were harvested through the Impact Pathway-OH assessment of the 'Seeds for Needs India' program. This constitutes evidence that development outcomes linked to these two CCAFS climate products – as we defined them in this evaluation – emerged during the evaluation period 2010-2016. That our considerable harvesting efforts resulted in relatively few GCM Climate Portal and Climate Analogues and no MarkSimGCM development outcomes is not necessarily an indication of their limited development effectiveness. There are explanations beyond the purpose, usability and quality of the tools including structural factors concerning CCAFS' knowledge bases and network and a need for sensitizing CCAFS members to recognizing also the upstream ('output-near') outcomes in the impact pathway of projects, where CCAFS' tools often play a more direct role, so that these will be reported as results and monitored.

2: What types of outcomes are influenced by CCAFS' climate data/tools?

Changes were observed in various societal actors, next-users of CCAFS' climate products such as funders, NGOs, INGOs, national governments and government agencies, and end-users such as farmers and communities, benefitting indirectly from the climate products. They occurred on all levels of the impact pathways of the interventions, i.e. there were immediate, intermediate and ultimate level outcomes.

3: How do CCAFS' climate products contribute to outcomes?

The emergence of development outcomes linked to CCAFS' climate products involves a range of different contributors (including academia, national research agencies, NGOs), who often work together to achieve results; this can take place independently from CCAFS' support. We identified five categories of different uses of the climate products all in line with CCAFS' goals, but specific uses could go beyond CCAFS' primary objectives, and intended uses could lead to unintended results. Apart from the primary

Box A: Assessed CCAFS products

- *GCM Climate Portal housing global datasets of climate change projections for climate change impact assessment, downscaled from several methodologies;*
- *MarkSimGCM simulating daily weather data specifically designed for use in the tropics, including rainfall, maximum and minimum temperatures and solar radiation;*
- *Climate Analogues tool, allowing researchers to identify, connect and map sites with statistically similar climates across space and time.*

Box B: The data

>100 outcome leads, details and use of tools often unclear

45 survey cases analyzed in terms of usage of tools (Volume 2)

30 cases researched further via Skype/email for which use of the tools was confirmed (Section 4)

14 of these developed into SMART outcomes with descriptions of outcome, contribution, significance of outcome, and importance of contribution (c. 1 page each, Annex 9.2, Volume 3)

1 of the 14 cases extended into a comprehensive outcome story ('Farms of the Future Africa', c. 7 pages) (Section 5.4.1)

1 outcome researched further through Impact Pathway-related Outcomes Harvesting resulting in an additional 18 SMART outcomes ('Seeds for Needs India', Section 5.4.2)

functions of the tools (i.e., provide climate projections), they have also secondary functions (e.g. as a learning or engagement tool). CCAFS' climate data sometimes were only one piece of information among a bouquet of other research approaches and data, but users seemed to appreciate these as an essential contribution to their work. Frequently, additional strategies such as engaging the right stakeholders, capacity building and advocacy were employed enabling the uptake of the research outputs.

Conclusions on effectiveness, relevance and sustainability

The results of this study suggest that CCAFS' climate products – the GCM Climate Portal and the Climate Analogues tool – are effective in contributing to development outcomes. Mapping the outcomes assessed here onto CCAFS objectives for Phase II showed that they are relevant to CCAFS' planned contribution to CGIAR's overall goals. The outcomes occurred on different stages of their respective impact pathways and on each level there were some indications of post-funding sustainability. Still, CCAFS may benefit from exploring how both research uptake and sustainability of changes can be increased through implementation of enhanced facilitative strategies by CCAFS and others.

Recommended strategic considerations

1. We provide discussion points on the **value added of investment** into the development and maintenance of climate products while donors put forth an increasing demand on delivering towards development outcomes.
2. We discuss how CCAFS can further **sharpen its niche and comparative advantage** as climate data/tool provider and highlight three dimensions, each presenting a gradient of choice along which respective decisions can be taken: i) promoting a wide-spread / narrow targeted use of the tools; ii) engaging in grass roots / policy level work; iii) investing in network purpose functions (e.g. supporting programs) / and form (e.g. monitoring of outcomes).

Opportunities

The above strategic decisions will require some maneuvering to determine the best options within CGIAR's complex set up and multi-dimensional context. Yet, CCAFS also has many opportunities with a range of quick wins to immediately improve on some of the areas identified in this study that will set it up well for a successful Phase II:

1. **Developing impact pathways specifically for the climate products** to describe their strategic logic and their contribution towards CCAFS' overall program Theory of Change can help to derive a more explicit definition of their added value and will inform the strategic considerations above.
2. **Emphasizing an informed, strategic selection process for partnerships will strengthen CCAFS climate product development, maintenance and support, as well as the uptake and implementation of research outputs; this process can be** based, e.g., on the specific tool impact pathways and using methods such as network analysis to determine the best mix of collaborators.
3. **Putting together a strategic marketing mix** will support the dissemination and communication of the **climate** products, e.g. i) improving the Tools, maps, models and data website; ii) integrating a forum functionality to facilitate knowledge exchange; iii) enhancing dissemination via partners.
4. **Honing operationalization of CCAFS' outcome-focused, results-based Monitoring and Evaluation**, capturing in a more systematic way where and how CCAFS' climate products contribute to outcomes, will allow a better targeting of projects and a more informed Value for Money discussion, e.g. i) strengthening CCAFS' knowledge base for tracing climate product use and effectiveness; ii) enhancing network members' Monitoring and Evaluation capacity, sensitizing them to recognize immediate and intermediate outcomes; iii) tracing outcomes from climate tools in non-CCAFS funded projects (wide spread uptake).

1. Introduction

CCAFS' role in CGIAR

The effects of climate change (CC) – global warming, climate variability and extreme weathers – present a major challenge to humanity. They threaten particularly the poorest people, living in vulnerable areas with few resources, where an increase in temperature and an increase in frequency of droughts and floods can cause dramatic crop and livestock production losses.

> **Box 1: CCAFS' goal**
>
> *The overall goal of CCAFS is to catalyze positive change towards climate-smart agriculture, food systems and landscapes. CCAFS takes its mandate from the CGIAR vision: "a world free of poverty, hunger and environmental degradation".*
>
> *CCAFS Phase II proposal, 2016 (Executive Summary)*

CGIAR – the global partnership of funders and international agricultural research centers – is committed to devoting at least 60% of its work to research and development activities that focus on CC adaptation and mitigation and increased resilience to climate shocks, as stated in CGIAR's new Strategy and Results Framework for 2016-2030.

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a collaboration among all 15 CGIAR Research Centers and integrates CC research across all CGIAR Research Programs and Centers, who all have their stakes in this program and contribute considerable CC expertise and activities (Box 1). The program is led by the International Center for Tropical Agriculture (CIAT) and governed by a range of bodies, each playing a specific role.

CCAFS in transition to Phase II

CCAFS Phase I began in 2011 and ran up to 2014. While the work in the early years of Phase I was more opportunistic and not fully aligned with an overall strategic framework, the subsequent Extension Phase 2015/16 brought a transition to a structured framework focused around 'Research Flagships' and a results-based management approach to planning, reporting and evaluation. Inspired by Theory of Change (ToC) thinking, CCAFS has developed a series of Impact Pathways that link research activities and outputs to the desired outcomes and impacts on people's well-being, up to the global level of the Sustainable Development Goals. Yet, to follow CCAFS contribution towards development outcomes is a challenging task as CCAFS' work is undertaken by many partners within a wide-ranging network. This includes research partners such as universities and governmental institutions, development partners from the public sector and inter-governmental partners, as well as national and international non-governmental partners (NGOs, INGOs). To date, CCAFS has engaged and co-funded collaborative work with more than 1000 partner organizations worldwide, bringing together the expertise of researchers in agricultural, climate, environmental and social sciences to explore new ways of helping vulnerable rural communities adjust agricultural practices in the context of global warming, climate variability and increased risks of extreme weathers such as floods and droughts.

Evaluation context, purpose and focus

CCAFS mandate is to develop innovative research for development (R4D) outputs and use these to achieve outcomes in collaboration with its various partners; up to date it has been successfully producing a wealth of data, tools, models and approaches. In 2014/2015, during CCAFS' transition to a more outcomes-focused culture, an evaluation team from TANGO International was commissioned to assess who is using CCAFS' research outputs where and for which purposes (usage of outputs), and to evaluate how far CCAFS' activities and outputs have changed the behavior of direct or indirect users of CCAFS data in terms of outcomes in knowledge, attitude or practice (see TANGO evaluation report). Nine very different types of tools ranging from published papers and approaches to climate projection data/tools were assessed. However, while the study provided an overview on the geographic and thematic dimensions of the use of these products, it failed to produce specific evidence (case studies or outcome stories) of how this influenced the behavior of various user groups.

Therefore, in 2016, the present evaluation was commissioned on the development effectiveness of CCAFS research outputs, this time with a stronger lens on outcomes and the particular contribution of three selected CCAFS climate data/tools, namely:

i) GCM Climate Portal, an online platform providing access to high resolution statistically downscaled future climate surfaces which was published by CIAT/CCAFS in 2008 (Ramirez & Jarvis, 2008; tool website). The portal offers researchers worldwide easy access to actualized climate information for projects in agro-climatology, crop modeling and ecology aiming to increase understanding of CC effects in agriculture. The data correspond to the 'Intergovernmental Panel on Climate Change' (IPCC) Fifth Assessment Report and can be used for applications such as assessing ecosystem functioning, options for policy-making, and food security and adaptation planning.

ii) MarkSimGCM, a stochastic weather generating tool published in 2013 by Waen Associates and CCAFS (Jones & Thornton, 2013; tool website), which can be accessed directly or via the GCM Climate Portal. The tool has a visual interface based on Google Earth satellite imagery and maps: clicking on the map, it generates future daily weather data for a specific location anywhere in the world that can be used for crop, livestock and natural resource modeling and risk assessment. Feeding directly into the Decision Support System for Agrotechnology Transfer (DSSAT), MarkSimGCM outputs can also be used to set up different simulations and evaluate the risks of growing specific crop varieties (e.g. including biophysical parameters such as soil composition, structure, moisture). The 2013 version builds on an older application (Jones & Thornton, 2000, Jones *et al.* 2002), including now data from a total of 17 individual climate models that were part of IPCC' Fifth Assessment Report (CMIP5); the user can select just one or any combination of these 17 models.

iii) Climate Analogues tool, using one or more global climate models to project future (or current) climate (temperature and rainfall) predictions for a particular site and locate where else in the world one could find a comparable current (or future) climate. Based on Climate Analogues data, farmers, researchers and policy makers can explore their own adaptation options, or use historical data from other sites to learn how communities there have adapted – or have failed to adapt – to CC over time. Also, the tool can help identify crop traits and varieties that will be needed in specific locations with particular climatic conditions, or where to collect genetic resources that are endangered due to CC risks. Commissioned by CCAFS, the Climate Analogue methodology and broad application concept was jointly developed by CIAT, the Walker Institute at the University of Reading, UK, and the Climate Impacts Group at the University of Leeds, UK, and was published in 2011 (Ramírez-Villegas *et al.*, 2011). CCAFS provides two tools to apply the Climate Analogues approach: i) the Climate Analogues online tool as a user-friendly and readily accessible platform that will facilitate quick identification of likely analogue sites; and ii) the Climate Analogues R-package, which allows a more detailed analysis to be performed with the potential introduction of user defined data and improved uncertainty quantification.

In this study we evaluate i) whether the use of the three climate products above has influenced stakeholders to do things differently in relation to decisions in, e.g., research agendas, capacity development, investment, programming, and policy formation; if so, ii) what changes in knowledge, attitude, capacity, relationships, policy or practice were observed, and iii) how and to what extent CCAFS outputs or activities involving the three products contributed to such outcomes. In doing so we hope to explore if and how CCAFS' climate products offer an added value provision supporting a successful implementation of its Phase II 2017-2020 program.

2. Evaluation design

This outcome evaluation was designed in close collaboration with CCAFS' internal evaluation focal points: Philip Thornton, leader of CCAFS' Flagship 1 "*Institutions and Policies for Climate-Resilient Food Systems*" and Laura Cramer, CCAFS Science Officer for Flagship 1, both affiliated with the 'International Livestock Research Institute' (ILRI, a CGIAR Center). Over the first three months of the evaluation, the design was adjusted in an adaptive management approach in response to the initial results, as is normal for the principle method chosen here: 'Outcome Harvesting' (OH, Wilson-Grau & Britt, 2013). OH consists normally of six steps, the first comprising the evaluation design, components of which are discussed in this section; the other OH steps and their adaptation for this study are described in Section 3.

2.1. Users and uses of the evaluation

The evaluation followed a utilization focused approach (Patton, 2008) where the external evaluating team aimed to facilitate a very participatory process engaging the intended users of the evaluation at CCAFS in its design and decision making in order to increase usefulness and ownership of the results of this work. OH is a utilization-focused, highly participatory tool that enabled the external evaluators to work very closely with CCAFS informants and particularly the **three primary user groups of the evaluation** defined during the design phase.

CCAFS' internal evaluation team consisted of Philip Thornton and Laura Cramer, supported by Osana Bonilla-Findji, Science Officer, and Andrew Jarvis, Leader of the Flagship 2 "*Climate Smart Agricultural Practices*" affiliated with the 'International Center for Tropical Agriculture' (CIAT, CGIAR Center). Hence, representatives of two primary user groups were directly involved in the evaluation process: the CCAFS Program Management Committee with Theme Leaders and Regional Program Leaders; and the Lead Center, CIAT. The third primary user group, the Program Director and Coordinating Unit, did not participate directly in the evaluation management but was updated on the progress of the evaluation. Together, the internal and external evaluation management team identified **six primary uses** of the evaluation (Box 2.1).

Box 2.1: Primary uses of the evaluation

1. *Promote engagement, self-reflection and sharing of good practice across CCAFS / CGIAR*
2. *Inform strategy development and decision making*
3. *Provide a body of evidence for accountability*
4. *Build relationships with funders for resource mobilization*
5. *Promote CCAFS and its data platforms to various stakeholder groups for strategic partnerships*
6. *Inform future Monitoring, Evaluation and Learning (MEL) of CGIAR Research Program*

2.2. Objectives of the evaluation

As indicated in the above section, there was a strong emphasis on learning in this evaluation which was commissioned by CCAFS' itself. An evaluation is always a learning experience and the evaluation process can be as insightful as are the findings and conclusions drawn from the actual data collected. On the one hand the work can shed light on the supporting structures and dynamics of the organization or program under study; on the other hand there will be lessons concerning the evaluation methodology – what worked well and what did not in this particular context – which is especially useful when new approaches are explored for potential future use in the monitoring, evaluation and learning (MEL) system of the organization/program. Here, a learning component was specifically included in the agreed objectives of the evaluation:

1. **Describe a number of outcomes** that the three CCAFS climate data and tools have influenced in specific CCAFS climate data/tool user groups over the evaluation period; and how CCAFS outputs or activities have contributed to these;

2. Use the described outcomes to **assess independently** to what extent CCAFS tools and information have influenced CCAFS' user groups to do things differently in relation to climate related research agendas and policy and practice changes in the context of poverty or food security;
3. Serve as a **learning experience**, leading to i) a deeper and shared understanding of the contribution of CCAFS data and tools to the outcome delivery of CCAFS as a program; ii) outcomes data and lessons learned for better informed decisions and improved future programming; iii) enhanced participation, sharing of good practice and ownership within CCAFS and its partners; and iv) increased CCAFS' in-house understanding and competence in OH and insights if and how components of the approach may be helpful for CCAFS' future MEL.

2.3. Evaluation questions

The evaluation question posed in the Terms of Reference (Annex 9.1) consisted of three parts (see Box 2.3), which were specified in more detail during the design phase.

Box 2.3: Evaluation Question

***Part 1**: To what extent do CCAFS climate data/tools influence CCAFS' user groups to do things differently in relation to research agendas and investment decisions (or other like environmental programming, capacity development and policy formation);*

***Part 2:** What behavioral changes in knowledge, attitude, skills, relationships, policy or practice were observed;*

***Part 3**: How and to what extent have CCAFS outputs or activities climate data/tools contributed to such outcomes.*

To address **Part 1,** the evaluation would aim to identify '**development outcomes'**, i.e. results such as stakeholders being influenced by evidence generated with the help of CCAFS' climate data/tools resulting in observable changes in their knowledge, attitude, capacity, programming, policy or practice; rather than cases where the climate products were used by researchers to generate such evidence or improve the tools and methods needed (Volume 4). The idea was to harvest outcomes along the causal chains or impact pathways of results and as far downstream as possible while still being able to establish a plausible connection between the use of CCAFS' climate data/tools and the achievement of results.

If we were able to identify such development outcomes, **Part 2 of the evaluation question** would involve exploring what type of societal actors were concerned, how exactly they had changed, and what was notable about the nature of these changes. The different aspects of this part of the Evaluation Question were:

- Where in the impact pathway from upstream (i.e. output-near) to more downstream (i.e. impact-near) results would changes influenced by CCAFS climate data/tools emerge; e.g. were there predominantly 'early' changes such as the use of research results to influence development partners such as NGOs or extension systems? And/or could we also detect downstream changes such as farmers changing their farming technologies to adapt to CC influenced by climate data/tools?
- Could we detect patterns in the outcomes, e.g. were there more/different changes observed in specific target audiences; and/or in different regions where CCAFS was active; or did the pattern of outcomes have a time dimension to it?

Finally, for **Part 3** we intended to examine in detail how CCAFS climate data/tools contributed to the observed changes, and which value they added to CCAFS work. In detail we looked at:

- Which change agents contributed to the emergence of the observed outcomes, and what exactly did they do to bring about the change?
- How important was the contribution of the change agents to the emergence of the outcomes? For example, what role did CCAFS' climate products play compared to other contributions (of CCAFS or other players) for a specific outcome to be achieved?

- In case we could collect a number of outcomes within one program area to which CCAFS climate data/tools had contributed directly or indirectly: where was their contribution most important in the impact pathway and what role did the contribution play for the overall program achievements?

In line with the criteria defined by the 'Development Assistance Committee' of the 'Organisation for Economic Cooperation and Development' (OECD-DAC criteria) this report discusses the harvested outcomes data also using the framework of relevance, effectiveness, and sustainability, but we do not look at impact and efficiency of CCAFS achievements as this would be beyond the scope of this evaluation (Section 5.5).

3. Methodology

3.1. Rational for using Outcome Harvesting, an Outcome Mapping-inspired method

OH is informed by 'Outcome Mapping' (OM, Earl *et al.,* 2001) a framework used in actor-centered planning and assessing of development programming. OM and OH make people the central focus of development, connecting behavioral changes in societal actors on the one hand with outputs and activities of the program or intervention on the other to help understand and assign credit for the outcomes to which they contribute. OM and OH recognize that impact is the ultimate goal towards which a development intervention works, however, the complexity and long-term nature of the development process often makes it extremely difficult to link impacts to a specific intervention. In addition, a focus on impact may not provide the kind of information and feedback in the right time and place that an intervention requires to improve its effectiveness during implementation. For these reasons, OM and OH focus on outcomes in the 'sphere of influence' of an intervention (where we can proactively do something about), that will enhance the possibility of development impacts in its 'sphere of interest' (where we hope to have an impact eventually). Within the 'sphere of influence', OM and OH are **powerful approaches in unpacking outcomes at various stages of the impact pathway** – from the more basic immediate results to those further downstream and potentially more transformative – and can thus help to unfold and/or test the program's ToC. The full implementation of the OM framework can be quite cumbersome and is not always necessary, but users find the approach beneficial when adapted and simplified (Smith *et al.,* 2012), as was also concluded in a study done for a R4D project of the CGIAR Center WorldFish in 2010 (Sheriff & Schuetz, 2010).

Building on the above principles of OM, OH offers a very systematic and methodological approach to collecting ('harvesting') behavioral outcomes as evidence of what has changed and, working backwards, determining whether and how an intervention contributed to these changes. Like OM, OH is a flexible approach that needs adaptation to the respective context and can require mixing with other methodologies. It usually involves **an intensive and interactive design and a very participatory data collection phase**; the method is therefore great for organizational learning. In fact, a **participatory learning culture** of the program or organization under study may be an important enabling factor for the successful implementation of this approach, just like in OM (Smith *et al.,* 2012).

3.2. Definitions, scope and criteria for selecting 'development outcomes'

In this section we define the term 'outcome' as used in this evaluation and how it relates to that of CCAFS, and several other key terms relevant to this study; we then explain which criteria guided the outcome harvest.

3.2.1. Outcome definition and terminology

Since the beginning of CCAFS' Phase 1 in 2011 and particularly during the Extension Phase 2015/2016 and planning for Phase II starting in 2017, there has been a significant shift from focusing on research outputs towards aiming to achieve development outcomes. In order to better understand, capture and analyze the factors that enable progress towards such development outcomes, CCAFS developed a guide (Schuetz *et al.*, 2014) to help their Flagship and regional teams, and project partners to unpack and review the outcomes along CCAFS' impact pathways, with a quite generic outcome definition:

> *"Outcomes are changes in next-user behavior, i.e. knowledge, attitude, skills and practices."*

Box 3.2.1a: Definitions

Development outcomes: *Stakeholders doing something differently with respect to CC-related knowledge, attitude, capacity, relationships, policy or practice, being (partly) influenced by evidence generated with the help of CCAFS' climate data/tools; rather than the uptake of CCAFS' climate data/tools by researchers to produce evidence or improve the tools and methods needed.*

Contributor / change agent*: Stakeholders who produce or repackage climate evidence through CCAFS tools or develop improved tool,, but can also be non-research partners contributing to outputs or outcomes that influence e.g. end-users.*

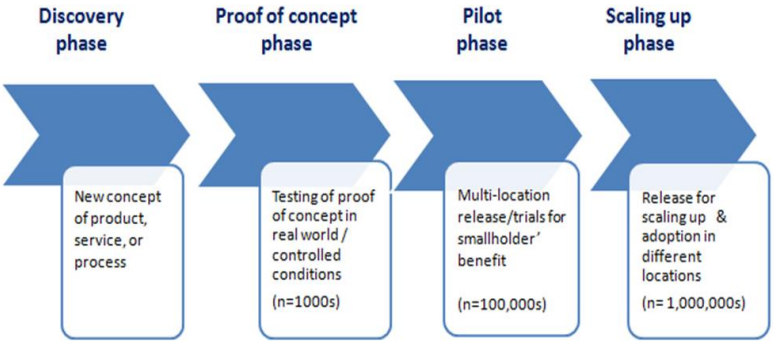
Societal actor / key game changer: *The target audiences, i.e. individuals, groups, organizations, institutions who did something differently being (partly) influenced by the activities, research outputs or outcomes of the interventions CCAFS' climate data/tools contributed to.*

CCAFS defines 'next-users' as those accessing and using CGIAR products directly creating an environment that enables the target impact for 'end-users', i.e. the population benefitting from the research. A more detailed interpretation of what an 'outcome' should imply in the CCAFS' environment was communicated by Bruce Campbell, Program Director of CCAFS, as guidance for project planning and reporting their outcomes (Figure 3.2.1):

> *"An Outcome is use of the research by non-research partners to develop new, or change, policies and practices. In many cases the users of the research will be policy makers (or those influencing the policy process), national development agencies, service providers to farmers including non-governmental agencies, and sometimes farmers themselves. Uptake of the results to design further research work, even if this further work will be conducted by national partners […] may be crucial to achieve an Outcome, but it is then a step towards an Outcome, not an Outcome itself. Or, if you want to call it an Outcome it is too early in the impact pathway to be considered. 200 farmers using a technology in the testing of that technology may be a good/essential accomplishment, but an Outcome is uptake by 1000's of farmers who are not part of the research process."*

For the purpose of this evaluation we allowed a wider range of behavioral changes to qualify as outcomes to analyze results along the complete impact pathway, including output-near ('upstream') outcomes where CCAFS' climate data/tools had a more direct influence on results, and those outcomes further along the impact pathway where the expected influence of the data/tools is less direct and one among many others.

Figure 3.2.1: Different phases in flagship projects from the CGIAR Planning of Work and Budget Template, issued with the guidance to the annual planning of work and budget by the CGIAR System Management Office



We distinguished in a first step among the two stakeholder roles with respect to emerging outcomes: i) the '**contributor' or 'change agent'**, who influenced an individual, group or organization to do something differently, and ii) the '**societal actor' or 'key game changer'** who was influenced to change through the activities or outputs of the contributors. Thus, contributors could comprise both CCAFS and non-CCAFS organizations, research or non-research institutions, and they could work directly with CCAFS climate

tools to produce outputs ('primary users') or use research outputs or information based on them and target their work towards other next- or end-users ('secondary users'). Societal actors, too, included CCAFS partner or non-partner organizations ranging from those employing CCAFS' tools directly e.g. to inform their own strategies and programming ('primary next users'), to 'secondary next-users' such as NGOs or national governments using climate research outputs generated by others e.g. to develop or implement plans, to – ultimately – end-users such as farmers starting or adapting climate smart agriculture (CSA) practices influenced (partly) by interventions to which CCAFS' climate products contributed. In a second step, key game changers and changes, and contributors and contributions were then tagged further according to their relationship to CCAFS, functions, type of change or contribution, and more (Volume 4).

Hence, **'outcomes' in this study comprised the two basic components** defined in OH: a description of i) an observable change in the behavior of an individual, group, organization, institution or community; and ii) what the intervention did that plausibly contributed to the observed behavioral change (Box 3.2.1b). In addition, we included **two further components**: a statement on the significance of the outcome, and one on the importance of the contribution.

Box 3.2.1b: Definition of SMART outcomes (adapted from Wilson-Grau & Britt, 2013)

Observable changes in the behavior, relationships, activities and actions of individuals, groups, organizations or institutions that were influenced in a small or large way, directly or indirectly, intentionally or not by actors producing or using research outputs based on CCAFS' climate data/tools.

*To qualify as an 'outcome' the descriptions need to be **SMART**: **S**pecific (formulated in sufficient detail), **M**easurable (providing objective, verifiable quantitative and qualitative information), **A**chieved (establishing a plausible relationship between the outcome and contribution), **R**elevant (presenting a significant step towards the impact that is strived for), **T**imely (emerging within the time period being evaluated).*

In this evaluation, outcomes consist of 4 components, namely descriptions of i) outcome, ii) contribution, iii) significance of outcome, iv) importance of contribution.

3.2.2. Scope and criteria for selecting and developing SMART outcomes

The outcome harvest was guided, first, by the **SMART criteria** described in Box 3.2.1b. They comprised results emerging during the evaluation period 2010-2016 (CCAFS' Phase I), which were plausibly influenced through one or more of the three tools being assessed: the **GCM Climate Portal, MarkSimGCM, and the Climate Analogues tool**. Further, we aimed to cover a **broad spread** of outcomes with respect to geographic range, types of stakeholders and types of changes observed (Box 3.2.2).

Box 3.2.2: Criteria for selecting SMART outcomes

- *Comply with SMART criteria*
- *Outcomes emerged 2010-2016*
- *Plausible direct or indirect influence of the 3 tools*
- *Broad spread (geographic range, nature of outcome)*
- *Changes classify as 'development outcomes'*
- *Emphasis on results highly ranked by CCAFS*
- *Not too complex*

To classify as a '**development outcome'** and thus to be considered in this evaluation, there had to be an observed change in a key game changer at least partly influenced by information from CCAFS' climate data/tools that either enabled CC related development work (e.g., new funding for CC relevant research or for strategy development and implementation; development of new advocacy strategies; increased awareness of or capacity built in CC adaptation or mitigation); or constituted a policy or practice change (e.g., key game changers engaging or taking decisions in planning or program formation, or implementing new or adapted strategies and plans in CSA or CC mitigation) (Volume 4). The use of CCAFS' climate data/tools by researchers to generate evidence or adapt methods *per se* was not seen as a development outcome;

however, if an organization using the tools then employed the research outputs to e.g. adapt their country strategies or implement a specific CSA project, then the case would qualify.

Emphasis was also put on outcome cases that had been **evaluated in annual assessments and rated highly** by the CCAFS Program Director (Section 3.3.1); the assumption was that we could trace back the contribution story from some of these observed significant downstream outcomes to where in the results chain the CCAFS' climate products had played a role.

Finally, we had to **exclude** a number of these highly ranked outcomes particularly from the policy field although an influence of CCAFS' climate data/tools seemed likely; they appeared to be **too complex** and thus it would have been too time and resource intensive to establish the specific, plausible connections between outcomes and contributions and trace back exactly how CCAFS' climate data/tools influenced their emergence. These cases included, e.g., the development of the 5th Assessment Report of the IPCC (IPCC-AR5) which featured CCAFS' research prominently; the post-2015 UNFCCC agreement announced in Paris in December 2015 which was proposed to be influenced by CCAFS' work in that it did not exclude agriculture and food security was given prominence; and the 'International Treaty on Plant Genetic Resources for Food and Agriculture' which may have been partly influenced by outcomes to which CCAFS' Climate Analogues tool contributed. However, there would have been too many stakeholders contributing and being influenced in these outcome areas. These cases would call for a separate in-depth evaluation of potential key game changers, contributing actors and factors and resulting outcome chains.

3.3. Harvesting and analyzing SMART outcomes

The standard OH approach comprises six steps. Step 1 concerns the evaluation design, elements of which were presented in the previous sections. This section explains how we adapted Steps 2-6 in order to meet the needs of this evaluation, the sources we used, the type of data we collected, how successful the outcome harvest was, and how we analyzed and interpreted the results.

3.3.1. Harvesting 'outcome leads' from documents and internal informants (OH Step 2)

In Step 2 of the OH approach the external evaluators normally harvest SMART outcomes from documents. In this study we researched a comprehensive catalogue of internal secondary sources including the knowledge base on the CCAFS website; project, training, workshop reports; the annual CCAFS outcome assessments provided by the Program Director for the years 2013, 2014, 2015; and external sources searching the web for published reports or scientific papers where CCAFS' climate data/tools were cited[1]. The 2014 TANGO evaluation report was also included as a harvesting source, yet, it mentioned only a few cases of policy/programming/investment changes (e.g. on p. 55), without providing any details or contact info. In addition, we followed up suggestions from CCAFS members where to look for potential outcomes and who to contact in CCAFS' vast network.

Unlike the standard OH harvesting Step 2, we did not invest time in extracting and describing SMART outcomes from the documents because i) for many cases it was not clear which, if any, CCAFS' climate data/tools had been used, and ii) the written sources rarely provided sufficient detail to formulate a verifiable outcome and contribution statement (Section 3.3.4). Instead, we decided to gather so called '**outcome leads'**, i.e. brief statements describing results that we thought had the potential for development outcomes but there was too much information missing to know for sure. In a second step, we would then follow up on these in interviews and formulate

Box 3.3.1: More than 100 outcome leads

Class A: Highly ranked outcomes, but tool unclear
Class B: Use of tool confirmed, but outcome unclear
Class C: Interesting but neither tool nor outcome clear

⇨ ***25 selected for further follow up***

[1] Researched secondary sources were compiled and provided to CCAFS in a shared Dropbox folder.

SMART outcomes if the change could be confirmed and linked to one of CCAFS' climate tools. In total, we harvested more than 100 of these outcome leads, which fell into three main classes (Box 3.3.1):

- Class A: comprising the highly ranked outcomes that had been assessed by the Program Director with Score 4 or 5 (Excellent/Relatively good) where it was evident that climate information was involved, though it was often unclear if CCAFS' climate data/tools had been used;
- Class B: cases where the use of one of the focus tools was unambiguous and where we saw a potential for development outcomes, but such changes were not sufficiently documented;
- Class C: cases where neither the tool nor the emergence of outcomes was clear, but that seemed nevertheless interesting.

In the end, about 25 of these leads were selected for further research, including five Class A cases which were selected together with the CCAFS evaluation management team.

3.3.2. Harvesting outcome leads through a survey to CCAFS' data/tool users

To improve prospects of finding SMART outcomes, we built on the work of the 2014 TANGO evaluation and used their respondents list plus a number of additional contacts to launch a survey to climate data/tool users. The purpose was to explore in more detail – building on the TANGO survey - whether CCAFS' climate products had potentially influenced any development outcomes and how the tools had contributed to these. A SurveyMonkey questionnaire was sent to 260 contacts and we obtained **45 useful replies** where one or more of the CCAFS' tools had been employed. For the detailed survey methodology and results see Volume 2 of the evaluation report.

Of these 45 survey responses, 11 had no or too unspecific information on a specific case of usage, or the researchers indicated that there will not be any outcomes from their work. In 19 cases information on specific and interesting projects was provided but there were not yet any outcomes emerging. These **19 cases represent potential outcome leads for later assessments**. In 15 cases the responses suggested interesting results and these were followed up further and developed into SMART outcomes where possible. One additional case was included in the follow-up research, where the respondent specified that the target audiences were not responsive to the research outputs and we were curious to explore the reasons for this. Thus, in total **16 cases from the survey were researched further**.

Box 3.3.2: Survey results

45 survey responses analyzed with respect to users and uses of tools (Report Volume 2)

⇨ ***16 selected for further follow up***

3.3.3. Researching and developing SMART outcomes (OH Step 3)

With about 25 outcome leads selected from the document review or following suggestions by CCAFS sources and an additional 16 cases from the survey we had **more than 40 leads to follow up intensively via email or Skype interviews**. For some of these, research either did not result in sufficient and/or conclusive information or revealed that the tools had not actually been used after all. These cases were discarded. This included four of the five Class A cases; in three cases, we could not plausibly establish that any of the climate data/tools had been used:

- A14[2]: "Climate change adaptation strategy adopted by Ethiopian government" (Assessment 2013, Score 4/"Relatively good")
- A24: "Colombia: FEDEAAROZ incorporates climate information in farm extension systems" (Assessment 2014/Score 4/"Relatively good)
- A04: "Mobilizing African meteorological institutions to serve the needs of smallholder farmers" (Assessment 2013, Score 5/"Excellent")

[2] Numbering refers to case numbers in the CCAFS' climate data/tool outcome Excel database

In one case, informants confirmed that they had used the GCM Climate Portal initially, but then switched to another tool (CORDEX):

- A02 "Scaling up seasonal forecasts to 3 million users in Senegal" (Assessment 2013, Score 5/Excellent) and "The impact of climate information services in Senegal" (Assessment 2015, Score 4.6/Excellent).

Only for one of the researched cases there was a clear link to one of the tools (Climate Analogues):

- A13: "Seeds for Needs: Broadening the genetic base of crops to empower Indian farmers for climate change adaptation" (Assessment 2014/Score "Relatively good/4).

In fact, the '**Seeds for Needs India' (S4N) program** seemed so promising that we selected it to be assessed in more detail through an **'Impact-Pathway-related Outcome Harvesting' approach (IP-OH)** (Section 3.4).

Including the S4N case, in total 11 leads were developed further into **14 SMART outcomes** that complied with the criteria discussed in Section 3.2.1 (one case was split into two, and one into three separate outcomes, according to the respective key game changer). The length of outcome narratives can vary greatly in OH from one-sentence statements to several pages. The harvesting process in this study showed that in-depth research and descriptions were necessary to fully understand and capture the changes and specific role the tools played for their emergence, hence we decided on narratives that were at least one page long. One was expanded into a more **comprehensive outcome story ('Farms of the Future', FotF, 7 pages).** Using input from several of the CCAFS team members from West and East Africa, the story summarized the changes in various key game changers in chronological order and provided detailed reflections on the role the Climate Analogues tool played for their achievement.

All 14 SMART outcome narratives, including the S4N and FotF cases that were researched in more detail, were developed together with the informants, in most cases the contributors to the outcomes, and in the end approved by them for publication. These data formed the main basis for exploring if and how CCAFS' climate data/tools contributed to development changes (Volume 3).

The 16 leads that our research disqualified as SMART outcomes and thus did not serve as evidence for addressing the evaluation questions still provided insights on the uses and users of CCAFS' data/tools (i.e. the contributors) and we draw from these at several points in this report. The overall information in the **30 researched cases** – 14 SMART and 16 informative leads – is summarized in Section 4.

Box 3.3.3: Researched cases and SMART outcomes

- *More than 40 cases researched in-depth through interviews*
- *30 researched cases with confirmed use of tool*
- *14 SMART outcomes (1 page each), of which*
- *1 developed into an extended outcome story (7 pages)*
- *1 explored further through an Impact Pathway-related Outcome Harvesting approach (plus 18 outcomes)*

3.3.4. Credibility of the harvested outcomes data (OH Step 4)

In OH, the descriptions of the outcome narratives have to be formulated in such detail, that they are **verifiable** during or after the evaluation process. They need to describe **observable changes**, even for outcomes in knowledge, attitude or skills, i.e. there has to be an **action evidencing the change**. For example, an informant may claim that his/her research outputs and/or lobbying for these helped to motivate a stakeholder to consider CC as a factor in their planning. This will qualify as a SMART outcome either if it is confirmed by the stakeholder in an interview and he agrees to be cited in the evaluation report, or if there is other written evidence (e.g. newspaper, reports, etc.) that the stakeholder has publicly declared that CC will be considered in the planning. Similarly, there needs to be a **plausible and verifiable explanation for the contribution, i.e. a very specific description** of the activities and outputs of the change agent that influenced the key game changers. The role of the evaluators in this study was to rigorously ensure that this level of specificity was provided, and that

the descriptions indeed established a plausible logical link between the outcome and contribution statements.

OH Step 4 usually involves the substantiation or external triangulation of the collected SMART outcomes through questionnaires; yet, this step was omitted in this study. The decision was taken jointly by the external and internal evaluation team because, first, many of the informants who helped to develop the outcome narratives and verify elements of the outcomes were external to CCAFS and not involved in the development of the tools. Second, since the main emphasis in this evaluation was on learning, less on accountability, the additional effort would not have been justified. Importantly, to further increase **credibility** of the SMART outcomes data, the informants who provided input to the outcome narratives were requested to agree that these would be made public and subjected to scrutiny.

3.3.5. Classification of survey results and outcomes (OH Step 5)

Classification of the 30 researched cases was done together with the CCAFS evaluation team. The data was tagged, e.g. according to the type of climate data/tool used, type of case study (i.e. purpose of tool use), contributor and contribution, key game changer and behavioral change, etc., as described in the Coding Book in Volume 4. The classification served the following purposes:

5. Stimulate discussions within the evaluation team to clarify terms and definitions and arrive at a common understanding and terminology.
6. Help organize the data and allow efficient and quick access to specific categories of cases, to support discussion and interpretation of specific (groups of) cases and outcomes;
7. Serve as a framework for the interpretation of patterns observed in the survey responses, researched cases, and SMART outcomes (e.g., geographic spread of cases, types of outcomes);
8. Finally, the efforts put into defining a classification scheme were also considered useful for potentially informing future elements of CCAFS' MEL.

3.4. Digging deeper: OH using elements from Impact Pathway and Contribution Analysis

In the TANGO evaluation (p. 57) it was stated that the "*lack of a Theory of Change made it somewhat challenging to assess outcomes and potential impacts*". An advantage of OH is that it can be applied in programs without pre-defined ToCs; in fact, it performs well in complex environments where objectives and the paths to achieve these are often unpredictable and likely to change over time. In these cases OH can be used to re-assess the objectives and/or formulate logic models (Wilson-Grau & Britt, 2013).

In this study we selected one of the 14 SMART outcomes to be unpacked in more detail and assessed through an **'Impact Pathway-related Outcome Harvesting' approach (IP-OH)**, aiming to identify where exactly in the results chain CCAFS data/tools had played a role, in what way, and what influence it had on the overall program achievements. We chose the Seeds for Needs (S4N) India outcome (A13) because there seemed to be a large number of different stakeholders involved including end-users (farmers), plenty of secondary resources available, and it was led by CCAFS partner Bioversity International, a CGIAR Research Center, where we hoped to be able to find available informants.

The innovative methodology mix included a harvest from documents and the development of '**Outcome Maps'** (Annex 9.4)**,** followed by further harvesting and iteratively assembling, revising and strengthening the impact pathway scheme and its contribution story. This adaptation of OH, inspired by **Impact Pathway thinking** (Douthwaite *et al.*, 2008) and **Contribution Analysis** (Mayne, 2008), helped to address the question of how and where in the results chain the CCAFS' Climate Analogues tool had contributed to the emergence of outcomes. More specifically, **steps 2 to 4 of the standard OH methodology were adapted** as follows:

OH Step 2:

1. The first step conformed with the standard OH approach and involved an **outcome harvest** from reports, online blogs, presentations and other documents publicly available or suggested by CCAFS on the S4N project;
2. These outcomes were then clustered by similar type of societal actor and change in order to formulate more general '**umbrella outcomes'**;
3. In the next step the umbrella outcomes were arranged in an '**Outcome Map'** very roughly reflecting the causal chain of results observed (the diagram may look more like an 'outcome bubble' than a chain); this Outcome Map together with the key activities and outputs contributing to the program achievements were then depicted in an **Impact Pathway-diagram** (Annex 9.4).

OH Step 3 and 4:

4. In the following we **engaged with informants to harvest more evidence along this Impact Pathway-diagram**, i) gathering further information on the existing outcomes (amending and adding the descriptions of the four components of the outcome narratives); and ii) harvesting additional outcomes for each of the umbrella outcomes, where possible.
5. During this process we aimed to test and **improve the Impact Pathway-diagram** as we went along, i.e. asking 'Did we capture all key societal actors / changes?' 'Are our causal assumptions plausible?' We focused particularly on **assessing the contributions** that were needed on various levels to bring about the overall achievement.
6. Finally, we asked the informants to specify exactly for which outcomes the Climate Analogues tool was important and, where this was the case, to **rate the importance of the tool** for the achievement of the result (low, medium, high). This ranking was then also depicted in the Impact Pathway-diagram (Annex 9.4).

Steps 4 to 5 were iteratively repeated engaging in several rounds of revising the outcomes data and the Impact Pathway-diagram, sending the documents to different informants and/or amending them together with these in GoogleDoc versions, until a final version was approved by the main contact (Prem Mathur, formerly Bioversity India) for publication.

Following the OH protocol, **substantiation** (OH step 4) of the S4Ns outcomes and Impact Pathway-diagram would involve external informants. In the process above, substantiation through external sources could also have been integrated in steps 4 and 5. Yet, due to time limitations we interviewed only staff from the lead organization Bioversity. Still, we believe that the data are sufficiently valid and credible for the primary intended users of this evaluation since i) they were triangulated by several individuals from Bioversity; ii) the informants agreed their information to be made public; and iii) key outcomes were previously published in reports.

4. Summary results from 30 researched cases

In Volume 2 of this evaluation report we analyze the results from the survey with respect to CCAFS' climate data/tool **users**, i.e. the potential contributors to outcomes, and their **uses** of the data/ tools (Box 4). Here we briefly summarize the information comprised in the 30 researched cases (Annex 9.2), including the 14 SMART outcomes, for which the use of CCAFS' climate data/tools was confirmed and which we drew from for this evaluation. Specifically we look at i) the geographic location and reach of these projects; ii) potential linkages to CCAFS work; and iii) the objectives behind the research.

Box 4: Survey analysis (Volume 2)

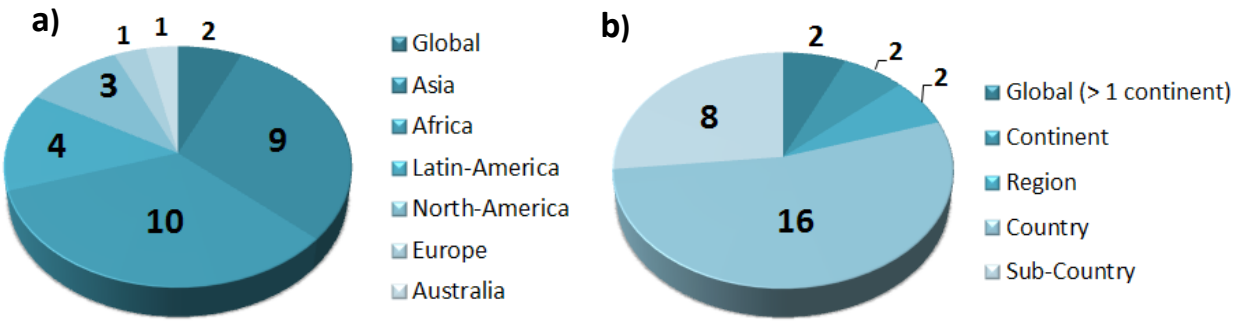
***Users** of CCAFS' climate data/tools*
- *What is the nature and geographic spread of the users?*
- *How do users find out about CCAFS' climate data/tools?*

***Uses** of CCAFS' climate data/tools*
- *Are any of the tools used more often than others?*
- *How intensively are they being used?*
- *Are they used along with other data/tools?*
- *How does CCAFS' support the use of the tools?*

4.1. Geographic scope and reach of research using CCAFS' climate products

The 30 researched cases involving CCAFS' climate data/tools covered countries or regions worldwide including Africa, Asia, Latin-America, North-America, Europe and Australia (Figure 4.1a, Annex 9.2). They had varying potential geographic reach: The majority was expected to generate results with **countrywide** relevance (e.g., S05a, b; S11, A13, PW3). A substantial number focused on **local sites or districts** within countries (e.g. S01, S08, PW1). Others potentially had **regional** (PW2, S07), **continent-wide** (S09), or even **global reach** (e.g., Pub1) (Figure 4.1b).

Figure 4.1: Geographic scope (a) and reach (b) of 30 researched cases.



4.2. Linkages of the case studies with CCAFS' work

It is noteworthy that 21 of the 30 researched cases (70%) were newly identified studies using the climate products, i.e. were not financially supported or known to the CCAFS internal evaluation team. Out of the nine known to CCAFS, there were six Climate Analogues cases of which three were co-funded by CCAFS, namely the 'Seeds for Needs India' program (A13), the 'Farms of the Future' implementations in West and East Africa (B10), and the collaborative work with 'Fundación Ecohabitat' in Colombia (B42). CCAFS was aware of but not directly engaged in the other three Climate Analogues cases involving the NGO 'Concern Worldwide' (PW1, PW2, PW3). Finally, there were two MarkSimGCM and one GCM Climate Portal study known to CCAFS: in the GCM Climate Portal case, use of the tool had been discontinued (A02), and the two MarkSimGCM collaborations had used and older version of the tool for vulnerability mapping pre-dating the evaluation period (B47: USAID's 'Feed the Future' program; PT1: DFID's climate vulnerability and poverty mapping in Africa); these cases could not be considered as SMART outcomes.

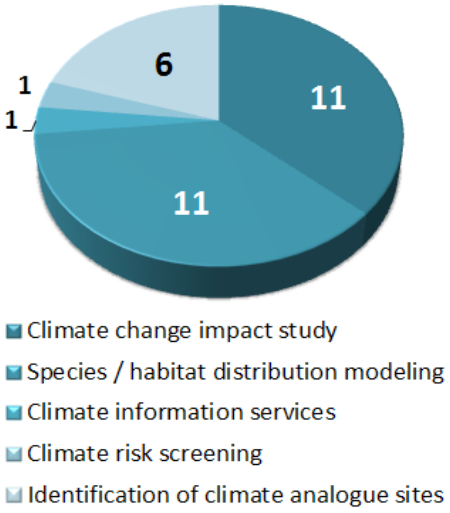
4.3. Purposes of research using CCAFS' climate products

The studies investigated here served a broad range of purposes which fell largely into five different categories, correlating with the climate product employed (Table 4.3, Figure 4.3, Annex 9.2). The cases are described in more detail in the following.

GCM Climate Portal and MarkSimGCM studies

Researchers in the first category – **climate change impact studies** – tried to assess the influence of future climates on agricultural productivity of crops or livestock (e.g. cases S05; S03a) or on forest health; one case was concerned with the water supply and demand for the water-energy-agriculture nexus (S11), and one analysed wind erosion on soils (S12) in relation to CC. One study even looked at a theme beyond the goals of CCAFS, i.e. researchers from McGill University and the Ministry of Forests, Wildlife and Parks, Canada, employed MarkSimGCM to research the in fluence of CC on cultural ecosystem services, predicting a declining availability of outdoor ice skating in Canada (S14).

Figure 4.3: Purposes of research



Studies in the second category – **species and/or habitat distribution modeling** – aimed to provide evidence how CC would influence the species distribution or habitat suitability for a range of different organisms including various plants, forest species, reptiles, or fish for decision making in species, biodiversity or habitat conservation (B22, S01, S04, S08, S10, S13). An interesting use of GCM Climate Portal and MarkSimGCM was species/habitat distribution modeling with respect to pest species in order to assess future risks to plant health. For example, José I. Barredo, Scientific Officer at the European Commission - Joint Research Centre, conducted habitat suitability modeling for various tree insect pests under present and future climate conditions in European forests to increase awareness within the European Commission of looming forest threats resulting from CC (S09). Similarly, Srinivasa Rao Mathukumalli from the Central Research Institute for Dryland Agriculture (CRIDA) in India used MarkSimGCM data for demonstrating a potentially higher incidence of pest species on cash crops in India, namely i) a moth pest species on pigeon pea (Pub2), and ii) the tobacco caterpillar on peanut crop (Pub3). In a study with global reach, MarkSimGCM helped to map the environmental suitability for a human disease vector: Jane Messina, Department of Zoology, University of Oxford, UK, and colleagues conducted species distribution modeling to show that a large portion of tropical and sub-tropical regions globally have suitable environmental conditions for the ZIKA virus with over 2.17 billion people inhabiting these areas (Pub1).

Table 4.3: Purpose of tool use in 30 researched cases

Purpose of use	Total	GCM Climate Portal (16)	MarkSim GCM (8)	Climate Analogues (6)
Climate change impact study	**11**	6	5	
Species / habitat distribution modeling	**11**	8	3	
Climate information services	**1**	1		
Climate risk screening	**1**	1		
Identification of analogue sites	**6**			6

In one case (A02) we could confirm the use of a CCAFS tool for **climate information services**: The Senegalese meteorological agency ANACIM employed the GCM Climate Portal to retrieve high resolution data for their CC report in order to enhance their early warning system. However, later they shifted to CORDEX which uses regional models and provides higher spatial resolution than the GCM Climate Portal. Several other national meteorological agencies were researched or contacted, e.g. in Ethiopia, Rwanda, Ghana, and Francophone West Africa, but we received either a negative or no response. We also inquired at the International Research Institute for Climate and Society (IRI), Columbia University, USA, a CGIAR partner where the Climate Predictability Tool (CPT) was developed for seasonal forecasting, but they were not aware of any meteorological services using CCAFS' climate data/tools. Roger Stern from 'Statistics for Sustainable Development', formerly University of

Reading, who worked with the Ghana national meteorological agency thought that "*individual staff at an NMS may well be using these resources. But most won't even know about them*."

Finally, there was a case where the GCM Climate Portal was employed by a Chinese freelance consultant for **climate risk screening:** Since 2010, a department within a financial institution in Asia uses his information to identify high/medium risk projects and allocate additional funding to these for CC adaptation purposes. Since 2016, this has been enforced more formally and every investment project requires a climate risk to be incorporated into project design and all projects of this department are assessed by the consultant employing GCM Climate Portal.

Climate Analogues tool studies

The six Climate Analogues cases dealt with the **identification of climate analogue sites** for various purposes (all of these were developed into SMART outcomes). In three of the cases the tool was used to identify places with current climates that are similar to projected future climates of reference sites, and support cross-site farmer visits aiming to foster knowledge exchange potentially improving farmers' decision making, adaptive capacity and planning (PW1, PW2, and the extended "Farms of the Future" outcome story B10). The INGO 'Concern Worldwide' used the Climate Analogues tool to develop their country strategy for Liberia integrating the identification of CC adapted agricultural practices (PW3). The Colombian NGO 'Fundación Ecohabitat' collaborated with CIAT to inform their local CC adaptation planning through Climate Analogues analyses. Finally, in the 'Seeds for Needs India' program the Climate Analogues tool served to find suitable see varieties and sites for germplasm identification and breeding to expose 15'000 farmers to a greater variety of crops (A13). This case was selected to be researched through the Impact Pathway-OH with elements of Contribution Analysis to assess to what extent and where in the outcome hierarchy information from the Climate Analogues tool played a role (Section 5.4.2).

It is striking that only three of the 24 GCM Climate Portal and MarkSimGCM cases analyzed here were known to and/or co-funded by CCAFS (Section 4.2). Taken together with the findings that many cases were tracked in countries not targeted by CCAFS and that a majority of researchers stated that they discovered their tools via web search (Volume 2, Section 3.1), this suggests that CCAFS' climate products are widely used even without specific promotion by CCAFS. The CC community seems to like and employ CCAFS data/tools for their own purposes which reflects back on CCAFS' proficiency as a provider of International Public Good products (IPGs).

All Climate Analogues cases were known to or even co-funded by CCAFS. The sample size in this study is too small to draw any firm conclusions from this but it stands to reason that this tool tends to be used predominantly by CCAFS partners - or that Climate Analogues users at least have been trained by CCAFS staff and thus are in close contact with CCAFS and the developers of the tool. The TANGO evaluation stated that it needed sufficient training on its use and implementation and a number of Climate Analogues users "... *did not yet feel comfortable or skilled enough to appropriately use it*" (p22). Also, several of our informants indicated that Climate Analogues applications needed adaptation to the respective project and context, calling for additional parameters to be linked in.

Note that for two categories that we identified for the GCM Climate Portal - **climate risk screening** (S07) and **climate information services** (A02) – there was only one case and both could not be developed into SMART outcomes (see next section). While we don't see any technical reasons why a more extensive harvest shouldn't bring up more examples of the first category, there may indeed be better suited software than the GCM Climate Portal for use at meteorological agencies. This might explain why all our efforts in this direction did not bring up further cases.

5. Findings and conclusions from the SMART outcomes (evaluation questions)

On the basis of 14 rigorously assessed SMART outcome cases with supporting information from the other researched cases and survey data, this section aims to answer the three parts of the evaluation questions: whether there are emergent outcomes influenced by CCAFS' climate data/tools (Section 5.1); if so, of what type they are (Section 5.2), and how exactly CCAFS' climate products contributed to them (Section 5.3).

> **Box 5: Evaluation question – Part 1**
>
> ***To what extent do CCAFS climate data/tools influence CCAFS' user groups to do things differently in relation to research agendas and investment decisions (or other like environmental programming, capacity development and policy formation).***

Section 5.4.1 delves deeper into a particular outcome study, the implementation of the FotF approach (B10), summarizing the results achieved in various sites in West and East-Africa and assessing if and how the Climate Analogues tool influenced these. This was done in even greater detail for the 'S4N India' program (A13), where we reconstructed an Impact Pathway along which we harvested evidence examining in what way and where in this pathway the Climate Analogues analyses had contributed to the results (Section 5.4.2).

5.1. Are there emergent outcomes informed by CCAFS climate data/tools?

In this evaluation we gathered evidence for development outcomes, i.e. behavioral changes in actors who, based on their own research outputs generated with CCAFS' climate products or that of others, do something differently with respect to knowledge, attitude, skills, policy or practice, creating a more enabling environment for CC-related development work, taking programming, planning, or investment decisions; or implementing CC-related plans or strategies.

Table 5.1: Years when the 14 SMART outcomes emerged

Year	Total (14)	Climate Portal (8)	Climate Analogues (6)
2011 onwards[1]	**2**		2
2013	**1**	1	
2014	**3**	2	1
2015	**1**	1	
2016	**7**	4	3

1: FotF and S4N outcomes

The OH approach was able to unearth such changes, although it took intensive research (Section 3.3) as they were not readily available through CCAFS' knowledge bases, MEL system, or network of contacts. Also, despite our efforts to harvest about equal numbers of outcomes for each tool, the 30 researched cases included about double as many GCM Climate Portal (16), than MarkSimGCM (8), or Climate Analogues cases (6) (Table 5.1). There were a **number of interesting leads for MarkSimGCM**, i.e. research outputs that were directly aimed at influencing programming or decision making (Annex 9.2), yet, our efforts did not result in any SMART outcomes for this tool. More intensive inquiries focusing particularly on the MarkSimGCM tool might well detect development outcomes. Yet, for the eight leads researched here, we either failed to get any response from informants (Pub1, Pub2, Pub3), could not (yet) detect any changes that were influenced by the research outputs (S15; S14), did not retrieve sufficiently specific information on the potential outcome (B17), or an older MarkSimGCM version was used and the results predated the evaluation period (B47, PT1).

In the end, the evaluation produced **14 outcomes that complied with the SMART criteria** (Section 3.2.1): eight GCM Climate Portal and six Climate Analogues cases. The outcomes emerged between 2011 and 2016, half of these only in the final year of the evaluation (Table 5.1). Only the six Climate Analogues outcomes were previously known to CCAFS' internal evaluation team. Two of these were selected to be assessed in more detail (S4N/A13 and FotF/B10), unpacking further SMART outcomes

in these programs. These data constitute **evidence that outcomes linked to CCAFS' climate data/tools – as we defined them in this evaluation – did emerge during the evaluation period.**

One possible reason why we harvested double the number of GCM Climate Portal outcome leads than for MarkSimGCM may be that the latter currently can be accessed via the GCM Climate Portal website (www.ccafs-climate.org). This may be confusing to users who possibly specify the GCM Climate Portal instead of MarkSimGCM when asked for the tool used. A more rigorous registration process for researchers accessing the tools, inquiring details about the users and uses of the tool, would be an effective solution to this (Section 7.3.4). In any case, the sample is too small to draw conclusions on the relative effectiveness of the tools and there may well be plausible alternative explanations why our efforts resulted in relatively few development outcomes, and none for MarkSimGCM, beyond the purpose, usability and quality of the tool, which will be discussed further in Sections 5.5.1 and 6.

5.2. What types of outcomes are influenced by CCAFS' climate data/tools?

Box 5.2: Evaluation question – Part 2

What changes in knowledge, attitude, relationships, policy or practice were observed?

Section 5.2 examines patterns and observations in the 14 SMART outcomes to address evaluation question Part 2 (Box 5.2). The changes observed in the eight GCM Climate Portal and six Climate Analogues outcomes involved a wide geographic spread (covering four continents) and a broad range of societal actors – none of these being a CCAFS partner[3]. They concerned four national and international NGOs, three national and sub-national government agencies or research institutions, three policy makers in national governments, and a donor agency (Table 5.2). Finally, there were three Climate Analogues outcomes that used climate information to enhance CC adapted farming practices and succeeded to engage end-users, i.e. communities and farmers, directly in the projects (B10, A13, PW1). This section looks more closely at the nature of these changes – what exactly it was that the societal actors did differently. We found that these behavioral changes fell into three main categories (Box 5.2), which will be presented in turn.

5.2.1. Immediate level changes

There were five immediate level changes, three GCM Climate Portal and two Climate Analogues cases. In two of the GCM Climate Portal outcomes the key game changers **became interested** in CC work informed by CCAFS' climate products and engaged in **advocacy activities** promoting the results:

- **Outcome S12 (GCM Climate Portal)** – Increased awareness and advocacy support through the Argentinian Ministry: In 2014, the Ministry of Agriculture of Argentina for the first time published a book on "*Soils, agricultural production and climate change: advances in Argentina*" composed of peer-reviewed papers. Juan Cruz Colazo, Soil Scientist at the Research Department, Instituto Nacional de Tecnología Agropecuaria (INTA) and colleagues were invited to provide a chapter on "*Climate change and wind erosion in Argentina*" based on their research between 2010 and 2013 combining a field-scale wind erosion model with future climate estimations done with GCM Climate Portal.
- **Outcome S08 (GCM Climate Portal)** – Increased awareness and advocacy through a Mexican NGO: In 2013, 'Pronatura Veracruz', an NGO involved in ecoforestry, became more aware of the vulnerability of cloud forest reserves in Mexico to CC and engaged in producing advocacy material targeted at the Mexican government after reading publications by Rocío Ponce Reyes and colleagues the School of Biological Sciences, University of Queensland, employing GCM Climat Portal to show CC related threats to Mexico's cloud forests.

[3] According to CCAFS online partner database

Table 5.2: Key game changers

Key game changer	Total (14)	Climate Portal (8)	Climate Analogues (6)
Communities	**3**		3
CSOs	**4**	2	2
Gov. research institutions, etc.	**3**	3	
National Governments	**3**	3	
Donors	**1**		1

Box 5.2: Classification of SMART outcomes

Immediate level outcomes: *stakeholders who became more aware of climate change issues; financially supported CC research; increased institutional or personal capacity; and/or changed their advocacy strategy with respect to CC themes (3 GCM Climate Portal, 2 Climate Analogues cases);*

Intermediate level outcomes*: stakeholders who changed their CC related policies and/or invested resources in CC strategy development or implementation (5 GCM Climate Portal, 1 Climate Analogues case);*

Ultimate level outcomes*: end-users of CCAFS climate data/tools, i.e. farmers, who engaged in CC related projects and were stimulated to adapt CSA practices (3 Climate Analogues cases).*

Additional resources for CC related research using CCAFS' tools were provided by a government agency in case of the GCM Climate Portal and by a donor for Climate Analogues work on the basis of previous results achieved with these tools:

- **Outcome B22 (GCM Climate Portal)** – Funding through the US Fish and Wildlife Service: In 2016, the agency co-funded a second, more detailed study on CC influences on ecosystem vegetation in southern USA after the pilot study by Drs Michael Jennings, University of Idaho, and Grant Harris, US Fish and Wildlife Service Southwestern Region, that used the GCM Climate Portal to develop and test methods to identify specific climate-vegetation parameters, was published and circulated widely within the agency.
- **Outcome PW2 (Climate Analogues)** – Funding through DFID for Concern Worldwide's Climate Analogues work in Chad and Sudan: In 2014, DFID awarded a 3-yr grant to a consortium of Concern Worldwide, World Agroforestry Centre (ICRAF, a CGIAR Center), Tufts University and Al Massar under the 'Building Resilience and Adaptation to Climate Extremes and Disasters' (BRACED) program based on a proposal that had a strong action research component and could conclusively prove, or disprove, the Climate Analogues concept. Despite initial doubts concerning the approach, an initial report sent to DFID was seen positively by the DFID advisor.

A fifth outcome in this category concerns **capacity building** in a Colombian NGO using the Analogues tool for CC adaptation work:

- **Outcome B42 (Climate Analogues)** – Increased capacity in the Colombian NGO 'Fundación Ecohabitats' for local CC adaptation planning: During 2016, Fundación Ecohabitats has collaborated with CIAT in incorporating outputs from the use of the Climate Analogues Tool (how future projected climatic conditions might look like) into local adaptation planning work with community leaders in the Cauca Climate Smart Village (CSV), after learning about the tool through their partnership with CCAFS.

These outcomes represent very upstream/'output-near' changes in the assumed results chains towards more significant development achievements influenced by the respective interventions. They do not comply with CCAFS' current definition of outcomes (Box 3.2.1). However, they are important steps demonstrating how CCAFS' climate information can assist key game changers to achieve their CC related objectives by creating an environment of increased awareness, capacity and funding in which they can better perform their CC related work. CCAFS' contribution to development partners creating their own environment as they want and need it for them to better perform their work – i.e. providing and faciliting the use of CCAFS' climate products - is a crucial one and needs to be acknowledged.

5.2.2. Intermediate level changes

All six outcome cases in this category – five GCM Climate Portal and one Climate Analogues case – concerned stakeholders who changed their policies by **integrating CC into strategies or plans for development work** and, in two cases, **implementing such plans**.

In one case, the **strategy planning itself was co-funded** by a government agency:

- **Outcome S01 (GCM Climate Portal)** – Australian National Resource Management groups integrate climate information in their planning: In 2014, the South West and the Northern Catchments Councils co-funded work and published reports incorporating CC information from CCAFS GCM Climate Portal into their resource management projections. The work built on a framework for assessing the vulnerability of aquatic species conducted by Barbara Cook, Acting Director, and Benjamin Ford, Research Assistant/PhD student at the University of Western Australia.

Two cases describe the integration of information retrieved through the GCM Climate Portal and, in one case, the Climate Analogues tool into **planning activities**:

- **Outcome S04 (GCM Climate Portal)** – A South African national government agency agrees to include CC related biome change predictions in the next South African National Biodiversity Assessment: According to a verbal agreement in 2016 between the Deputy Director at the South African National Biodiversity Institute (SANBI) and Danni Guo, Senior Scientist at SANBI, the next Assessment in 2019 will be partly informed by research employing the GCM Climate Portal to assess CC impact on the local ecosystem and environment.
- **Outcome PW3 (Climate Analogues)** – 'Concern Worldwide' includes Climate Analogues analyses into their country strategy for Liberia: Since 2016, the INGO is developing its country strategy for the next four years; the contextual analysis includes information from the Climate Analogues tool showing that coffee/cocoa producing sites in Ivory Coast are climate analogues. The proposal to Irish Aid has a focus on agro-forestry, aiming to build up the skills set of the Concern staff and other Liberian institutions accordingly.

In one case a national program that was partly influenced by GCM Climate Portal analyses received **resources for implementation**:

- **Outcome S11 (GCM Climate Portal)** – Indian Cabinet approves a water-energy nexus program: In 2015, the Indian Cabinet Committee on Economic Affairs approved the national program *'Pradhan Mantri Krishi Sinchayee Yojana*' (PMKSY) that aims to extend the coverage of irrigation and improve water use efficiency. The program was partly informed by research conducted by Prabhat Ojasvi, Principal Scientist at the Indian Institute of Soil and Water Conservation, Dehradun, using GCM Climate Portal data.

In two cases, resources were immediately allocated and the **re-prioritized plans implemented**:

- **Outcome S05a (GCM Climate Portal)** – NGOs in Timor-Leste adapt their planning and invest in climate risk adaptation measures: In 2016, all major NGOs in the Timor-Leste who were coordinated with the UN in the Humanitarian Coordination Team re-prioritized their activities and responded more timely to the extreme drought predicted through climate modeling using GCM Climate Portal conducted by Samuel Bacon and his colleagues from the Seeds of Life program.
- **Outcome S05b (GCM Climate Portal)** – Government of Timor-Leste co-funds climate risk adaptation measures: Several Ministries responded to the unfolding difficulties during the El Niño cycle in 2016 that caused an extreme drought on the island by committing around $12 million USD to buy reserve food stocks, after becoming aware of climate related risks through research employing the GCM Climate Portal and promotion of the results at workshops.

All 'intermediate' cases potentially had national reach, with the exception of outcome S01, where Australian Resource Management groups integrated climate information in their regional resource management projections. The identification and engagement of

strategic national entry points is a critical success factor for enabling nation-wide rolling out of a program. An existing, good relationship to national governments and their agencies constitutes an asset that helps to get the commitment of such national partners for programs with larger reach. Some of the 'intermediate' level changes assessed here may have influenced further outcomes, possibly also 'ultimate' ones, and may be promising case studies for follow-on assessments.

5.2.3. Ultimate level changes

The final category comprised the three Climate Analogues cases where farmers either participated in farm-to-farm exchange visits to climate analogue sites and were motivated to employ new farming practices (B10, PW1) or took part in field trials using new seed varieties identified through analyses with the Analogues tool and ultimately engaged in a citizen science approach evaluating and selecting seed varieties themselves (A13).

- **Outcome PW1 (Climate Analogues)** – Farmers in Sierra Leone start growing cash crops from climate analogues sites: In 2016, 60 farmers from Tonkolili district, Sierra Leone, engaged in a project by Concern Worldwide, participated in a visit to a climate analogue site in Bo District and subsequently started sourcing coffee and cocoa germplasms from there. Additionally, the sourcing of tree seedlings for reforestation and shading trees for the farmers' tree nurseries was switched from the Forest Department nursery in Freetown to Bo District based on Climate Analogues analyses.
- **Outcome B22 (Climate Analogues)** – East and West African farmers participate in the 'Farms of the Future' project: They took part in learning journeys and adopted new farming practices: From 2011 to 2014, 60 farmers and other agricultural stakeholders from East Africa and 200 from West Africa engaged in visits to climate analogue sites and/or capacity building work. A CCAFS' assessment of the FotT approach in 2016 in one of the sites (Lushoto, Tanzania) concluded that the farmers had been inspired by their interaction with other farmers and now were using a variety of new CSA technologies and practices, and institutional innovations. This outcome is discussed in more detail in Section 5.4.1.
- **Outcome A13 (Climate Analogues)** – Over 15'000 farmers participate in CCAFS-funded Seeds for Needs (S4N) program in India: Since 2012, the farmers' network participating in the Bioversity led 'Seeds for Needs India' program rapidly increased from 80 to now 15'000 farmers who engaged took up resilient farming system starting to grow climate-adapted seed varieties.[4] This case study was selected to be explored further Impact-Pathway-related OH (Section 5.4.2).

These outcomes are examples of how CCAFS' climate data/tools can contribute to achieving results involving the end-users or beneficiaries of CCAFS' work, the farmers and communities, to enhance their adaptive capacity and resilience to CC and thus reducing potential adverse impacts on their food and livelihood security.

It is notable that all cases involving end-users were linked to the Climate Analogues tool and there was not a single GCM Climate Portal 'ultimate' outcome, although there were many more GCM Climate Portal cases in the survey (Volume 2). GCM Climate Portal related work may have a more direct influence on the intermediate level, informing programming, strategy planning and policy changes, and may have less direct influence on end-users. Among the 16 researched GCM Climate Portal cases there was only one that potentially had a direct link to farmers/communities: the Senegalese meteorological agency used the tool to enhance the early warning system benefitting farmers to better adapt to climate variability (A02). Indirect influences on end-users are more difficult to track and would call for more thorough studies of specific GCM Climate Portal related projects or programs (e.g. through an Impact Pathway-OH approach such as in the S4N case). This

[4] The Seeds for Needs program is active in 15 countries, in this study we focused on the results in India.

may explain why we did not observe more 'ultimate' GCM Climate Portal SMART outcomes in this study, however, the sample in this study is too small to confirm this hypothesis.

In only one case the number of farmers and communities engaged were at a scale that would possibly comply with CCAFS' current outcomes definition (Section 3.2.1), the S4N India program (A13). Still, it is remarkable that even in the small sample of 14 outcomes assessed here we could observe results occurring on all levels of the outcomes hierarchy, some earlier, some later in the respective impact pathways of the interventions. Unpacking and capturing these is an essential step towards being able to tell a plausible, consistent and coherent story of how CCAFS climate products can contribute to downstream, impact-near outcomes. Sections 5.4.1 and 5.4.2 will examine more closely such pathways of results and if, how and where the tools played a role in these.

5.3. How do CCAFS' climate products contribute to outcomes?

Box 5.3: Evaluation question – Part 3

How and to what extent have CCAFS outputs or activities employing climate data/tools contributed to outcomes?

In this section we examine more closely who exactly contributed in what way to the outcomes described in this evaluation, e.g. who produced what type of evidence or improved research methods/tools with the help of CCAFS's climate products to influence results, and/or communicated such evidence to stakeholders, or supported them to apply these in development projects (Section 5.3.1). We further explore the role CCAFS played in this, in how far the contributors were supported by CCAFS apart from providing the climate data/tools (Section 5.3.2). Finally, we try to shed some light on the question regarding the way CCAFS' tools were employed to bring about change (Section 5.3.3), what other factors may have influenced the results (Section 5.3.4), and how important the contribution of CCAFS' tools were to achieve the results (Section 5.3.5).

5.3.1. Who contributed to the observed outcomes?

Representatives from a range of different types of institutional entities contributed to the sample of 14 outcomes analyzed here (Annex 9.3). The contributors who influenced **GCM Climate Portal** related results were affiliated either with **government institutions** (S04 SANBI, S05 Seeds of Life; S12 INTA) or with **universities** (S01 University of Western Australia; S08 University of Queensland, Australia), or both (B22, S11). For three of the six **Climate Analogues** outcomes, the contributors came from a specific **CSO** (PW1/PW3 Concern Worldwide; B42 CIAT); the other three concerned partnerships. Thus, five outcomes - two GCM Climate Portal and three Climate Analogues cases – involved representatives from several types of institutions that had **collaboratively worked together** to achieve results:

- **B22**: With the help of GCM Climate Portal data, **Michael Jennings, University of Idaho**, and **Grant Harris, US Fish and Wildlife Service Southwestern Region**, developed and tested methods with which to identify the specific climate-vegetation parameters needed for assessing the threats from CC; they could secure funding for a respective assessment across the southwestern USA which will serve to set priorities for ecosystem conservation and restoration.
- **S11: Prabhat Ojasvi, from an Indian government institution** (Institute of Soil and Water Conservation, ICAR) together with researchers from two academic institutes (Institute of Management; Institute of Technology) used GCM Climate Portal information to conduct research on the impact of CC on the Water-Energy Nexus in agriculture for canal irrigation systems which influenced a national program extending the coverage of irrigation and improving water use efficiency.
- **PW2: Concern Worldwide together with ICRAF (a CGIAR Center), Tufts University and Al Massar** developed a proposal including a strong action research component that could conclusively prove, or disprove, the Climate Analogues concept planned to be used for their work in Chad

and Sudan; this convinced DFID to fund the pilot project and allowed Rolandt Kindt from ICRAF to test and adapt the Climate Analogues tool for this work.

- **B10: The FotF project** in East and West Africa involved various contributors including the CGIAR Centers CIAT, ILRI, and ICRISAT, researchers from academia (Natural Resources Institute, NRI, University of Greenwich), representatives from several national government research institutions (Annex 9.3) and an independent consultant. This collaborative work contributed to the outcome that farmers engaged in farm-to-farm exchanges and incorporated new learnings into their farming practices. Outcome and contribution are described in detail in Section 5.4.1.
- **A13: The S4N program in India** is another example of CGIAR's partnership approach, involving government agencies at the national and local level, NGOs, and universities. The case is discussed in detail in Section 5.4.2.

The above represent good practice examples of how researchers **collaborated with a variety of development partners** and contributed complimentary lines of expertise to achieve results. Multi-stakeholder partnerships, involving e.g. academic, policy and NGO partners, offer the opportunity to understand and address the views from various actors and angles. They can help to better translate academic research into changes 'on the ground' and, vice versa, feedback on the experiences from the grass roots level to academic learning.

There is a **considerable involvement of national actors** in the GCM Climate Portal studies. Incorporating scientific knowledge into policy is a challenge (Jones *et al*., 2009), yet, the outcomes show that through collaborative, science based projects like those identified here, CCAFS or other organizations can fulfill their role as facilitators of policy formation or implementation or, when directly involved, as policy advisors, supporting countries achieve their ambitions in CC adaptation and mitigation. This role is explicitely recognized in CCAFS' proposal for Phase II, emphasizing a 'Partnership Strategy' that *"...focuses at the national level as the key route to impact."* (CCAFS Phase II Full Proposal, p. 29).

Universities engaged as contributors in seven of the 14 SMART outcomes (Annex 9.3) and in the survey the largest group of tool users were affiliated with academic institutions (47%; Volume 2, Section 3.1.2). Academic researchers thus seem to be an important actor producing research evidence that can potentially lead to development outcomes. CCAFS can play an important role in targeting academic researchers to encourage and enable them to increase impact from their CC work, e.g., by connecting research stakeholders with the development world; facilitating knowledge transfer; and helping to repackage 'academic' evidence according to the needs of their end-users (see S08 for a successful case where CCAFS was not involved). This illustrates the importance of the expanded mandate that CGIAR has taken on in the past years, and how it can be implemented[5].

While CCAFS' full proposal for Phase II explicitly mentions the inclusion of **private sector partners** (several companies under WBCSD, p. 29) and they were also a target group under Phase I[6], we did not detect any in our sample of 14 SMART outcomes, nor in the other researched cases. A shy exception was case S07, where a freelance consultant used the GCM Climate Portal for CC risk analyses commissioned by an Asian financial institution. Possibly CCAFS achieved indeed only few outcomes in this sector during Phase I, however, our sample is too small to make a conclusive judgement on this.

[5] See "*The CGIAR at 40 and Beyond*", CGIAR 2011.
[6] Personal Communication Philip Thornton

5.3.2. What was CCAFS' role in achieving the outcomes apart from providing climate products?

In eight of the 14 outcomes, the contributing organizations were either CGIAR Centers or CCAFS collaborating partners[7]. The remaining six outcomes were influenced by organizations that had no formal connection to CGIAR/CCAFS (B22, S04, S05a, S05b, PW1, PW3). The email or Skype interviews conducted with representatives from these organizations – Paul Wagstaff from Concern Worldwide, Michael Jennings from University of Idaho, Samuel Bacon from Seeds for Life, and Danni Guo from SANBI – showed that none had made use of additional assistance through CCAFS apart from retrieving the data from CCAFS' web portal, except Danni Guo, who had requested some technical support. Even where CGIAR partners were directly involved and thus potentially more closely linked through the CCAFS CGIAR Research Program (CRP), direct support through CCAFS tool developers was not necessarily requested: Benjamin Ford from the University of Western Australia (S01), Prabhat Ojasvi, from the Indian Institute of Soil and Water Conservation (S11), Juan Cruz Colazo from INTA, and Rocío Ponce Reyes from the University of Queensland, all stated that they conducted their research without further support through CCAFS.

This is in line with findings from the survey (Volume 2, Section 3.5) where the majority of users (61%) replied that they did not request any further technical assistance or training through CCAFS for their work. Users of CCAFS' climate products, i.e. the contributors to potential outcomes, thus seem to be **fairly intuitive in their use**, **and independent from CCAFS** and often able to achieve results without further CCAFS involvement.

In addition, many users seem to **learn about the tools** not via the CGIAR network, events or scientific publication, but **through web searches** for suitable climate data providers. Even the majority of CGIAR partners discovered their tools via the web (see Volume 2, Section 3.2). This indicates that **CCAFS is filling its role as a developer and provider of well-functional, comprehensible and widely usable IPGs.**

In a system wide review of CGIAR focusing on its **function as IPG provider**, Sagasti and Timmer (2008) distinguished between two components of CGIAR's IPG delivery system: i) **making quality research results or knowledge services globally available** (core activities closer to CGIAR' 'sphere of control'), and ii) **facilitating their adoption** and use by developing country partners and agents (complementary activities closer to CGIAR' 'sphere of influence'; p. 8). Thus, activities, outputs and strategy decisions in both areas will influence the uptake of CCAFS R4D. With respect to the facilitating function, the analyses revealed that in two of the three 'ultimate level' outcomes (Section 5.2.3) the contributors were CGIAR Centers (CIAT/FotF and Bioversity/S4N). Both cases involve a multitude of stakeholders and emphasize a crucial role that CCAFS takes on in the science-policy arena, i.e. engaging in collaborative, science-based projects that involve grass roots work with farmers and at the same time bridge across a multitude of stakeholders including national partners.

5.3.3. In what way were CCAFS climate data/tools used to influence outcomes?

Here we mainly summarize what was done and what types results and evidence were produced that influenced the SMART outcomes. Section 5.3.4 will then look at additional strategies that may have facilitated the uptake of the research results.

The research contributing to the outcomes assessed here fell into three of the five categories identified in Section 4.3: the GCM Climate Portal was used in **CC impact studies** and **species/habitat distribution modeling** (4 outcomes each), and the Climate Analogues tool served to **identify climate analogue sites** for varying purposes (6 outcomes).

[7] According to CCAFS online partner database

GCM Climate Portal cases

The four **CC impact studies** were all conducted at or in collaboration with (sub-)national government research institutions

- Prabhat Ojasvi at the Institute of Soil and Water Conservation, India, assessed the impact of CC on the Water-Energy Nexus in agriculture for canal irrigation systems using future precipitation and temperature data at the highest resolution downloaded from GCM Climate Portal, in addition to climate information retrieved through WorldClim (S11).
- Juan Cruz Colazo at INTA conducted research combining a field-scale wind erosion model with future climate estimations gleaned from the GCM Climate Portal in a Geographic Information Systems (GIS), in order to address the spatial and temporal (1950 – 2000, 2030, 2050) variation of national wind erosion risks (S12).
- Samuel Bacon from the ACIAR-funded Seeds of Life program hosted by the Ministry of Agriculture and Fisheries of Timor-Leste looked at the impact of CC on maize production sourcing climate information through the GCM Climate Portal as well as WorldClim (S05a, S05b).

Two of the **species/habitat distribution modeling cases**, too, involved government institutions:

- The pilot study quantifying the relationships between CC and ecosystem composition at the US Fish and Wildlife Service Southwestern Region, which used bioclimate variables of a single climate model downscaled to 1 km obtained from the GCM Climate Portal (B22), and
- The work by Danni Guo and colleagues at SANBI who published research on the conservation of Quiver trees in Namibia and South Africa under a changing climate based on climate projections gleaned from GCM Climate Portal and WorldClim (S04).

In the other two cases where GCM Climate Portal was used in species/habitat distribution modeling the research was conducted at universities and published in scientific papers, but it was also promoted strongly to other audiences beyond the scientific community (S01 and S08, see next Section 5.3.4).

The five institutions above **used the results to inform their own agencies or governments.** They had an interest in including CC as a theme in their strategic planning and programming decision making. In some cases these are still very early results which should be followed up upon later (e.g. B22, S04). Some larger national programs, however, would be time intensive to evaluate in more detail, e.g. S11: while we provided evidence in this report that information from the GCM Climate Portal did partly inform the Indian national irrigation program, we would need to examine this outcome in much more detail to assess the relative importance of CCAFS's contribution compared to other factors. As pointed out in Section 3.2.2, it can be very resource intensive to establish the specific, plausible connections between outcomes and contributions in national or international policy programs.

The work of Samuel Bacon, Seeds of Life (a program within the Timor Leste Ministry of Agriculture and Fisheries funded by the Australian Centre for International Agricultural Research - ACIAR) and his colleagues demonstrates the **use of CCAFS' climate information beyond the actual purpose** of the study (resulting in the originally unintended outcomes S05a/S05b): they employed the GCM Climate Portal and WorldClim data to analyze the impact of CC on maize production in Timor-Leste. They had very good credentials for quality climate change work, which was partly based on their research using the GCM Climate Portal. When they were invited to present their data at workshops and educational sessions to government staff and INGOs, they took the chance to provide climate information about a looming El Niño event and succeeded to convince these actors to change their original plans and prepare accordingly to implement appropriate measures.

Climate Analogues cases

The Climate Analogues tool was used in six cases with varying purposes:

- Three of these cases involved the **identification of sites for farm-to-farm exchange visits** in order to enhance knowledge sharing and peer learning. This included the CCAFS projects in East and West Africa where the FotF approach was piloted (B10). Additionally, the approach was employed by Concern Worldwide in their work in Sierra Leone (PW1), Chad and Sudan (PW2).
- Concern Worldwide also used the Climate Analogues tool as a learning resource to **identify suitable agricultural strategies and CC adaptation planning** in Liberia (PW3) and does so in many of its focal countries in an explorative way. Similarly, CIAT and Fundacion Ecohabitat currently adapt the tool to better meet the needs of their local adaptation planning in Colombia (B42).
- In the S4N program, finally, the Climate Analogues tool was employed to i) **identify climate ready seed varieties** and ii) **select sites for crop evaluation trials** under specific growing conditions.

These different uses of the Climate Analogues software in our sample demonstrate how one tool can have varying purposes and applications. Several of these uses are documented on the Climate Analogues website and an overview of potential applications is presented for the GCM Climate Portal on the respective website (including also some information on MarkSimGCM uses). A systematic classification and monitoring of such uses may be helpful to gain deeper insights into how exactly the tools are employed and how they can contribute to development results.

5.3.4. What else contributed to achieve outcomes apart from producing research outputs?

Noticeably, in 11 of the 14 outcomes the informants explicitly used additional strategies to achieve their results, apart from solely producing research outputs:

- One strategy already described above was to work **collaboratively together with partners**, like e.g. Concern Worldwide, ICRAF, Tufts University and Al Massar to develop the proposal to DFID (PW2); or representatives from CIAT, NRI, ILRI, KALRO and an independent consultant jointly coordinating the FotF work in East Africa.
- A related strategy was the **engagement of relevant stakeholders** beyond partnerships: For example, Samuel Bacon from the Seeds of Life engaged with representatives from the government and all major NGOs on Timor-Leste who were coordinated with the UN in the Humanitarian Coordination Team to present climate information and encourage them to act upon the unfolding difficulties during the El Niño event (S05). An enabling factor for engaging partners is a high reputation for competence in CC research, or, as Samuel Bacon puts it, being "*the 'go-to' organization for quality climate information*".
- **Capacity building in partners** played a role in a majority of the SMART outcomes (8 of 14): Barbara Cook and Benjamin Ford from the University of Western Australia (S01), Samuel Bacon from Seeds of Life in Timor-Leste (S05), Rocío Ponce Reyes from the University of Queensland (S08), Paul Wagstaff from Concern Worldwide in their work in Sierra Leone (PW1), CIAT in its work with Fundacion Ecohabitat (B42), the S4N (A13) and FotF (B10) programs all tried to increase the understanding and hence better uptake of their results by their partners through training workshops and meetings.
- In some cases the researchers repackaged their results in more accessible formats in order to better communicate these to their audiences. Such **advocacy activities** were observed, e.g. in outcomes S05a/b where climate information sheets covering the nation were made available online; or in S01 where one of the South West Catchments Council reports explicitly acknowledged that the researchers had developed "*a range of new data structures that are much more useful to NRM groups*". In another fine example, Rocío Ponce Reyes from University of Queensland, engaged in various promotional activities, publishing her work for the general audience, disseminating it via the website of the partner NGO, and participating in one of their webinars (S08).

These observations support the notion that **research outputs on their own will rarely achieve outcomes** – further strenghtening the point raised in Section 5.3.2 that both lines of work – making research results available and facilitating their adoption and use – are important. The SMART outcomes cases above present good practice examples of how complementary strategies can facilitate the uptake of climate information. The list is not comprehensive, there may well be additional strategies to the ones listed above that CCAFS and partners take on to enhance research uptake to achieve development outcomes. And there are further enabling factors and assets that play an important role, i.e. building on long standing releationships with relevant partners as for example Bioversity and the Indian Council of Agricultural Research (ICAR) in the S4N program (Section 5.4.2). This was also suggested by Jones *et al*. (2016) for the policy arena, who found that "*isolated external interventions targeted at promoting the uptake of climate information into decision-making are unlikely to succeed without the establishment of meaningful and sustained relationships between the relevant scientists and policy-making stakeholders*."

The examples from the University of Queensland (S08) and Seeds of Life, Timor-Leste (S05) show how science outputs can be made accessible to other stakeholders (NGOs, authorities, governments) by **repackaging them into more suitable knowledge formats**. It takes a good understanding of the communication challenges, knowing the audience and their skills, individual incentives and entry points to bridge between different disciplines and sectors, promote mutual learning and capacity building.

5.3.5. How important was the contribution of CCAFS' climate products (user perspectives)?

While facilitation of research uptake is important, as discussed in the previous section, there is also the need for high quality, accessible and usable climate information and tools. Many informants in this study considered CCAFS' climate products to be an essential component for their work. Some stated explicitly that they could not have produced their results without the climate data/tools. Some appreciated the ease of use and/or accessibility of the tools, e.g. Rocío Ponce Reyes (S08); some referred to the quality of data, e.g. Benjamin Ford (S01) who indicated that at the time of the research, the required GCM and SRES combinations were not available from other sources (Volume 2, Section 4).

Three informants in our outcomes sample specified that they had also used alternative sources for retrieving climate information. In all cases this concerned WorldClim data (though it is not clear whether the data was retrieved via the WorldClim website or through the GCM Climate Portal). Nevertheless, all three confirmed that they still could not have done their work without the GCM Climate Portal:

- Danni Guo stated that he appreciated the easy to use Ascii format and good data resolution (S04).
- Prabhat Ojasvi acknowledged that CCAFS provided a spectrum of future climate scenarios along with updates in an easy to use format (S11).

Box 5.3.5: Beyond the hype: reliable, open access climate data helps to put food on people's plates

"In the context of a developing country that is trying to rebuild from a traumatic struggle for independence, climate change does not have great immediate relevance. That is, these are people trying to get food on the plate this week so they are not too concerned about 50 or 100 years into the future. In that sense, from an objective point of view, there was not a lot of specific changes in policy to implement real change. [...] Still, "...the modeled data was able to provide a balanced and scientific analysis of the real predicted changes in climate rather than the 'hype' that is so often presented. [...] We were able to present the data from CCAFS in graphic format using maps to show changes in temperature and rainfall which were more meaningful and gave more validity to our presentation. In short, having this data gives us more confidence in knowing what the real predications are rather than relying on journalistic hype."

Samuel Bacon, Seeds of Life / TOMAK, Timor-Leste

- Samuel Bacon commented similarly on the easy to access in-depth climate data and application in GIS format (S05). As he pointed out very well, climate information and thus CCAFS' climate products may have an important contribution to make even where CC may not be the foremost priority (Box 5.3.5). His academically rigorous presentation of climate information stimulated INGOs on Timor-Leste to align their planned responses and the clear understanding of the situation supported the release of more funds from the Government and international bodies to support these activities and assist the farmers to be better prepared for the unfolding disaster.

Credible, scientific, up-to-date climate data is the basis for CC related development work. To fulfill and strengthen their delivery role, CCAFS and other providers still face a vast field of work, further eliminating technical issues and finding ways how to deal with the inherent uncertainty of climate information and complexity of the climate system. Users and producers likewise benefit from good quality data and tools: they can increase their credibility and visibility/reputation in the 'climate change and development'-arena. The survey results suggest, that CCAFS' currently has a good standing as a tool provider in the CC research world (Volume 2, Section 4). So both components of the IPG delivery system, the 'tool developer' and the 'facilitation' roles are important for CCAFS, yet, it may not be easy to maintain and financially support both in an environment that increasingly demands development outcome delivery. Three factors are crucial for this:

i) careful strategic decisions and resource allocations balancing both roles within CCAFS;
ii) development of specific partnerships for the tool development and its implementation;
iii) an appropriate M&E system that can demonstrate the effectiveness of CCAFS' climate data/tools to deliver results, including their influence on 'impact-near' program achievements

The latter is attempted in the next section, where we aim to unpack and assess the outcomes in two larger CCAFS programs in more detail.

5.4. Insights from two detailed case studies: 'Farms of the Future' and 'Seeds for Needs India'

In order to examine if and how CCAFS' climate products contribute to overall program achievements and where in the impact pathway of a program they may be important, we looked for cases where i) CCAFS was actively involved and thus knowledgeable informants presumably available; ii) the project covered most of the evaluation period and hence outcomes were likely to have emerged and we could draw on evidence published in reports and assessments. Originally we planned to include one or two cases for each of the three tools in this study (see discussion in Section 6), but in the end we selected only two Climate Analogues cases: the FotF implementation in East and West Africa led by the CGIAR Center CIAT, which was developed into an extended outcome story (B10, Volume 3, Section 3); and the S4N program in India led by the CGIAR Center Bioversity International, which was examined through an Impact-Pathway-OH analysis resulting in 18 additional outcomes (A13, Volume 3, Section 4).

5.4.1. The 'Farms of the Future' implementation in East and West Africa

Climate conditions are changing rapidly and communities, policy makers and scientists need to learn, faster than ever, how to enhance their adaptive capacities to better respond to plausible novel future climates. CCAFS' FotF approach addressed this objective by connecting farmers from CCAFS sites[8] to their plausible future climates to stimulate uptake of new knowledge and technical and institutional innovations/initiatives by communities. The approach comprised **learning workshops** with agricultural stakeholders from the regions using the Climate Analogues tool to identify climate analogue locations. Also, the workshops drew heavily from the local knowledge of the participants to include additional criteria such as socio-economic (market access, employment availability, political

[8] Now referred to as "Climate-Smart Villages"

unrest) and biophysical factors (soil composition, structure and moisture content, topography or water available for irrigation). Farmers as well as various stakeholders from the local Agricultural Information System were then encouraged to take part in **learning journeys** to a range of selected farms to envisage what their climate and farming systems might look like in the future and how other farmers were already coping with the projected climates. Between 2012 and 2014, the approach was tested and validated by CCAFS' regional teams in East and West Africa and about 60 farmers and other agricultural stakeholders from Tanzania and Kenya, and about 200 from Burkina Faso, Ghana, Mali, Niger, and Senegal participated.

Outcomes of the FotF implementation

The sharing of knowledge and practices in CSA during the exchange visits led to the emergence of development outcomes, changing farmer's attitudes (e.g. increasing women's self-confidence) and leading to the adoption of technologies and innovations that are expected to improve their current livelihoods and adaptive capacity to climate variability and change (B10, Volume 3, Section 3). An assessment in 2016 in Lushoto district, Tanzania, four years after the implementation of the first pilot study in 2012, found that "*farmers acknowledged the FotF approach as a useful tool that enabled them to interact with other farmers and learn new CSA practices and innovations*"; and respective statements were also made at other locations. Overall, the program contributed to three areas of achievement and/or learning:

9. The FotF approach as such – i.e. the facilitation of shared learning processes exposing stakeholders to climate information using the Climate Analogues tool as well as a range of other important factors, and the following farm-to-farm visits – was considered a **useful methodology enabling farmers** to interact with others and adopt new CSA practices and innovations.
10. The implementation of the approach helped to **improve CCAFS' understanding of situational factors**, i.e. social and cultural perceptions of future climates, local practices as well as the cultural, socio-economic and/or institutional barriers that might need to be overcome for enabling adaptive change, informing future programming and CSV work.
11. Finally, the FotF approach demonstrated how CCAFS' climate products could usefully be employed as **learning tools** to inspire change despite the inherent uncertainties in climate modeling/projections.

Contribution of the Climate Analogues tool to the outcomes of the FotF implementation

Climate modeling does not result in accurate predictions, but in projections of possible future climates and they comprise always a range of scenarios. With full consideration of the technical (and ethical) implications of this, the CC training and future scenarios planning exercises carried out in the context of the FotF exchanges were deliberately designed to be informative and forthcoming about the uncertainties inherent to the climate models used. Further, emphasis was put during the exploratory scenarios exercises on integrating also other sources of change that can affect future community development and the social, economic and environmental systems in which they evolve. The Climate Analogues tool thus contributed to the FotF approach during its scoping phase, getting rapid assessments at a low cost and engaging stakeholders in the **ground-truthing of the outputs, sparking critical thinking and finding diverse plausible scenarios** also with respect to relevant social, cultural, political and environmental variables.

Hence, while there is a need for scientifically reliable climate projections, this case shows that there are applications or functions of CCAFS' climate tools beyond their **primary use**. Such **secondary or meta-functions** that can contribute to the achievement of outcomes include communicating about the future and helping visualize future climates; enhancing reflective and independent thinking; engaging partners and stakeholders in collaborations or projects; and more (Section 7.1.1). Identifying and defining these functions carefully and mapping where and how they can support CCAFS' ToC will help CCAFS' to better define strategic goals for its climate products.

With respect to the African FotF program, there are no further assessments to date that investigate the uptake of technologies and learnings by communities after their exchange journeys[9]. A more targeted assessment in how far the FotF approach and particularly the use of the Climate Analogues tool have inspired other (CSV) work in these regions may provide additional insights into the added value of CCAFS' climate products. Also, it will be interesting to compare CCAFS' findings to results from similar approaches by other organizations such as Concern Worldwide's program in Sierra Leone, once they are available (PW1). Paul Wagstaff from Concern Worldwide believes, for example, that "*the Climate Analogues concept is most relevant for long-term investments, like tree planting*" since climate changes, too, would occur in longer term perspectives. Hence, projections from the Climate Analogues tool may have their specific niches where they are more useful than in other areas.

5.4.2. Impact Pathway analysis in the Seeds for Needs India program

The 'Seeds and other Planting Materials for Needs' program (S4N) in India

Farmers in India traditionally source and cultivate crop varieties that are available at their local markets. However, the seed varieties available there are selected for their particular agro-climatic conditions, so farmers normally do not have access to a great variety of seed material. Yet, crop diversity is essential to respond to a changing climate. With increased information and access to a wide range of crops and varieties, farmers will be able to make better choices according to climatic conditions.

The concept for the S4N program was developed by Bioversity International and initially supported by an anonymous funder from UK to support work in Papua New Guinea. In late 2010, Bioversity India engaged with the Indian Council of Agricultural Research (ICAR) in discussions to integrate the S4N program as a 'citizen science' approach[10] for CC adaptation into the ICAR-Bioversity workplan 2012- 2016. The objectives of the S4N India program were to i) expose farmers to more crops and their varieties and increase their first-hand knowledge about different traits and options available; and ii) strengthen their seed systems and seed-saving capacity so that they always have access to planting material that fits their changing needs. To implement the approach, it was planned to establish a farmers-based experimentation network in the Indo-Gangetic Plain region of South Asia. The farmers in this network would test and select landraces and varieties identified based on the climate analogue approach. Ultimately, it was planned to establish an enhanced seed system to enable CC adaptation at community level including Community Seed Banks, which offer farmers informal ways of obtaining access to a variety of seeds as an alternative source for planting in the next season.

ICAR appointed the National Bureau of Plant Genetic Resources (NBPGR), an ICAR institute, as its nodal institution to support the planning of the ICAR/Bioversity S4N program and integration into the ICAR-Bioversity workplan. The national genebank helped in selecting varieties of seeds for the field trials, and engaged also in a separate project on accession screening: for the first time they used GIS and the Climate Analogues tools to cluster their accessions based on agro-climatic zones in India and thus identify locations from where to collect and conserve endangered genetic resources.

During 2011 and 2012, several pilot trials with wheat and rice were conducted at four locations in India and one in Nepal coordinated by ICAR institutes (the 'Directorate of Wheat Research', DWR, and the 'Indian Agricultural Research Institute', IARI) and the Nepal Agricultural Research Council (NARC). The work on the ground was largely done through ICAR's local agricultural extension systems (Krishi Vigyan Kendra, KVK), who still implemented most of the field trials since 2012. The crop varieties for the trials were selected carefully by Bioversity and the ICAR scientists from NBPGR, DWR, and IARI who supported the field trials. The selection was based on both the use of the Climate

[9] Note that the approach was also piloted in Nepal in 2012 and an evaluation in 2013 reported very tangible changes in agricultural management. However, a discussion of the results was beyond the scope of this evaluation (see CCAFS blog on the pilot study, lessons learned, and the impact evaluation 2013 by Jessica Thorn).

[10] Where the public participates and contributes to scientific research

Analogues tools, GIS, and other software, as well as taking into account datasets for the past performance of the crop varieties in various field trials in different climate conditions (see below).

From 2012 onwards there were regular field trials, i.e., the Participatory Varietal Selection (PVS) trials and Crowdsourcing (CS) trials: here the farmers who received and planted trial seeds were asked to report on their performance, and varieties that had higher yields than those normally grown were selected for the next season. Farmers thus became 'citizen crop scientists', providing feedback on their preferences, which was collected through innovative technologies: Bioversity's partners who supported the field trials used mobile devices to collect farmers' perspectives on crops varieties, as well as information from 'iButton weather sensors', i.e. devices recording temperature and humidity that were installed on the farms to compare how varieties perform under different climates. These data were compiled and analysed at the Bioversity Delhi offices and a particular data analysis software developed by Bioversity (ClimMob) helped to identify trends. The results were then shared by Bioversity's partners with the farmers during field days and seed distribution programs. Regular field trials with wheat and rice and later also other crops (e.g. mustard, mung bean, sesame, chickpea, vegetables crops, etc.) were conducted in the states of Bihar, Uttar Pradesh, Chhatisgarh, Madhya Pradesh, Punjab, Haryana, Odisha, and Nepal.

In 2014, groups of farmers initiated the process of seed multiplication and setting up Community Seed Banks offering them informal ways of obtaining access to a variety of seeds as an alternative source for planting in the next season. These community-managed seed banks helped to maintain and distribute seeds of selected varieties to other networked farmers.

Today, the rural communities in most of the states where S4N was implemented are still involved in the program and are expected to be better able to use adapted genetic materials through an improved local seed system network and agricultural systems that are more resilient to CC. The farmers' network is expected to increase organically as members will share their knowledge and project outputs via their family connections and some will sell their seeds on the market. Also, selected varieties will become a regular part of the seed material of the extension service and they will disseminate these throughout their districts.

In future, Bioversity India is planning to connect the local seed banks to the national genebank in order to ensure long term storage of local varieties. Transferring local seeds to the national genebank allows to screen these accessions for their climate suitability and further safeguard these resources.

The S4N program in CCAFS' assessments

The program "*Seeds for Needs India: Broadening the genetic base of crops to empower farmers for climate change adaptation through crowdsourcing*" was assessed in the CCAFS' 2013 annual reporting as "Relatively good": "*Upscaling is on-going, so perhaps this is better reported again in 2014 with an external evaluation […]. This seems like an excellent case where an ex post impact survey may be desirable.*"

However, we did not detect the program in the 2014 assessment. In the 2015 reporting there was also no mentioning of "Seeds for Needs", but the project P43 "*Outscaling a citizen science approach to test climate adaptation options on farms"* was evaluated. This referred to the creation of a geographical software and web resources that advice on software choice and relevance (Bioversity's Resource Box for Resilient Seed Systems), and to building capacity for the use of the software in order to strengthen CC analysis in agriculture in 16 different countries. The ranking of this outcome was lower than in 2013 (3.1 on a scale from 1 to 5, with 5 being the best), and some of the comments were: "*Link to outcome quite distant*;" and "*The significance of this outcome is not clear*;" but also "*Given the scale of the effort, some form of targeted follow-up survey of this could be very useful*." While the Climate Analogues tool is part of the Seed Resource Box, and a Bioversity S4N researcher (Sarika Mittra) provided a chapter to the handbook, it is not quite clear how this 'outcome' links to the S4N program. In fact, the authors of the 'outcome' say themselves: "*It is not possible to trace for all uses given to our tools and datasets how they have precisely informed decision-making*."

To keep the task concise and manageable, we therefore concentrated the efforts in this study on the S4N program in India, well aware that the approach may also be relevant to a range of programs and national policies in other countries.

Outcomes harvested trough the Impact Pathway-OH analysis of the S4N India program

We employed an innovative evaluation approach combining OH with Impact Pathway thinking and Contribution Analysis to better understand the chronology of and interrelation of the program results; explore who the key game changers were; in what way they had changed; and if, how and where in the causal chain of outcomes the Climate Analogues tool had directly or indirectly influenced program achievements (Section 3.4). Several reports guided our initial harvest and the development of a first 'Outcome Map' from the observed outcomes[11]. Both outcomes and the 'Outcome Map' were then amended and finalized in several revision cycles with Prem Mathur, Sarika Mittra, Arnab Gupta and Neeraj Sharma from Bioversity International, India (Volume 3, Section 4).

The harvest identified 18 outcomes involving various key game changers including the Indian government and its agencies, agricultural extension services, universities, NGOs, farmers, and communities. Below we briefly summarize the key behavioral changes observed:

- **Farmers, farmer organizations and communities** rapidly engaged in the S4N program taking up using sustainable yields and resilient farming systems. Most of the selected varieties outperformed those, which farmers were cultivating before and they were happy to continue the trials in the next season. The numbers increased from 30 participating farmers in 2012, to 5000 in 2013/14, and by 2014/15 the network had grown to 15'000 farmers involved. Today, over 15'000 farmers from more than 600 villages in 49 districts of seven states in the eastern, central and northern parts of India engage in the program. Communities also engaged in establishing about 14 Community Seed Banks in Chhattisgarh, Bihar, and Uttar Pradesh; seven of these under direct supervision of farmers' communities. They are currently storing about 500 varieties of 21 crops. In some states S4N is no longer active (e.g. in Punjab and Haryana) where farmers partake in agricultural intensification and thus are less interested growing more varieties.
- **The Indian Government via the ICAR institutes and extension services (KVK)** supported for the first time a project employing GIS software and the Climate Analogues tool:
  - The national genebank NBPGR functioned as a nodal point supporting the planning of the program; it assisted in the screening for suitable varieties; In addition, it embarked on a separate project using the Climate Analogues and GIS software to identify climate pre-adapted varieties as well as locations where crop diversity might be at risk due to a changing climate.
  - Two ICAR institutes (DWR, IARI) as well as NARC in Nepal helped coordinating the pilot and regular field trials. This involved the selection of field sites and seed varieties as well as the packing of seeds and their distribution to all 15'000 farmers involved to date.
  - ICARs local agricultural extension systems KVK agreed to assist in the regular field trials and implemented most of the PVS and CS trials. Working closely with Bioversity, they disseminated the seed packages seed materials, maintained the trials in good condition and educated the farmers on field practices as necessary. Also, they collected the farmers' feedback on the seeds and the weather data from the iButtons via mobile devices and transferred this information directly to Bioversity's server in Dehli.
- **NGOs and universities** hosted some of the KVKs and thus also supported the S4N program. They provided their own seed varieties and participated in capacity building workshops, including training on GIS/Climate Analogues software.

[11] E.g., "*Utilization of ex situ collections and climate analogues for enhancing adaptive capacity to climate change: Final Report*." NBPGR (2014); and "*A novel strategy to discover and use climate-adapted germplasm*" Bioversity (2015).

- **Donors** including an anonymous funder from the UK and the Global Environment Facility (GEF) committed resources to projects related to S4N, based on proposals building on the successes and learnings from the S44N India program. The GEF project is financed with 3.5 M US$ and will commence in 2017/05.

Contribution of the Climate Analogues tool to the outcomes of the S4N program

We asked Prem Mathur, formerly Regional Representative Central/ South Asia, now Honorary Research Fellow at Bioversity International, to specify where in the impact pathway the Climate Analogues tool was directly involved and, for these cases, to rate its importance for the achievement of the result (e.g. low, medium, high). This ranking was then depicted in the Impact Pathway-diagram (Annex 9.4).

The Climate Analogues tool was **employed in collaboration with ICAR institutes** from the start of the project in two ways:

12. It helped to **select crop traits and varieties for the field trials;** this contribution had **"medium" importance** (Volume 3, S4N umbrella outcome 1). First, it was only one component of several climate models and databases the project had taken advantage of, including amongst others also Maxent, FloraMap, Diva-GIS, and the data of the Global Biodiversity Information Facility (GBIF). Second, it would have been possible to use other tools for selecting climate analogue sites as these also had built-in components to predict climate similarity. But at that time most of these still used old data for climate grids, so the Climate Analogues tool was chosen for the S4N program as it promised to provide more up-to-date information. Also it allowed the use of both current as well as future climate datasets of any of 24 models or combinations thereof. Therefore, outcomes of the Climate Analogues tools were considered more reliable for climate matching sites. Overall, Prem Mathur states that while it might have been possible to conduct the S4N program using alternative software instead of the Climate Analogues tool, it possibly would not have led to the same success.
13. The Climate Analogues **contribution to the NBPGR genebank accession screening** was also rated "**medium**" (Volume 3, S4N umbrella outcome 2): Allowing the identification of climate pre-adapted varieties as well as locations where crop diversity might be at risk due to a changing climate, the Climate Analogues tool added a further layer to the accession screening of the NBPGR, directly influencing the decision process, so that endangered genetic resources could be collected and conserved. Yet, again, the climate information was not the only factor influencing the accession process and other tools also could have done the job. Today, the tool is still being used for accession screening at the NBPGR, which may be taken as a sign that it is useful for their purposes.

Box 5.4.2: Bridging among grass roots and policy level work

"The new Government in India has set up a new regulation enhancing overall development, e.g. in education, health, and environment: each Member of Parliament has to adopt a village. Recently, the Minister of Environment, Forest and Climate Change, visited his adopted village in one of our S4N project sites in Madhya Pradesh, where mustard varieties are tested in response to the higher temperatures until March and lower rainfall. I showed the Minister around and first he did not believe that mustard would perform so well for this region. Seeing the extremely successful yields, he was very happy about the success of the program."

Prem Mathur, Bioversity International, India

For the reasons above, the role of Climate Analogues in **securing continued government support,** as well as **financial support from other funders** for the S4N and related programs, and **engaging further stakeholders both nationally and internationally** was also rated **"medium"** (Volume 3, S4N umbrella outcomes 8, 10, 12, 13).

The Climate Analogues tool was further employed in **capacity building sessions** with staff from the KVKs, universities and NGOs supporting the field trials, but had only **low influence on some academic researchers** and **none on staff from KVK and NGOs**. Some of the academic staff were eager to use the tools for their scientific research, but so far there are no outputs or outcomes.

Finally, climate information from the Climate Analogues tool did not directly influence outcomes involving **farmers** as key game changers. However, the new seed varieties that were selected using a range of methods and software including the Climate Analogues tool were performing well; they convinced the farmers to continue with the trials and start selecting seeds by themselves. Thus there is evidence that **research outputs to which the Climate Analogues tool contributed to a "medium" extent have indirectly influenced CCAFS' end-users.**

Engaging 15'000 farmers from the Indo-Gangetic Plain and other parts of India and stimulating communities to establish seed banks that they run and supervise by themselves, the S4N program showcases important behavioral changes in end-users of CCAFS' research outputs. It demonstrates a successful approach to conducting collaborative, science based projects and bridging across various stakeholders, especially connecting grass roots work with farmers and communities on the one hand, with awareness raising and capacity building in national partners on the other (see also Box 5.4.2).

Many strategies and factors contributed to the success of this large scale program, among these:

i) **Using the national policy level as an entry point** to pilot projects in the field that are informed by scientific results;

ii) Including a selection of different sites under a variety of conditions and farming systems in order **get different perspectives from the ground** as a basis for successful outscaling;

iii) **Transferring insights from this work on the ground back to the national level** to adapt the approach;

iv) **Leveraging from the resources and expertise of the national agricultural extension network** to scale up the project.

v) And, last but not least, using the **in-house knowledge** of Bioversity, ICAR institutes, universities and NGOs on potential seed varieties, as well as **appropriate state-of-the-art software, including the Climate Analogues tool** for careful seed selection, climate matching sites and capacity building. Without a good performance of the novel varieties in the field, the farmers would not have been convinced to continue using the adapted genetic materials and build up their own local seed system networks.

While reports on the achievements of the S4N India program in its various stages are readily available through CCAFS' website, the outcomes of the S4N India program do not appear in CCAFS' annual outcomes assessments 2014 and 2015. CCAFS may benefit from identifying such key programs where it is directly involved and its climate products are used. There, one could consider ways how to capture on a regular basis if and how CCAFS' open-source software delivery, documentation and training has helped to facilitate development outcomes, in order not to miss out on learning and accountability.

5.5. Conclusions on effectiveness, relevance and sustainability

In this section we discuss the findings presented above in terms of the OECD-DAC criteria to summarize our conclusions on the **effectiveness** of the interventions using CCAFS' climate products examined here, and the **relevance** and **sustainability** of the observed outcomes.

Sustainability is examined for particular outcomes in this study, not with respect to sustainable **impact**, i.e. in how far CCAFS' interventions influenced long-term sustainable changes in the

conditions of people and state of the environment supporting a food-secure world (CCAFS' 'sphere of interest'). Evaluating this would involve the assessment of so many variables that it would be beyond the scope of this evaluation. Instead we used OH, which focuses on the 'sphere of influence' of the program, and assessed outcomes in terms of the behavioral changes observed in key actors who are assumed to help creating a world where such 'impact' is possible.

We also do not look at the **efficiency** of CCAFS achievements, although it is an essential part of the **Value for Money** discussion. The latter may actually be a key question for CCAFS, i.e., examining whether the added value of CCAFS' climate data/tools to development outcomes justifies the resources needed to develop, maintain and support the use of the tools (Section 7). However, it was not the mandate of this evaluation to look at efficiency; nor do we assess technical specifications and suitability of the tools in the context of alternative data and portal providers serving CC related development work, although some user perspectives on this are gathered in Volume 2 (Section 4) as background to better understand the outcomes assessed here.

5.5.1. Effectiveness

Effectiveness looks at two questions: i) to what extent were the objectives achieved, and ii) which were the factors influencing the achievement or non-achievement of the outcomes.

Conclusions on the extent to which objectives were achieved

In Section 5.1 we examined whether the three assessed CCAFS' climate products had contributed to the emergence of development outcomes, i.e. whether outputs or outcomes from the use of CCAFS' climate products influenced observable knowledge, capacity, policy or practice changes. We identified eight GCM Climate Portal and six Climate Analogues cases on different levels of the impact pathway that complied with the SMART criteria of OH and were thus plausibly and credibly linked to CCAFS' climate data/tools. **We take this as evidence that the GCM Climate Portal and the Climate Analogues tool contributed to the emergence of development outcomes (as defined here) during the evaluation period**.

These cases were not readily available through CCAFS' knowledge bases, MEL system, or network of contacts (see discussion in Section 6). It took intensive efforts including wide-ranging document and online reviews, contacting internal and external sources and a survey to users to dredge up about 40 promising leads, but many had to be discarded again (Section 3.3). This included also leads suggested by the TANGO evaluation, e.g.:

- A respondent from the meteorological agency ANACIM, Senegal, had specified in the TANGO survey that he used MarkSimGCM, Climate Analogues and GCM Climate Portal; and that the information would be relevant to senior-level decision making. Yet, our intensive inquiries indicated that the agency is not employing any of the tools nowadays (A02, Section 4.3).
- Another case ("*Designing adaptation strategies to improve food security in Ethiopia*", TANGO report, p. 55), was also picked up from CCAFS' 2013 outcomes assessment and researched ("Climate change adaptation strategy adopted by Ethiopian government", Annex 9.2, A14). Yet, while our inquiries confirmed a contributing role of the CGIAR Center CIMMYT to this impressive case, it also showed that none of the three selected tools had been used in this case.

These cases demonstrate how important rigorous inquiry and scrutiny are to unambiguously establish a plausible link between an outcome and the contribution of CCAFS' climate products.

That dispite all efforts we still did not capture a single MarkSimGCM outcome case is striking, especially since the scientific publication on the new MarkSimGCM version, published in 2013 (Jones & Thornton), was one of the most highly cited papers in 'Agricultural Systems' during 2014, 2015 and up until June 2016. We detected 16 MarkSimGCM cases in the survey, but only two of these seemed promising to follow up further. An additional six cases were added through other sources and researched, but none of these could be developed into SMART outcomes.

There are three conceivable explanations as to why outcomes linked to CCAFS' climate tools were not easy to harvest:

14. research outputs from CCAFS' climate products so far have not led to a substantial number of development outcomes;
15. for some (e.g. more downstream) development outcomes it is not easy to establish a clear linkage to climate information produced by one of the tools; and
16. development outcomes influenced by the climate tools are difficult to retrieve through CCAFS' current MEL structures and network.

With respect to **explanation 1**, there may be technical or programmatic reasons involved why GCM Climate Portal outcomes were easier to find than Climate Analogues or MarkSimGCM outcomes. Yet, there may also be explanations beyond the purpose, usability and quality of the tools. For example, it is notable that half of the 14 outcomes assessed here emerged only in 2016, the final year of the evaluation period (Table 5.1). It could be that the number of outcomes from CCAFS' climate products has increased over the evaluation period and this time was too short for outcomes to have materialized at a larger scale.

Examples for **explanation 2** were already described in Section 3.2.2: we deliberately excluded several highly ranked, policy level outcomes (e.g. some of the results of the post-2015 UNFCCC agreement in Paris proposedly linked to CCAFS' climate information) because they seemed too complex and thus beyond the scope of this evaluation. Such cases would call for an in-depth assessment possibly using Impact Pathway-OH to try to plausibly trace back the influence of CCAFS tools; and it should be carefully considered whether the expected results and insights are likely to justify the efforts.

Explanation 3 – that there are various structural factors making it difficult to retrieve outcome cases through CCAFS' knowledge bases and network – seems to us also a likely interpretation. For example, the information on the use of climate products and their contribution particularly to upstream/ 'output-near' outcomes may get lost as valuable contacts move on, unless they are recorded and updated in CCAFS' MEL databases. Equally important may be sensitization to recognizing and monitoring such upstream outcomes in the impact pathway of projects, where CCAFS' tools more often play a direct role, so that these will be captured and reported. These factors will be discussed in more detail in Section 6 and 7.

All of the above explanations may have played a role and, with the data at hand, it is not possible to assess which had more weight. Thus the fact that considerable efforts were needed to unearth a relatively small sample of outcomes – and none for MarkSimGCM – must not be over-interpreted. It is not necessarily an indication of the extent to which the data/tools contributed to development outcomes. Still, from the outcomes assessed here we can learn what has influenced their emergence.

Conclusions on factors influencing the achievement of the outcomes

Insights into the second aspect of effectiveness – who and what contributed to the outcomes – were discussed in Section 5.3. Interestingly, CCAFS internal evaluation staff was not familiar with many of the outcomes and a substantial number of the contributing organizations were not CCAFS partners. Thus, influencing development outcomes outside of its own network, **CCAFS has maintained its mandate as an IPG provider**. Further, apart from providing the climate data/tools, CCAFS did not play an active, facilitative role in most of these outcome cases, such as supporting the use of the tools or connecting stakeholders.

Where CCAFS was directly involved, they employed a bouquet of additional strategies which constitute **supportive enabling factors for the uptake of climate research**. Both CCAFS partners and non-partners often worked in collaborative partnerships; involved target audiences directly in their projects; built capacity; or engaged in advocacy. Sometimes, these additional strategies seemed just as (if not more) important than the climate information produced with the tools. For example, in the

FotF outcome (B10) the reflection on socio-economic factors and the careful preparation of the learning journeys were key factors to facilitating change.

Also, the outcomes show that the **specific role and use of a climate tool** in an intervention has to be considered when assessing the **importance of its contribution**: In the FotF case, the Climate Analogues tool was deliberately not used for deriving accurate predictions about climate analogue sites, instead it was effectively employed to facilitate **critical reflection and learning**. In other cases, **scientific credibility and reliability** were a crucial factor, like in the Timor-Leste case (S05). Here, data produced with the GCM Climate Portal was repackaged and presented in an accessible format to government and NGO stakeholders, who trusted the information to be meaningful and reliable and thus were convinced to prepare for a nearing El Niño event.

Conclusions on factors influencing the non-achievement of outcomes

Finally, we also encountered cases where the use of the climate tools did not (yet) lead to outcomes:

- A researcher at a university in Kenya modeled the impacts of CC on sorghum growing regions using the GCM Climate Portal. He presented his work at a conference in 2014 and co-authored a paper in the conference proceedings. However, so far policy makers and other key stakeholders have not made use of the findings. According to the researcher, **scientific research is not given the attention it deserves, especially if it is produced by local "unknown" researchers** (S03).
- A researcher at the Soils, Water and Environment Research Institute, Agricultural Research Center (SWERI), Egypt, used MarkSimGCM to study the effect of CC on the water requirements of various crops in Egypt. The research outputs were targeted at policy makers in the agricultural sector, potentially influencing irrigation water management and mitigation of CC effects on crops; yet, the researcher found that although her work was acknowledged, **CC was not prioritized as a theme** within her institution (S15).
- In 2011, a researcher from the Environment Agency in Abu Dhabi, United Arab Emirates (UAE), found the GCM Climate Portal through an internet search and used the tool for modeling of reptile species distribution ranges in UAE under current and future predicted climates. The study concluded that 13 out of 70 reptile species assessed might become extinct due to unsuitable habitat rendered by CC. Yet, this study was purely **a personal initiative of the researcher** and not commissioned or sponsored by the Environment Agency; as of now, there are no steps being made either in planning or implementation based on the outcomes of this study (S13).

The survey speaks of many further cases where research results have not (yet) been taken up and turned into (even 'output-near') development outcomes: 17 of the 45 survey respondents had used CCAFS' climate products for "research or tool development" and specified that their results had not (yet) been used to "*influence awareness, policies or practice changes*". Nine of these users were affiliated with universities (Volume 2, Section 3.4).

These results suggest that while development outcomes clearly did materialize, it may be interesting to explore in more depth to what extent researchers can be supported to make better use of the results, i.e. how the **effectiveness of research uptake could be further increased** through enhanced facilitative strategies of CCAFS and others (Section 7).

Box 5.5.1: Resulting key questions

1) *How can CCAFS balance its efforts between the delivery of state-of-the art climate products on the one hand, and facilitating the outcome delivery from such climate information on the other?*
2) *Where are opportunities to improve strategies that will enhance the achievement of outcomes from CCAFS' climate products?*

5.5.2. Relevance

The relevance of development interventions can be discussed in several aspects (see OECD-DAC criteria). We focus on the question whether the outcomes influenced by CCAFS' climate products were **consistent with CCAFS planned contribution to CGIAR overall goals**.

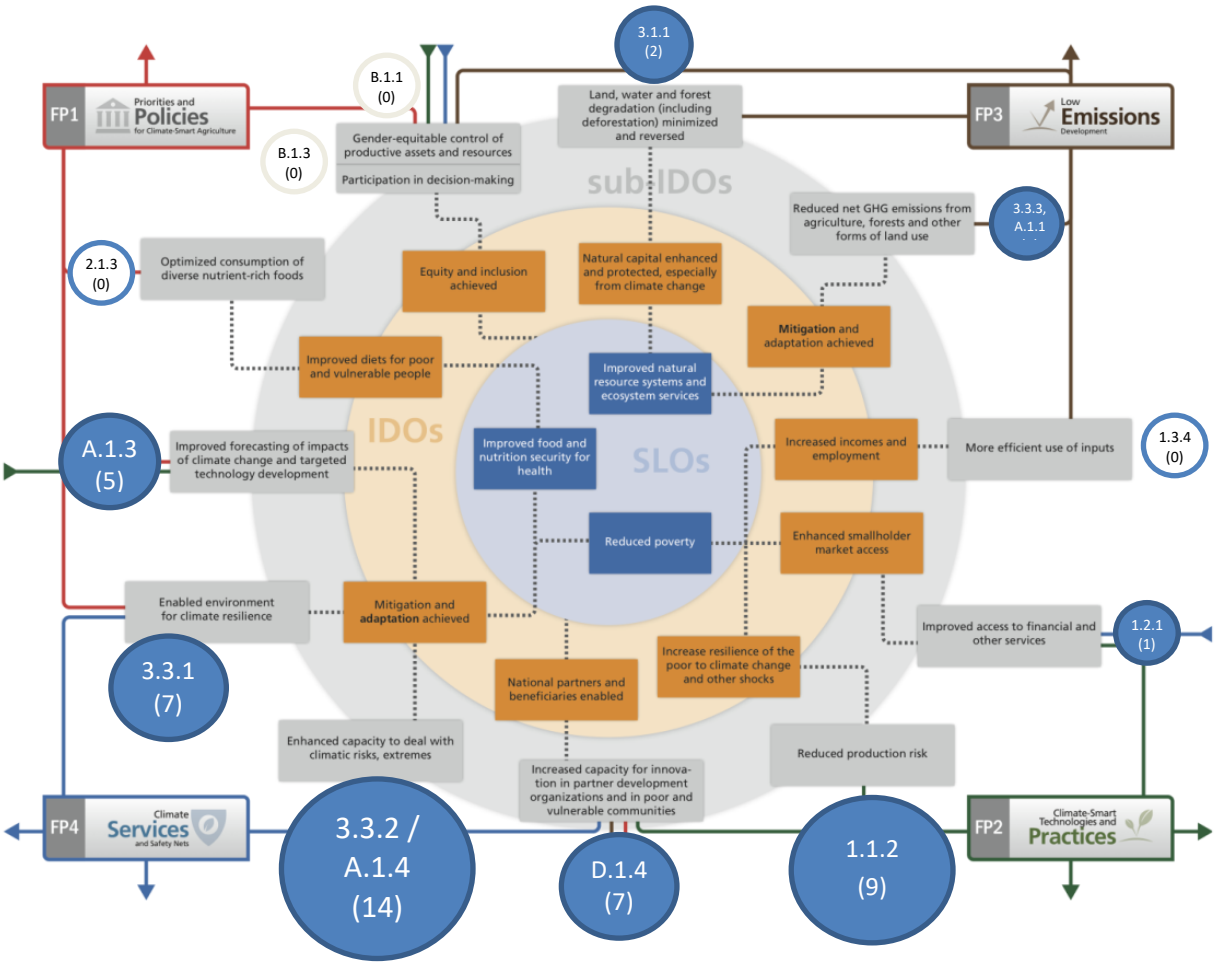


Figure 5.5.2: 14 SMART outcomes mapped onto 12 sub-IDOs selected for CCAFS' Phase II. Original figure taken from CCAFS' Full Proposal Phase II p7, showing the targeted SLOs, IDOs and sub-IDO and their relation to the four Flagships. The size of the blue circles correlates with the number of outcomes that mapped onto a particular sub-IDO. Outcomes were not assessed for the cross-cutting sub-IDOs on gender/youth (B.1.1-3).

Given the lack of an explicit ToC or impact pathway for the three CCAFS' climate products for Phase I, we thought it would be useful to conduct an analysis in how far the type of outcomes observed would support CCAFS' delivery against the new CGIAR Strategy and Results Framework (2016-2030) for its Phase II (2017-2022) (here abbreviated to "SRF Phase II").

On the system level, CCAFS aims to contribute to three goals: reduced poverty, improved food and nutrition security for health, and improved natural resources and ecosystem services (System Level Outcomes, SLOs). There are Intermediate Development Outcomes (IDOs) linked to these and four cross-cutting themes, one explicitly mentioning CC ("*Mitigating and adapting to climate change risks and shocks*"). Below this level, CCAFS identified 46 Sub-Intermediate-Development-Outcomes (sub-IDOs), which represent "*research outcomes adopted by immediate users such as National Agricultural Research Systems (NARS) researchers and national policy makers*" (SRF Phase II). For Phase II, CCAFS focuses particularly on 12 selected sub-IDOs (Figure 5.5.2).

We used all 46 sub-IDOs as our reference point[12] onto which we mapped the 14 SMART outcomes observed in this study in an attempt to link them to the overall CGIAR development goals (Annex 9.5). This should be taken as a very crude analysis since the formulation of the sub-IDOs sometimes allowed various interpretations. Also, we did not map outcomes onto sub-IDOs that seemed to be too general and thus not informative, applying to all outcomes, e.g. "*Increased livelihood opportunities*" (1.3.2[13]) and "*Enabled environment for climate resilience*" (A.1.5); or that were gender/youth specific since we had not assessed the SMART outcomes in this respect (B.1.1-3).

[12] In effect there were 42 unique sub-IDOs, four seemed to be duplicated (see Annex 9.5)
[13] Numbers correspond to those used by CGIAR

The 14 SMART outcomes mapped onto 26 sub-IDOs (Annex 9.5). Among these were eight of the 12 sub-IDOs selected by CCAFS for Phase II (blue circles in Figure 5.5.2), particularly:

- "*Enhanced adaptive capacity to climate risks*" (3.3.2, all outcomes);
- "*Reduced smallholders production risk*" (1.1.2, 9 outcomes);
- "*Increased resilience of agro-ecosystems and communities, especially those including reduced smallholders*" (3.3.1, 7 outcomes);
- "*Increased capacity for innovation in partner development organizations and in poor and vulnerable communities*" (D.1.4, 7 outcomes).

In addition, the 14 SMART outcomes could also be mapped onto 16 sub-IDOs that had not been selected by CCAFS for Phase II, e.g. "*Increased access to productive assets, including natural resources*" (1.4.5, 7 outcomes); or "*Enhanced conservation of habitats and resources*" (2.3.2/3.1.2, 6 outcomes).

There were sub-IDOs to which both GCM Climate Portal and Climate Analogues outcomes potentially were relevant, e.g. "*Enhanced adaptive capacity to climate risks*" (3.3.2/A.1.4), or "*Reduced smallholders production risk*" (1.1.2, 9 outcomes). Notably, there were also sub-IDOs to which only GCM Climate Portal outcomes mapped, and others where only Climate Analogues outcomes potentially contributed, e.g.:

- GCM Climate Portal: "*Enhanced conservation of habitats and resources"* (2.3.2, 3.1.2) and *"More productive and equitable management of natural resources*" (3.2.1);
- Climate Analogues tool: "*Diversified enterprise opportunities"* (1.3.1) and *"Closed yield gaps through improved agronomic and animal husbandry practices*" (1.4.2).

This exemplary analysis shows that i) it is possible to map outcomes influenced by CCAFS' climate products onto the SRF Phase II; ii) these outcomes are relevant to CCAFS' planned objectives; and iii) more detailed analyses of this kind will provide deeper insights into where exactly in the Flagship Impact Pathways CCAFS' tools play a role, and to what extent.

Box 5.5.2: Resulting key question

3) *How can CCAFS improve its MEL System to adequately and timely inform the strategy decision process with respect to achieving outcomes resulting from CCAFS climate products?*

5.5.3. Sustainability

The extent to which the outcomes and benefits will be maintained even after the formal support of a program has ended is difficult to assess, and increasingly so when programs are in their early stages like for some of the outcomes we looked at here. In this section we highlight selected cases from the ultimate, intermediate and immediate levels (Section 5.2) with respect to their sustainability and examine the factors that might have influenced it.

Ultimate level outcomes

Two outcomes on the ultimate level catch the eye: the S4N India program and the FotF implementation in Africa, where there has been a shift in thinking and practice in the stakeholders involved and this over years and in growing numbers. This can be taken as an indication that there will be some post-funding sustainability. In both cases, the end-users or beneficiaries of CCAFS' research were engaged directly and strongly from the start of the project, and individual as well as systems perspectives were included in the project planning. This **assessment and fostering of community readiness** to adopt and implement CCAFS' outputs and activities may be an **essential enabling factor for both effectively influencing change and increasing its sustainability**. Other enabling factors observed in both cases were also already discussed earlier: collaborations with strategic stakeholders (government institution, universities, NGOs), and capacity building through training and technical assistance.

Intermediate level outcomes

Four of the six outcomes on the intermediate level concerned policy changes of government bodies with respect to CC adaptation planning in various stages of implementation. In outcome S01 Australian National Resource Management groups integrated climate information in their regional plans; S04 refers to the verbal agreement to include climate data in the South African National Biodiversity Assessment; in S05b the government of Timor-Leste committed around 12 million USD that were then spent on reserve food stocks to reduce risks from the nearing El Nino event; and case S11 describes the approval of a national program aiming to extend the coverage of irrigation and improve water use efficiency in India.

While these are important outcomes, suggestive of practice changes in the future, and it would be advisable to follow up on some of these through in-depth assessments, it is **not easy to make predictions on the sustainability of such national or sub-national policy level changes**. National policies, regulations and plans may change over time and with changing legislatures. It is therefore important that CCAFS and other stakeholders in the CC arena continue also their policy level efforts on multilateral strategies to foster long-lasting national commitments, although even this may not be a guarantee for sustainability (see Paris 2015).

Immediate level outcomes

One case stands out among the outcomes on the immediate level, involving the use of the Climate Analogues tool for the work of Concern Worldwide in Chad and Sudan. First, the adoption of the FotF approach – or at least of employing the Climate Analogues tool for exploring options for farm-to-farm visits together with other parameters – by an organization outside of CCAFS' 'sphere of control' in various of its projects or programs and for planning speaks for the **sustainability of the approach as such**. Second, the project may have a **far reaching influence on the CC funding environment**: a report on the pilot project was seen positively by the DFID advisor, despite initial doubts concerning the approach. According to Paul Wagstaff from Concern Worldwide, "*the results of the pilot study will be highly significant, potentially changing the way how DFID will work by motivating them to integrate climate modeling into their programming*."

Thus, indications for sustainability can be found for outcomes on each level and there are various options for CCAFS that are worth exploring what can be done to further increase the probability of such behavior changes to be sustained. Strategies for this will vary depending on CCAFS strategic orientation balancing their role as climate product provider and/or facilitator of climate information uptake (Section 7).

Box 5.5.3: Resulting key question

4) *Where are opportunities for CCAFS to increase the sustainability of results achieved through the influence of their climate products?*

6. Insights from the evaluation process

In this section we present observations from the evaluation process – a very participatory learning journey - highlighting key points concerning the evaluation methodology and how it performed within the environment of CCAFS' existing MEL system and partnership structure and programming.

6.1. Useful adjustments to the evaluation design

The previous evaluation of CCAFS' products 2014/15 looked at the usage of CCAFS' products by researchers and captured their perspectives on how useful these potentially could be for influencing outcomes. Two years further down the line, we wanted to challenge ourselves and go further by assessing if and how three of these products had actually contributed to development outcomes. The initial evaluation design aimed for identifying one or two confirmed and highly ranked outcome areas for each of the three climate tools from CCAFS' own programs and projects, clarifying that they

indeed contributed directly or indirectly to these, and unpacking them further to examine their specific contribution using Impact Pathway-OH, as described in Section 3.4.

Complementing the OH approach with retrospective impact pathways building and elements from Contribution Analysis (Impact Pathway-OH) worked well to dig deeper in one outcome area, the S4N India program (Section 5.4.2). It helped to better understand the direct or indirect influence of the Climate Analogues tool on the different types of outcomes described for the program; and hence ultimately to assess its role in achieving overall program results.

Yet, it took considerable efforts to find suitable, previously confirmed and highly ranked outcome areas, where we could establish a plausible linkage to one of CCAFS' climate products. For example, from the 27 cases ranked "*Excellent/5*" or "*Relatively good/4*" in the outcome assessments 2013-2015 we selected five promising cases (Class A), and only one of these, the S4N case, seemed useful for the Impact-Pathway-OH methodology within the scope of this evaluation. Therefore we fell back on a broader OH approach, harvesting in a less targeted way by including, e.g., a survey to tool users to find outcome leads.

This **adaptive character of the OH methodology proved to be very successful**: first, the decision to include a survey and the resulting data strengthened the finding that CCAFS' products are widely used around the world, also beyond CCAFS' own partner network (Volume 2, Section 3.1.3); second, half of the 14 SMART outcomes described here were retrieved through the survey. These cases would not have been available through CCAFS' network and MEL system.

Overall, the OH approach resulted in **useful evidence to address the evaluation questions**. While we did not explicitly include a "substantiation" step (OH Step 4), we invested much time into drafting verifiable and plausible outcome stories with the informants, scrutinizing the narratives rigorously to comply with the SMART criteria. Also, many of our informants were external to CCAFS and thus, although we omitted substantiation as it is described in Step 4 of OH, we received knowledgeable external views on CCAFS' climate products.

6.2. OH in the context of CCAFS' partnership structure, programming and MEL system

CCAFS has built and maintains an amazingly disbursed network and multi-facetted partnerships. CCAFS' **project landscape is therefore extremely rich** and programs cover a broad range of strategies and activities, and not all are streamlined into its project portfolio and embedded in a common strategy framework (SRF Phase II). This had some implications for the evaluation process:

While the results from many projects and programs were readily available through public and internal **CCAFS knowledge bases,** including project descriptions, blogs, reports and assessments, these documents sometimes **did not specify whether any of CCAFS' climate products were used and if so, which**. Hence, in some cases we followed leads where the use of climate information seemed apparent and the use of CCAFS tools possible, but that in the end were not linked to any of CCAFS' products. For example, various cases mentioned national and regional meteorological stations producing historic and monitored climate information at a scale relevant to rural communities (e.g., A04); yet, none employed one of the tools assessed here during the evaluation period. One informant stated with respect to results at meteorological agencies that there was "*a lot of capacity development for people who asked his input, but nothing on higher level outcomes*." (Peter Jones, Waen Associates, UK).

Also, the **taxonomy of programs/projects and their interrelationships were not so clear, even within the realms of work funded by CCAFS**. It was very time intensive to gather and compile the dispersed information on a specific program, or to reconstruct how a particular project that used one of the climate tools influenced other related work and outcomes. This problem was acknowledged, e.g., in the outcome assessment 2014, where "Farms of the Future" (B10) was mentioned as one potential contributing factor to a highly ranked result of CCAFS' Coordination Unit, namely "*CCAFS informs*

large-scale global and national investments in food security and CC"; yet it was stated that "*it is not entirely clear what the uptake of CCAFS research has been in these investments.*" (See Section 5.4.2 for a further example involving the S4N program).

Related to this was the finding that some of CCAFS' **published and assessed outcomes were so far downstream from the contribution of the climate data/tools that information on their specific use got lost over time** and among other contributing outputs and activities important to report**.**

Further, since CCAFS' programs are set up and work in a very participatory and inclusive manner with often geographically disbursed responsibilities, employing a participatory approach and following up through interviews took time and resources and in some cases was not successful. For outcome leads from projects that were in their later cycles or had already ended it was an ambitious endeavour to **find the appropriate informants who would still be aware of all detailed steps** from the use of CCAFS' data/tool through to the observed development outcomes. An example for this may be the Ethiopian Climate Change Adaptation Strategy case (A14), where it took substantial amounts of time and effort to unearth information and knowledgeable contacts, only to learn that the GCM Climate Portal indeed had been used for various purposes by the CCAFS organization contributing to this outcome (CIMMYT), but not for this particular area of work. In other cases, **contacts had moved on** after the project was finished, or meanwhile had **other obligations and time commitments** so that they could not dedicate their spare time to provide information for the evaluation.

Finally, CCAFS outcomes definition communicated as guidance for project planning and reporting currently includes only very downstream/'impact-near' achievements (Section 3.2.1).Thus, **network members may not have been sensitized to reporting on immediate and intermediate outcomes**, making our inquiries within the network far less successful than what would have been possible.

In sum, while we observed a **very positive attitude and invaluable support from the informants** contacted during the evaluation from organizations both internal and external to CCAFS network, as well as ample appreciation for the products CCAFS' provides (Volume 2, Section 4), it still has been an elaborate and resource-intense evaluation. Harvesting and the reconstruction of impact pathways was challenging due to i) the disbursed information across a large dynamic partnership network, and ii) inherent challenges in CCAFS' MEL infrastructure. The partnership approach is an important cornerstone of their ToC (as stated CCAFS Phase II proposal) and essential for the achievement of their development goals, yet, CCAFS may benefit from finding improved systems to identify and keep track of a multitude of relevant results, share these through appropriate knowledge management and brokerage structures, in order to synthesize insights and lessons learnt for planning and strategy development (Section 7.3.3 and 7.3.4).

6.3. Lessons learned for future use of (Impact Pathway-) Outcome Harvesting

While CCAFS is currently following a rigorous outcome definition, postulating large numbers of end-users who benefit from the R4D products (Section 3.2.1), OH also encourages the capturing of upstream (output-near) changes, accepts these as outcomes and untangles the diverse influences that have led to results. Methodologies such as OH can highlight how CCAFS enables stakeholders to move from where they are now into the direction where they want to be, and how the key actors achieve progress along their intended path of change; they can make this role more visible and strengthen CCAFS' position as innovator and pathfinder in the CC adaptation and mitigation field.

In this section we present some insights on what it takes to do outcome-based evaluation, i.e. identifying and describing outcomes, and/or following-up and tracking back linkages from acknowledged/ confirmed development outcomes to the contribution of CCAFS R4D work, e.g., CCAFS climate products. The experience of this evaluation shows that it takes time, patience, endurance and resources. Preparedness to follow leads through sequences of interaction and interviews with people is a procedure that might be perceived as winding and difficult, however, it is a standard in any outcome-focused evaluation.

The participatory character of the OH methodology also takes considerable time from the evaluation team counterparts within the organization, i.e. CCAFS. Unlike other evaluation methodologies, they have to get used to the practice of getting deeply involved in the evaluative work, e.g. coordinating work and communication internally and contributing to writing outcome statements. In some evaluations there is a vivid exchange of outcome narratives among the internal staff in order to amend and verify descriptions and/or add additional outcome statements. Here, time constraints allowed only a limited hands-on involvement from CCAFS' internal evaluation counterparts to engage in the actual writing of outcome narratives. They took on a more coordinative role identifying valuable contacts and connecting the external evaluators to CCAFS informants from specific outcome areas. Particularly the contacts involved in the two focal projects S4N (A13) and FotF (B10) contributed substantially to drafting the narratives in Volume 3 and in a very participatory way engaged their respective team members to share, review, amend and add data. We anticipate that the results of this evaluation will be communicated more widely within the management team as soon as the report is publicly available, hopefully initiating discussions on the strategic implications of the findings. In addition, the outcome narratives can be shared throughout the network, informing about previously unknown results achieved through CCAFS' climate products, as well as potentially stimulating a discourse and eventually harmonizing the perception and understanding of CCAFS' outcomes' definition.

The below summarizes some general lessons learnt that may be useful for potential **future OH evaluation[14] activities** in CCAFS' projects or programs:

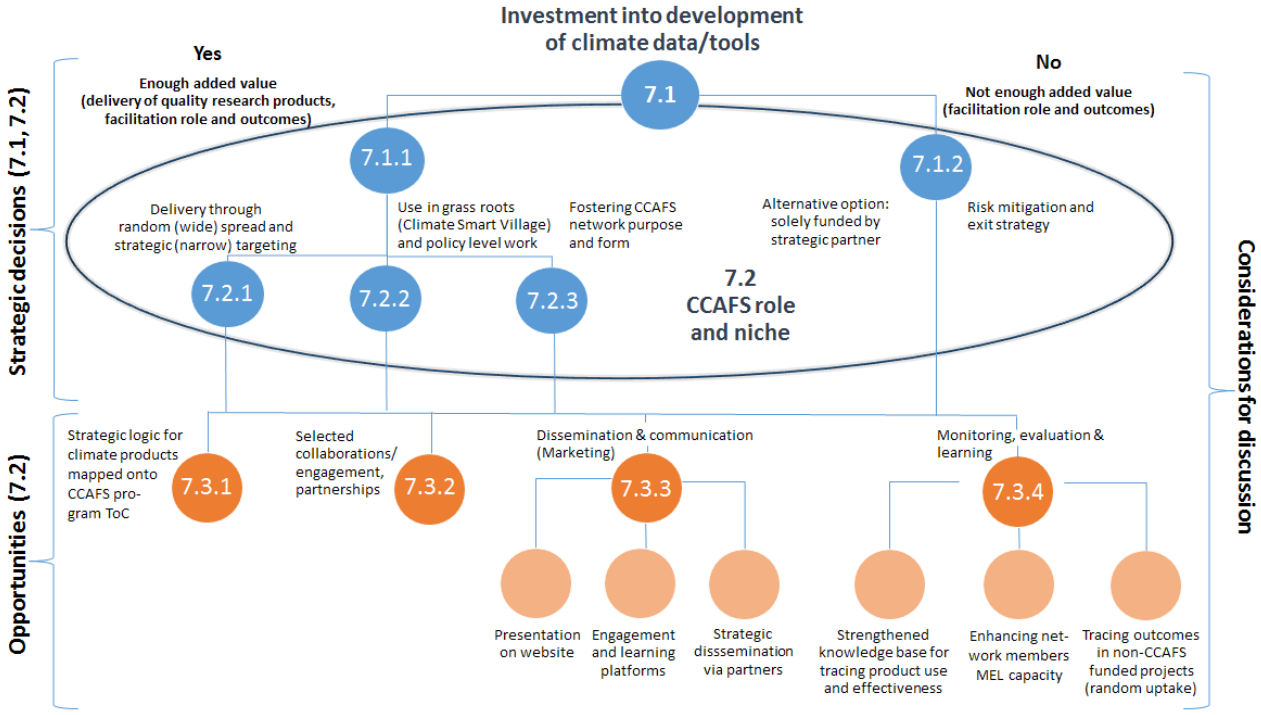
1. **Maintain the participatory, adaptive character of the methodology** from the design through to the validation with CCAFS partners to be able to make the necessary adjustments according to the insights gained during each of the phases. The participatory approach also has a promotional component: for example, some informants in this study used the opportunity to read up on new developments concerning CCAFS tool development and strategy.
2. **Clearly define roles within the evaluation management team** and allow time for finding suitable internal contacts supporting the outcome drafting; if appropriate, build capacity through training sessions within the team and facilitate internal sharing of outcomes data. Note that such sharing involves further time commitments, but can also have positive effects such as increased ownership and a shared understanding of the results.
3. **Build on the good relationships within CCAFS' network**: time and resource limitations of people who can contribute valuable facts and insights will always be a challenge in a participatory outcomes evaluation approach like OH. The informants in this study were prepared to commit time to provide input, which we believe was partly due to i) the fact that they felt positive about the CCAFS' contribution and ii) the personal connections to CCAFS staff.
4. **Decide clearly whether the harvest should be broad, covering various projects and programs, or more targeted**, focusing on particular programs. If the first, focus on those that are not too complex where it is possible to establish a linkage of downstream outcomes to the influence of CCAFS' research outputs (e.g., changes in multi-lateral policy strategies are likely to be influenced by many actors many factors and thus difficult to assess). If a more targeted approach is chosen, consider using an Impact Pathway-OH approach, including few selected outcome areas likely to be linked to a tool and focus efforts on unpacking outcomes within these areas.
5. For **Impact-Pathway-OH evaluations** it will facilitate the work when focusing on ongoing **projects where people are still involved and not too disbursed**, although in this evaluation we experienced that the approach was successful even though the key informants had retired or moved on to new positions in other organizations. They were still very dedicated to participate in several rounds of interviews and outcome drafting to provide information to the evaluation team (see Acknowledgements).

[14] Some of the outputs and learnings of this evaluation potentially can inform the future monitoring of outcomes based on the OH methodology, e.g., the code book in Volume 4 of this report.

7. Recommended points for discussion and opportunities

CCAFS has just started its Phase II 2017-22 with four Flagship Programs and a series of impact pathways linking its research activities and outputs to the desired overall outcomes. Drawing from the findings and conclusions in the previous sections, this chapter presents recommended points for discussion. These may help CCAFS to decide how to make best use of their climate products in the context of CCAFS' results-based performance management and its principles[15]. Section 7.1 presents considerations for evaluating the value added of CCAFS' investment into the development and maintenance of climate data/tools and resulting options. Assuming continued investment in climate products, Section 7.2 then explores options for CCAFS' roles and niche as climate data/tool provider in the context of different delivery strategies and purposes. Finally, Section 7.3 discusses opportunities for further enhancing the contribution of climate products to development outcomes delivery and strengthening monitoring and evaluation for learning and decision making.

Figure 7: Illustration of discussion points and opportunities



The top (blue) part of Figure 7 resembles a decision tree structure depicting a range of strategic decisions concerning CCAFS' climate data/tools delivery. Only the first node involves a clear "Yes or No" choice. Nodes 7.2.1 to 7.2.3 should each be seen as gradients of choice along which CCAFS needs to balance an appropriate mix of strategies. They are meant to stimulate a discussion on CCAFS' potential niche with respect to climate data/tool delivery. At the bottom (orange) part of the diagram are the areas of opportunities for CCAFS' consideration that will be put forth for discussion in Section 7.3. They will be relevant under all strategy scenarios presented in the upper (blue) part, yet, possibly differ in their extent when implementing respective mechanisms.

[15] E.g. '*Three-thirds principle: Allocate resources in three thirds – needs, research, capacity*', CGIAR 2016. Full Proposal Phase II 2017-2022, and the '*Ten principles for effective AR4D programs*' (Vermeulen & Campbell, 2015).

7.1. CCAFS investment into climate data/tools

Currently, CCAFS co-funds and conducts jointly projects with selected strategic and collaborative partners to develop, maintain and support open access, easy to use climate data/tools that generate high quality data focused particularly (but not exclusively) on the agricultural sector. This study presents evidence for contributions of the GCM Climate Portal and the Climate Analogues tools to mostly immediate and intermediate development outcomes, and only few ultimate outcomes. The ultimate outcomes were all linked to the Climate Analogues tool and included for example a case where 15'000 farmers engaged in testing new seed varieties and helped to establish Community Seed Banks in the S4N program India. Yet, it took considerable efforts through Impact Pathway-OH analyses, to evidence plausibly how exactly the tool contributed directly or indirectly to such downstream development outcomes.

Under increased pressures to deliver and report on development outcomes, does it make sense for CCAFS to invest in the generation of climate tools that in many cases may have a longer-term and only indirect influence on such achievements? Could CCAFS leverage its efforts better through financially supporting projects from e.g. previous R4D work that is close to realizing development outcomes and/or is easy to be reported on?

Against this backdrop it might be worthwhile to revisit and evaluate the question in how far climate data/tools are still a useful component of the 'CCAFS-branded' product portfolio, or whether it would be time to focus CCAFS' R4D efforts on other methods and approaches, handover the tools' further development, maintenance and dissemination to carefully selected partners, and rely on climate information from these or other platforms that the CRP itself does not, or no longer fund and support. The following may be helpful guiding questions for CCAFS in such a decision process:

i) Does CCAFS accept and value immediate and intermediate outcomes as important steps indirectly influencing downstream development outcomes?

ii) What is the added value of climate data/tools to next- and end-users of research outputs generated with these tools, and those using and producing the tools, i.e. CCAFS assuming it continues investing in these?

iii) And finally, since effectiveness is only one dimension to consider and efficiency will have to be drawn into the equation, will continued co-funding of climate product development and maintenance costs hold up against the Value for Money question?

This evaluation provided insights that feed into the discussion of questions i) and ii). The **finding that the climate tools have an effective influence on upstream development outcomes** and that these can **indirectly contribute to downstream results** supporting CCAFS goals (as in the S4N case), should be taken into consideration when the CCAFS management team wants to position the CRP strategically in response to question i). The next section discusses in more detail question ii), first highlighting the added value that a continued funding of tool development and maintenance could offer CCAFS (7.1.1), and then considering options if funding was stopped (7.1.2). Question iii) is beyond the mandate of this study.

7.1.1. Added value of CCAFS' continued funding into development of climate data/tools

The added value of CCAFS continued funding into the development of climate data and tools can be considered from three perspectives: There is the value proposition for i) the users of research outputs influenced by climate information derived from the tools, ii) those using the CCAFS' climate tools to generate such climate data; and iii) CCAFS and its strategic partners as the developers and providers of these climate products.

Added value for users of research outputs informed by CCAFS data/tools

Users of climate projections and other outputs generated from research involving CCAFS' climate data and products are provided with results based on **scientific, robust, credible climate information**

suitable for the agricultural context. Development partners can use the data for their planning, investment, programming decision making, policy formation, etc. and/or for developing and implementing adequate solutions fostering the adoption of climate adaptation and mitigation options by end-users (e.g., enabling them to take up resilient farming practices). The use of adequate and reliable climate data can help promote the achievement of CCAFS goals and mandate, which reaches into the added value from CCAFS perspective.

Added value to users of the tools CCAFS and other organizations generating research outputs

Researchers using CCAFS' climate tools (primary users) show a great diversity, ranging from, e.g. academic institutions, national government research agencies, to NGOs (see TANGO evaluation and Volume 2). The tool users interviewed or responding to the survey in this study conveyed a high appreciation of CCAFS climate data/tools, far beyond its own network of research and development partners, both of the primary and meta-functions of the tools.

Primary functions that tool users appreciated and benefitted from:

- **Accessible, publicly available free of charge tools with high user friendliness**, and therefore, optimal for research studies generating evidence on climate impact, species/habitat modeling, climate risk screening, etc.
- **Provision of high quality data** for CC research with sufficient spatial and temporal resolution with a focus on agriculture, e.g. "*downscaled to a resolution useful for studying biotic responses to climate*" as one user stated.
- **Technical support and capacity building** opportunities, although only few researchers outside of CCAFS network took advantage of CCAFS support.

Meta-functions that tool users experienced:

- **Building reputation** for providing high quality research outputs (e.g. S05, Timor-Leste)
- **Learning and engagement:** use of the data or tools helped to motivate audiences to participate in programs, supporting the communication of CC risks and potential adaptation / mitigation measures (e.g. B10 FotF).
- **Enabling networking** among the climate data research community, e.g. through providing a platform for exchange and a mechanism for bringing data together.
- **Supporting research programming fundraising:** innovative use of CCAFS climate tools may inform research agendas and stimulate funders to commit resources to research programs (e.g. PW2, Concern/DFID).

Added value to climate tool developers and providers

CCAFS and its partners benefit from all of the above, plus some additional meta-functions:

- **Support for CCAFS' learning and innovation** as a vehicle to keep CCAFS researchers up-to-date with state-of-the-art CC science through i) close partnerships with the developers of tools; ii) testing and validating the tools in the field and thus guiding tool development strategies.
- Use of the tools as a **strategy to mainstream CC across the CGIARs portfolio** as a cross-cutting topic, and even wider. Proposal Phase II Executive Summary states: "*CCAFS' role is to ensure integration on climate change across the CGIAR portfolio by providing the tools and advice on priorities in different contexts, making the links to the climate science community, and representing CGIAR in climate-related policy processes*."
- **Increasing CCAFS' visibility also to unanticipated (non-targeted / unknown) audiences**, using the tool websites to attract interested CC researchers, i) as an entry point for engagement / potential collaboration; ii) promoting CCAFS' projects and learning in the wider CC world;

- **Building CCAFS' reputation / branding as a provider** of reliable, good quality climate data and tools for the agricultural sector, scientific credibility and competence in the quality of research behind the tools ('go-to organization' on climate tools and data);

Thus the development and dissemination of tools can help to fulfill CCAFS mandate to catalyze positive change towards climate smart agriculture, food systems and landscapes, on the one hand directly by making available user oriented climate information; on the other there are decisive strategic benefits to CCAFS[16]. In how far these benefits outweigh investment costs and how important they are compared to those of alternative investment options is the key discussion CCAFS has to lead.

7.1.2. What if CCAFS stopped investing into the development of climate data/tools

Should CCAFS consider the option of pulling out of funding climate data/tool development, i.e. leaving this utterly to partner organizations, this would call for an assessment of **potential risks, e.g.:**

- Missing out on a learning and innovation strategy if not involved directly in climate tool development; CCAFS would have to find other ways to stay on top of the latest research findings;
- Losing direct influence on the development and quality assurance of the tools and thus having less access to tools and data that are in the best possible way adapted to CCAFS' purposes;
- Risking that the software of choice may become commercial at some point in the future;
- Losing the opportunity of getting credits for the development of climate tools and the reputation that comes with it; CCAFS would have to focus on other R4D areas to demonstrate competence in the field of CC, agriculture and food security.
- Losing the tools as entry points to their online platform and communication tools, and the visibility and opportunities for communication and engagement that come with it;
- Losing a mechanism for mainstreaming CC across the CGIAR CRP portfolio and network.

CCAFS could deploy other strategies and take on alternative attractive roles with respect to propagating state-of-the-art climate information that would help to **mitigate these risks** to some extent. One way would be to use the resulting free resources for strengthening and focusing on a potential brokerage role. Instead of acting as tool developer, CCAFS could become a one-stop shop for expertise and knowledge on a broad range of CC tools, platforms and data available from the various sources, offering users guidance on their purposes, advantages and disadvantages (Section 7.2). It could thus act as a knowledge broker, mediating between the services of tool providers and the needs of data/tool users, and possibly also as a broker for partnerships connecting users and developers. Both CCAFS partners and non-partner organizations would benefit through such a 'network service'. However, just like for the contribution of the tools, linking such a service to the resulting development outcomes is not an easy task and here, too, CCAFS would be faced with the challenge to assess Value for Money.

In any case, a decision to withdraw resources from tool development would call for a carefully thought out **'exit strategy'.** It would require the design of a plan on how best to transfer ownership and responsibility of the current software back to the strategic partner organizations that developed the software (e.g. CIAT, ILRI, University of Reading) or to carefully selected other strategic partners, while putting in place mechanism and agreements to mitigate the above-mentioned risks. These would need to ensure that previous investments, intellectual property into the tools and the tools themselves remain available to the CC community to support progress towards CCAFS' goals.

[16] See Cash *et al*., 2003: *"...efforts to mobilize [science and technology] for sustainability are more likely to be effective when they manage boundaries between knowledge and action in ways that simultaneously enhance the salience, credibility, and legitimacy of the information they produce. Effective systems apply a variety of institutional mechanisms that facilitate communication, translation and mediation across boundaries".*

7.2. CCAFS' roles and niche as climate data/tool provider

Assuming that CCAFS will continue investing in climate products, this section looks at how CCAFS can refine its particular niche with respect to delivering climate products and facilitating climate research uptake by taking a range of strategic decisions. In the following, three dimensions of particular relevance for such a strategic positioning process are highlighted: i) fostering wide-spread use of tools versus narrow targeting (Section 7.2.1); ii) use of CCAFS' climate research outputs in grass roots and policy level work (Section 7.2.2); and iii) utilizing CCAFS' climate products to support both network purpose and form (Section 7.2.3). Each of these presents not alternatives but gradients of choice along which CCAFS can balance the amount and intensity of its activities.

7.2.1. Wide-spread use of tools and narrow targeting

CCAFS' IPG mandate supports a random dissemination of the climate products via their online portals and a wide-spread uptake by data/tool users world-wide. How users employ these IPGs, and for what purposes, is mostly beyond CCAFS' 'sphere of control', and strategies for how to influence the wide-spread uptake are limited (see below). CCAFS' products can support projects not directly contributing to CCAFS' goals (e.g. S14, Annex 9.2). Monitoring the wide-spread uptake of CCAFS' data, tools and related outcomes is demanding and can be at best fragmentary, since many users do not belong to the CCAFS and CGIAR network and/or their use of the tool is not known to CCAFS; and ex-post assessments of tool use and potential outcomes (as in this study) are resource and time intensive.

Hence, in the context of a program with limited, often unsecured funding, a relatively short timeframe (2017-2022), and a growing demand for reporting and assessing outcomes, the question arises if CCAFS might benefit from focusing (some of) its facilitation and monitoring activities in a more narrowly targeted way. This builds on Jim Ryan's 2006 discussion of IPG uptake, pointing to a need for increasingly leveraging synergies in CCAFS partnerships to enhance local results[17].

Narrowly targeted approaches would involve both i) facilitating outcome delivery from climate products through selected CCAFS funded or supported projects and programs which strategically use the tools and build their work on it, and ii) focusing efforts in capturing outcomes that are directly or indirectly linked to the climate tools in such targeted projects/programs.

CCAFS can leverage on existing, on-going partnerships and identify those where there are high outcome probabilities from projects or programs informed by its climate data/tools. In addition it can encourage the establishment of new projects and partnerships using a range of strategic considerations and criteria (e.g., project logic and types of desired outcomes, partners' potential role and contribution to the collaboration, geography, themes, etc.).

A key element for both (i and ii) may be to develop well-informed impact pathways for each climate product as an ex-ante impact assessment specific for each intervention that explicitly links to CCAFS overall ToC (Section 7.3.1). This, together with a network analysis (Section 7.3.2) can help to identify the appropriate partners needed to successfully implement the projects and to set up the MEL environment required to monitor project outcomes and test the tools' impact pathways (Section 7.3.4).

At the same time, the production of IPGs is part of the CGIAR/CCAFS' delivery promise (Sagasti & Timmer, 2008) and cannot be neglected. If CCAFS decides to continue investing in climate products, then it also needs to continue strengthening its role in facilitating IPG adoption, e.g. offering technical guidance on using the tools (via the tool websites, manuals, support functions) and taking measures to keep their use focused on the CCAFS mandate (e.g., adapting approaches involving the tools to CGIAR specific purposes). Also, CCAFS may consider enhancing its efforts to follow-up on the non-CGIAR affiliated use of CCAFS climate products through periodically assessing the purpose of

[17] "*With the growing imperative on [CGIAR Centers] to measure and document their impacts […], the scope for ensuring this while at the same time engaging only in the production of IPGs, may become more limited. To help ameliorate this, there is a need for a stronger focus on the complementary advantages of CGIAR Centers and their research, so that their IPG outputs have a better chance of leading to local gains in terms of poverty alleviation"* (Ryan, 2006, p19).

use, the effectiveness of the interventions and the relevance of the outcomes to CCAFS goals, e.g. through ex-post assessments.

As is evident from this evaluation, CCAFS is currently engaged in both narrow targeted approaches and facilitation of IPG uptake: for example, the Climate Analogues tool played a specific (narrowly targeted) role in the Bioversity/CCAFS led multi-stakeholder S4N India program (A13), contributing to the identification of climate smart seed varieties. Such applications are developed and tested initially in order to support CCAFS mission through CGIAR partner projects, but they can also be communicated beyond the network and taken up by non CGIAR organizations (as e.g. for the FotF approach which was adopted by Concern Worldwide, B10). Within this 'R4D-continuum' (Ryan, 2006) of developing tools, testing potential (narrow targeted) applications, implementing projects and programs to deliver outcomes, and facilitating the wide-spread uptake of data, tools and applications, CCAFS can position itself and decide where to focus its resources and efforts.

7.2.2. Use of CCAFS' climate research outputs in grass roots and policy level work

With its different Flagships, CCAFS is already balancing its R4D portfolio across different scales and target audiences. For example, the "Priorities and **Policies Flagship" (1)** aims to assess how enabling policy environments and priority setting for targeted investment can support the scaling of interventions; while the "Climate-Smart Technologies and **Practices" Flagship (2)** uses CCAFS' Climate-Smart Villages as platforms for learning how to transition to CSA at a larger scale.

CCAFS' climate data/tools can support processes at both the policy and the grass roots level, and even bring these together, as shown by the findings here. The S4N case demonstrated impressively how national level engagement, capacity building and collaboration, combined with insights from grass roots level work led to a successful out-scaling of CSA efforts (Section 5.4.2). In this example, the Climate Analogues tool had a direct influence on the national level work and indirectly contributed to behavioral changes of farmers and communities. In other cases, such as the FotF approach where the Climate Analogues tool was used in educational sessions, local stakeholders were more directly involved in interpreting climate information and learning (Section 5.4.1).

CCAFS may benefit from defining and determining more clearly how their climate products can support work on such different scales and feed into the Flagships (Section 7.3.1). This may facilitate a more targeted approach to when and where to employ the tools to achieve change (Section 7.2.1), and accordingly balance between grass roots and policy level projects and programs in support to work in support of CCAFS' goals. An improved strategic framework for the climate products could then be complemented with an adapted and strengthened MEL system in order to better capture and unpack outcomes resulting from the interventions on various scales for continued learning and accountability (Section 7.3.4).

7.2.3. CCAFS' climate products supporting network purpose and form

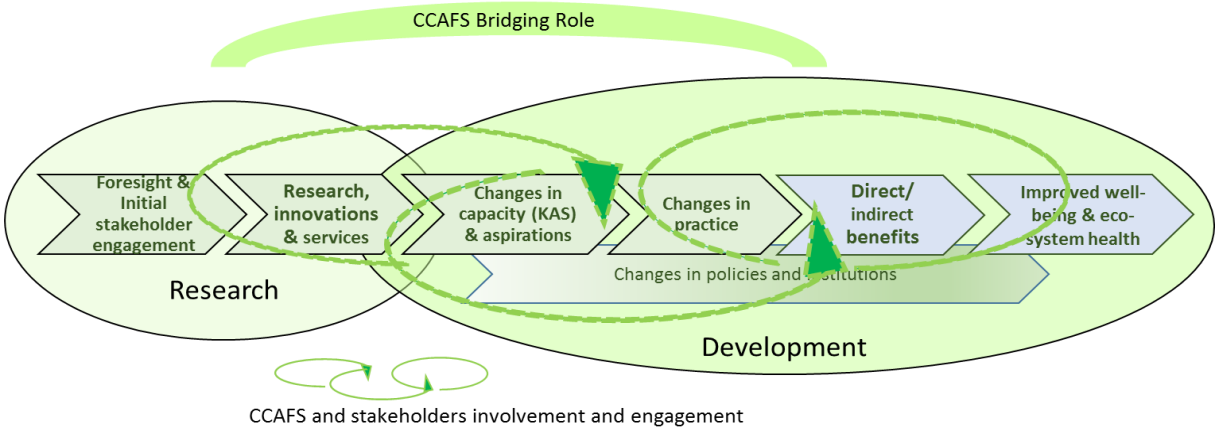
A further dimension for refining CCAFS niche – at least within CGIAR – would be from the network perspective: CCAFS has both '**network purpose functions'** facilitating the objectives and actual work of its members (e.g. connecting people and organizations, knowledge brokerage, advocacy of goals and results, fundraising for its programs); as well as '**network form functions'** fostering CCAFS structures and processes (e.g. governance, strategy and MEL system development) (Hearn & Mendizabal, 2011). CCAFS climate research outputs influence both types of functions:

Climate products supporting network purpose

From this evaluation it is evident that one of CCAFS' key strengths is having expertise in both the production of quality research outputs and the facilitation of development outcomes. It is thus well positioned with one leg in the research and another in the development arena to fulfill a **bridging role** between the science and development sectors, among different stakeholder groups, and among work on different levels of the impact pathway (Figure 7.2.3). The S4N (A13) and FotF (B10)

outcomes described here (Volume 3) are examples for such work where research approaches and outputs based on the Climate Analogues tool were tested, validated and scaled out in the field, engaging a broad range of stakeholders and thereby developing connections between supply and demand and fostering exchange and consensus.

Figure 7.2.3 CCAFS bridging and engagement role



There are a number of key facets of CCAFS bridging and engagement role that enable the network to **maintain highest standards of R4D expertise and strengthen outcome delivery** (the following inspired by Hearn & Mendizabal, 2011):

a. Building the research community that uses CCAFS climate tools (e.g. through collaborations, meetings, capacity building, partner brokerage, and more); this promotes collective learning and elaborating and realizing joint learning agendas and covers research quality and assurance of its relevance for the CC global, regional, national and local agendas;

b. Convening heterogeneous groups of next- and end-users of climate information derived from the tools, offering spaces for multi-stakeholder collaboration and exchange of ideas, findings, and (emerging) results, will facilitate learning from the multifaceted perspectives that CC as a wicked problem entails; this helps to assure the relevance of CCAFS work on different geographic scales and in various contexts and thus a successful up/out-scaling;

c. Developing and maintaining appropriate communication and knowledge management structures and processes to identify, filter, repackage and disseminate important climate information, data and tools, will help to amplify state-of-the-art R4D approaches and results among audiences within and beyond the network. They can also serve as a means for engagement and interaction with stakeholders (Sections 7.3.3 and 7.3.4).

This is strongly matched with what CCAFS proposes as its niche and comparative advantage "*CCAFS and its partners have comparative advantage in (a) science quality, (b) capacity to deliver outcomes at scale and (c) integration across disciplines and agricultural sub-sectors*." (CCAFS Full Proposal 2017-2022, p. 29).

Climate research informing network form

The form of a network follows its purpose (Hearn & Mendizabal, 2011), i.e. the work of CCAFS members will influence the organizational structures and arrangements of the network that are needed to foster CCAFS' capability to deliver outcomes. The dual nature of CCAFS' approach to CSA – facilitating targeted programs and producing IPGs for wide use within and beyond CCAFS – has already been taken into consideration in CCAFS' proposal for Phase II, i.e. "[…] *the unique focus and value-add of CSA in terms of delivering on IPGs is how these multiple goals come together both in theory and practice. This is also the reason that CCAFS will operate differently in Phase II, as an integrative platform across CGIAR and partners rather than as stand-alone entity."* (CCAFS Full

Proposal 2017-2022, p. 4); and *"CCAFS' role is to ensure integration on climate change across the CGIAR portfolio by providing the tools and advice on priorities in different contexts, making the links to the climate science community, and representing CGIAR in climate-related policy processes."* (CCAFS Phase II Proposal 2017-2022 Summary, p. 6).

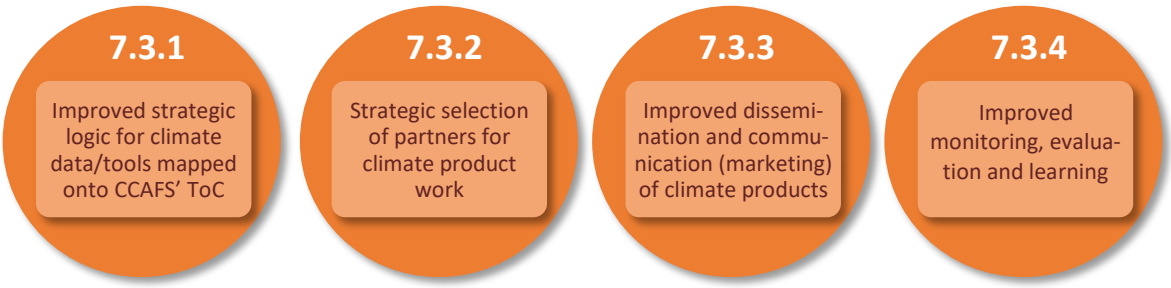
A proposed key mechanism for integrating CC work across the CRPs are the Learning Platforms (CCAFS Full Proposal Phase II 2017-2022, p. 2). Depending on how these Learning Platforms will be established and run, the CCAFS climate products could be one of several practical means of supporting the mainstreaming of CC across CGIAR and helping other CRPs in their CC impacts, adaptation and mitigation work.

Hence, as mentioned in Section 7.1.1, the climate tools can bring added value to the network apart from their direct contribution to development outcomes: they can help to bring together partners (community building, convening) and can support CCAFS' form (e.g. building an environment for mainstreaming CC across CGIAR). Yet, such purpose and form functions take resources from the network. Within its results-based performance management framework, CCAFS will have to identify the right balance between laying the foundations for its work (i.e. fostering the network form) and engaging in network purpose functions, e.g. community building, knowledge management, and fundraising directly supporting development work with a strong focus on outcomes.

7.3. Areas of opportunities

The last point of this section explains some key areas where CCAFS could strengthen its processes and mechanisms to allow for an improved delivery and evidencing of its outcomes. The areas for opportunities are like the discussion points above meant for consideration and decision making. Many of the processes are already in place; they may only need an adapted implementation varying in intensity and focus depending on the strategic decisions discussed under Sections 7.1 and 7.2. Thus, the changes will often not be very resource intensive. The areas of opportunities are structured around four main entry points as shown in Figure 7.3. These areas of opportunities will be relevant to CCAFS regardless if investment in the development of climate data/tools is continued or not – but their nature and extent will vary accordingly.

Figure 7.3: Main areas of opportunities for improved delivery and evidencing of CCAFS outcomes



7.3.1. Strategic logic for climate products and their contribution towards CCAFS' Theory of Change

CCAFS' transition to a results-based management approach to planning, monitoring and evaluation calls for a better understanding of how exactly its different climate products and applications contribute to the achievement of the overarching program ToC. The TANGO evaluation report 2014/15 already noted that *"It was not very clear what the strategic thinking had been for each of the tools being assessed […]. Thus, it was extremely difficult to identify exactly where and how most of the tools being evaluated fit into the overall CCAFS program strategy"* (p.7). Building impact pathways for the specific tools and how they support CCAFS achieving its outcome delivery promise will help to derive a more explicit and detailed definition of their added value and will inform the

strategic considerations discussed in Sections 7.1 and 7.2). Should CCAFS continue to invest in the development of climate products, such impact pathways will help to develop its partnership strategy (7.3.2), serve as a powerful tool for mainstreaming and communication of the tools to CCAFS' audiences (7.3.3), and strengthen CCAFS' monitoring and evaluation system (7.3.4). Even if CCAFS' decides to stop investing in its own climate data/tools, it may be beneficial to develop clear and testable hypotheses for how climate information (then sourced from non-CCAFS platforms) is intended to contribute to CCAFS' programs and projects and support outcome delivery as a framework for visualizing expectations, learning and decision-making.

In this evaluation we have shown retrospectively that CCAFS' climate products can have an effective influence on development outcomes and that these can be linked to CCAFS' global targets and processes, even beyond the prioritized 12 sub-IDOs for Phase II (Section 5.5.2). As the SRF Phase II with its sub-IDOs was only put in place in May 2015, i.e. after the development and release of CCAFS climate tools, it might be worth to consider the selection of CCAFS contribution to sub-IDOs in light of the findings from this analysis (Annex 9.5).

7.3.2. Strategic selection of partners for developing, supporting and implementing CCAFS climate data/tools

CCAFS has been very successful with its overall program's partnerships and investing resources (mostly in-kind, but also monetary) into the building and maintenance of its partnership network. In preparation of targeted approaches to employing the climate products (Section 7.2.1) and as part of the development of explicit impact pathways for CCAFS climate products (Section 7.3.1), a network analysis can help to (re-)assess the existing partnerships in relation to the climate products and identify key factors required for successful collaborative development, maintenance, support and implementation of the tools potentially enhancing the delivery of development outcomes. This assessment would need to clearly define the purpose of the partnership and the needs and roles of the various partners, e.g.:

- **Technical partners** contributing knowhow (and other in-kind or cash resources) to the collaborative tool development with CCAFS. These can be CGIAR (e.g. other CRPs or the Big Data platform) and non-CGIAR partners (e.g. a university being given money to develop the tool).
- **Primary users** of the climate tools providing research outputs for their own or others use to help CCAFS with its outcome delivery. These partners can provide feedback on the tool requirements particularly from a research perspective.
- **Secondary users** of CCAFS' climate data/tools, i.e. those who benefit indirectly from the data/tools being provided with climate information e.g. for decision-making, strategy development and advocacy. Partners in this group support outcome delivery and can feed back insights from the development perspective.
- **Investment partners** that contribute financial means to the development, maintenance and support of climate data/tools. These could take over financing the climate data/tools if CCAFS decided to terminate their investment. The influence of the financial partners on the strategic focus of the tool development is likely to increase with their level of invest.
- **Marketing partners** helping to promote the use of CCAFS' climate products and research uptake.

The appropriate mix of partners for CCAFS projects or programs involving the climate products will depend on the strategic decisions outlined above. A network analysis could then define the power and attitude dimensions for the identified network nodes to help the selection and prioritization of partners and key stakeholders (e.g. Schiffer & Hauck, 2010). When looking at the power dynamics and attitudinal indications in the stakeholder landscape, the selection of partners could consider the powerful players with an extremely positive attitude to function as champions and engage with the ones with extreme negative attitude to mitigate risks of corrupting the success of the tools.

Connecting partners from diverse sectors and stakeholder groups means developing an understanding of their respective needs and ambitions. For example, according to this (and the TANGO) evaluation, academics are an important user group of CCAFS climate data/tools. However, from the survey we learned that most researchers affiliated with universities were involved with basic research and only few targeted their work directly at development objectives (Volume 2, Sections 3.1.2 and 3.4). This raises the question **to what extent CCAFS wants to explore and address potential challenges and take on the task of providing support to scientists** to help them facilitate research uptake beyond academia. For example, CCAFS could assist to clarify the potential development relevance of academic work, provide guidance on how to make scientific datasets more useful for development work or how to communicate research, and/or connect academic researchers with other stakeholders. Offering advice and practical help may encourage more scientists to orient their work towards development outcomes (see also discussion in Section 5.3.1).

Generally, a clearer definition of the target audiences for the climate products and an analysis of their respective needs may lead to further insights how the network can best support its members to **address the disconnect between producers and users of climate information** (Jones *et al.,* 2016) and collaboratively achieve CCAFS goals.

7.3.3. Dissemination and communication of CCAFS climate products – a marketing mix

With an improved strategic logic for the climate products and increased knowledge of the needs of the different partners involved in facilitating outcome delivery from CCAFS climate products, their dissemination and communication can be strengthened to increase their uptake within and beyond the network and ultimately better support CCAFS goals. A strategic communication plan (e.g. using elements from Outcome Mapping) focusing on the identified key audiences and including a balanced marketing mix for the respective climate products can help to bundle resources while furthering both targeted outcome delivery and random product dissemination.

Below are a few key areas where improvements can be achieved. Some of them do not require significant additional resources, others may need specific funding.

Presentation of the climate products on CCAFS' website

a. **CCAFS' 'Tools, maps, models and data website'** could be improved by offering a **better taxonomy** of CCAFS products. Instead of presenting the various tools, outputs and methods – including the climate products - in a rather unstructured way, there could be special entry pages for related material, e.g. **a portal for all products involving climate information** (Box 7.3.3). This portal could contain a brief introduction on CCAFS' work and objectives in this field, an overview of the available tools (possibly with links to short YouTube elevator pitches on the various tools), and links to the tool pages.

Box 7.3.3: Example structure by purpose for CCAFS 'Tools' Website

1. *GCM downscaled climate data portal (GCM Climate Portal, MarkSimGCM, Climate Analogues)*
2. *Approaches to enhance CSA (FOTF, CSA-Plan, CSA Implementer)*
3. *Approaches to enhance gender equality*
4. *Information and guidelines for CCAFS specific work (M&E, work sites)*
5. *Other information and guidelines for CC work (Guide to UNFCCC negotiations)*

b. The tool pages could include an **expanded description of the functionality of the climate products**, their anticipated users, uses and limitations, added value, scope of applications, and possibly **position them in the landscape of other available tools** (e.g. based on comparative and overview studies commissioned in this field, Volume 2, Section 3.3.2). This would help the website visitor to make a decision on finding the right tool for their specific context and need. Apart from the manuals and handbooks, there could also be **online training guides or introductory webinar clips** for each of the tools.

c. Each tool could be linked to **example use cases** demonstrating the various types of applications and their potential impact pathways. The variety of uses is currently documented in numerous publications available through CCAFS website or web searches. Additionally, a brief overview of potential applications for the tools is presented on the Climate Analogues and the GCM Climate Portal websites (the latter covering also potential MarkSimGCM uses). This could be optimized by classifying the different types of applications for each tool and linking each to relevant (CCAFS and non-CCAFS) projects.

Creation of engagement and learning platforms

d. CCAFS could also offer an **engagement and learning platform (e.g. fostering a community of practice through a forum)** for interactive exchange among climate data/tools users, inviting them to add and share their feedback on experiences and lessons. Such a forum functionality could be established for each tool, various uses and applications, and/or different user groups. Should CCAFS be prepared to moderate the forum, one could consider building into this a support function in order to address user questions without much delay. The forum function can be considered in the context of the Phase II proposed integrating mechanisms (i.e. the Learning Platforms) as these might benefit from information technology supported sharing spaces.

Strategic dissemination via partners

e. **Marketing of the tools and their use internally with CGIAR partners could be improved.** In none of the 14 SMART outcome cases harvested in this evaluation, the societal actor observed to change was a CCAFS partner organization. CCAFS could tap deeper into its own resources and leverage the opportunities offered through its vast partner network. CC is a cross-cutting topic for all CGIAR work and in Phase II CCAFS as an integrating program can offer a clear voice and presence, on the one hand communicating CC to increase visibility of the theme, and on the other playing a key role in bringing together the CC work that is being done by other CGIAR entities and learning about their needs in the CC field. Concerning the first, CCAFS has Flagship and regional **e-/newsletters**, which are a good dissemination channels to run a series on the tools or have a climate tools column embedded. With resepect to the second function, CCAFS could make use of the already mentioned **Learning Platforms** for Phase II as an excellent set up for taking on board experiences with the tool within the network and facilitating and guiding climate data/tool implementation and adaptation across the CGIAR portfolio.

f. **Communication about climate products to non-CGIAR audiences** should be continued and maintained at the quality as it has been done in the past to give CCAFS visibility in the global CC context. CCAFS can feed its on-the-ground experiences into the policy arena and vice versa channel policy work to the grass roots.

g. Promotion of the tools can also take place through **collaborations or agreements with key players** supporting CCAFS' work, e.g. providers of climate (research) platforms or supporting software. For example, the GCM Climate Portal is apparently promoted through tutorials of the Maximum Entropy Modeling (MaxEnt) and the Diva-GIS software which both allow use of CCAFS' climate data (TANGO survey p. 25). Or the cooperation with universities may lead to multiplying effects when academics start teaching the use of CCAFS' climate tools to their students. Such marketing considerations might therefore also influence CCAFS' partner strategy (7.3.2).

7.3.4. Honing and operationalizing CCAFS outcome-focused MEL system

CCAFS' climate products are used within and beyond its network. In this section we propose opportunities to improve on tracing the influence of CCAFS through its climate tools. At the present, there are no systematic monitoring and classification efforts of where and for what purposes CCAFS' data/tools are being employed. Resources may be a limiting factor. Yet, capturing in a more systematic way where and how CCAFS' climate products contribute to outcomes – at least in CCAFS funded work – would allow a better targeting of projects and a more informed Value for Money discussion. Such an R4D MEL system would need to support the capture, storage, retrieval, and usability of comprehensive information on outcomes influenced by the three CCAFS' data/tools. The following areas of refinement concerning both CCAFS knowledge management infrastructure and individual MEL capacity of its members could help to support more comprehensive data collection and analysis:

Strengthening CCAFS' knowledge base for tracing climate product use and effectiveness

a. At the minimum, project reporting should **explicitly mention if they used CCAFS' climate products and if so, which exactly** (if possible referring to the online portals). Several projects researched in this study that directly or indirectly were informed by climate information did not specifically mention where this was gleaned from. An additional challenge was that the 'Climate Portal' and 'Climate Analogues' tool are not distinct terms and word searches in CCAFS knowledge bases will not yield results that are specific for these climate products. CCAFS thus may want to consider coining unmistakable names for their tools.

b. CCAFS' current outcomes definition for the annual reporting of outcomes to donors is useful, i.e. being focused on far downstream, impact-near outcomes at large scale. However, additionally, CCAFS' may benefit from putting **more emphasis on capturing and reporting of upstream (output-near) outcomes** – at least for CCAFS led and/or funded projects and programs – in order to build consistent evidence throughout the causal results chain..

c. CCAFS' should consider introducing a **refined classification system for outcomes data**, including e.g. level and type of change, relevance to sub-IDO, year of change, geographic reach, type of key game changer, contributor, contributing strategy, etc., possibly following some of the suggestions in the Code Book developed for this study (Volume 4). Such tagging would facilitate the analysis of the body of evidence and allow the detection of patterns in the outcomes data. Ideally, an agreed classification for reported outcomes would be **standardized across the whole CGIAR portfolio**, for example sharing a template for outcome stories and feeding the data into a common database. Since often CRPs, Centers and non-CGIAR partners collaborate to contribute to achieving outcomes, this could make reporting more efficient and potentially show that through a portfolio programmatic approach the sum is bigger than its parts.

d. Building on Section 7.3.1, the tagged outcomes data can readily be used to re-examine the ToCs developed for the climate data/tools. Such a **periodic review and revision of the project logic** is useful to test assumptions, capture lessons, and inform strategic decisions.

e. Ideally, there would be a **continuous capturing of results and assessment of lessons learnt throughout the project cycle (and even after)**, providing dedicated spaces for knowledge transfer among partners within and across projects. We observed in this study that information on the tools used in earlier stages of projects was sometimes lost over time (e.g. when staff members had moved on or when funding sources had shifted). Also, it was not always clear how particular projects using CCAFS climate tools had influenced other work. Such monitoring of the 'organic' evolution of projects and the linkages between projects would be a very strong base to help tracking CCAFS' contribution, however, i) there is a resource limitation (time and money) closely linked to this, and ii) it would require motivation of reporting staff and partners. Still, investing resources in this would be part of building CCAFS' evaluative culture.

Enhancing network members MEL capacity

f. To facilitate implementation and use of an advanced MEL system as described above, CCAFS would have to i) **increase awareness and sensitize its members to recognizing immediate and intermediate outcomes**, and ii) **build capacity in drafting outcomes** as descriptions of behavioral changes. Currently, outcomes described in the annual reporting comprise downstream, 'umbrella-type' results, and some are formulated as outputs (or contribution statements), rather than in terms of 'who did what differently, when and where'. It is understandable that these formulations are left to ensure ownership, yet, it would be good to provide some more guidance for the annual reporting and, for project reporting, also encourage communication of immediate and intermediate results. Outcome templates, webinar recordings or YouTube clips, of good example behavioral change outcome descriptions may be useful tutorials for this.

g. Even in an unsecured funding environment, it would be worthwhile to think about the design of an **award system and/or incentives** for projects and programs to put extra efforts into their outcomes documentation, from planning through to the reporting. There are also non-monetary incentives where people feel rewarded. For example, members may benefit from CCAFS showcasing their work and giving them visibility throughout its wide network. Also, partners may be incentivized by CCAFS' culture of mutual respect and appreciation of their work.

h. There could be great benefits if CCAFS **maintained established contacts to network partners beyond the life-time of a project** and encourage these to feedback on resulting changes: CCAFS could fill gaps in the outcome and contribution chains, and there would be an increased chance to harvest impact-near achievements that often emerge only after a project cycle has ended. In this study there were several instances where informants stated they could not report the results of their work since the funding had stopped and there were no resources for further assessing any outcomes.

Tracing outcomes from climate products in non-CCAFS funded projects (wide-spread uptake)

i. CGIAR currently has an open-access policy, i.e. products are usually publically available, often without any registration process. Users of the GCM Climate Portal and MarkSimGCM are asked to register voluntarily, thus making available information on their contact information and affiliation. For the Climate Analogues tool there is no registration process, but users participating in training workshops provide their details and thus can be contacted again. CCAFS might want to consider implementing a **more rigorous registration process** for all tools encouraging users (e.g. through incentives) to specify details about their planned tool use. This would provide an **opportunistic means of retrieving information on interesting projects and potential outcome leads**, which could be followed up on in evaluative assessments. **Retrospective ex-post assessments** (such as this study) can then be based on surveys to such user lists, as well as web searches and literature reviews of published results citing CCAFS' tools, to obtain insights on development outcomes emerging even beyond CCAFS' network.

The evidence collected in this assessment suggests that CCAFS climate products can support its outcome delivery, that it is possible to gather credible outcomes evidence both within and beyond CCAFS member organizations, map these onto CGIAR's Strategic Results Framework, and hence assess the effectiveness and relevance of its climate tool related R4D activities and outputs. The findings should inspire CCAFS to continue the results-based management of its program, balancing investments between i) IPG development, maintenance and support, ii) programs and projects aiming to deliver development outcomes employing these IPGs, and iii) monitoring and evaluation efforts to assess such programs. The strategic decisions outlined earlier in this section will require some maneuvering to determine the best options within CGIAR's complex set up and multi-dimensional context. Yet, CCAFS also has many opportunities with a range of quick wins to immediately improve on some of the areas identified here that will set it up well for a successful Phase II.

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9. Annex

9.1. Terms of Reference

Evaluation of Outcomes of CCAFS Data & Tools

19 August 2016

The CGIAR Research Program CCAFS aims to promote a food-secure world through the provision of science-based efforts (including tools and information) that help to better address food security and adaptation to and mitigation of climate change. In 2014 CCAFS commissioned an evaluation to assess who is using CCAFS tools and information where and for which purposes (usage of outputs), and to evaluate how far CCAFS' activities and outputs have changed the behavior of direct or indirect users of CCAFS data in terms of outcomes in knowledge, attitude or practice. That study provided an overview on the geographic and thematic dimensions of CCAFS data usage, but failed to produce evidence (case studies or outcome stories) of how this influenced the behavior of various user groups.

The purpose of this study is to explore whether CCAFS tools and information have influenced CCAFS' user groups to do things differently in relation to research agendas and investment decisions (or in any other way); and how CCAFS outputs or activities may have contributed to such outcomes. The objectives are as follows:

- Describe CCAFS results at the level of outcomes (definition below), collect and classify the outcomes data. This could be in form of a list with short descriptions of outcomes observed in different user groups and/or more detailed outcome case studies. If appropriate, case studies may include economic analyses of the costs and benefits of the outcomes, undertaken by researchers from CCAFS Flagships 1 and 4.
- Serve as a participatory learning experience by sharing outcomes data among CCAFS's partners and providing information that can inform CCAFS programming decisions.
- Briefly discuss how the information generated could be used to inform revisions to CCAFS's strategies on MELIA, open data & open access, and data management.

'Outcome Harvesting' (OH) is proposed as evaluation approach, which is inspired and informed by 'Outcome Mapping' (e.g., http://betterevaluation.org/plan/approach/outcome_harvesting). OH works backward from an effect to determine its cause: first the change in a social actor is identified and then the specific contribution of the evaluated program is determined. The general method will be adapted for this evaluation.

Based on OH's principles, outcomes will be defined here as changes in the actions, activities, relationships, policies or practices of CCAFS' target audiences related to climate change adaptation and mitigation, which were influenced in a small or large way, directly or indirectly, intentionally or not, negatively or positively, by CCAFS' tools.

In OH, 'outcomes' consist of both a description of i) the outcome itself and ii) the contribution of the intervention; they can optionally also include iii) a statement on how significant the change was for achieving the overall goals of the intervention, and iv) how relevant the respective contribution was to bring about the observed change. The outcomes will have to be formulated in sufficient detail and objective, quantitative and qualitative information to be verifiable; also, there has to be a plausible and logical relationship between the outcome and the claimed contribution of CCAFS.

The work will focus on outcomes of selected CCAFS tools and users, aiming to shed light on whether these contribute to changing the behavior of specific target audiences in line with CCAFS' theory of change. The focus will be on:

- a small number of tools, which will include the CCAFS climate portal (www.ccafs-climate.org) and the analogue tool (www.ccafs-analogues.org/tool/);

- selected representatives of identified user groups of CCAFS tools and information to explore how far their behavior has been influenced directly or indirectly by CCAFS tools. Potential user groups include:
  - implementing partners (e.g. NARES, CARE, IIRR);
  - government authorities and agencies (e.g. national governments, UNFCCC, WFP, WFO, CAADEP, CAC);
  - investment partners (e.g. World Bank, IFAD, Green Climate Fund, ECOWAS, COMESA, ASEAN);
  - field-based evidence providers (e.g. CORAF, CATIE, ICAR, WISAT, AAPARI, FAO);
- the evaluation period to cover all of CCAFS, from 2010 to date.

The exact tools, user groups and evaluation period to be focused on will be decided within the first days of the consultancy, in consultation with FP1 and FP4.

A starting point for searching for behavioral outcomes in specific user groups may be the findings of the 2014/15 TANGO evaluation, describing influence on policies and programming in various areas such as the National Climate Change Policy in Ghana, a Water Productivity Program in Kenya, endangered species work in Sonora, Mexico, a national food security mission in India, and the Kenyan Ministry of Agricultures' program with Traditional High Value Crops, for example.

The process, time frame, and payment schedule is as follows.

Step 1: Evaluation design and development of evaluation questions

Outputs: evaluation design (PowerPoint presentation or short report) and signed contracts.

Outcome: Common understanding of evaluation purpose and objectives and the TOC for CCAFS data portal and tools.

Payment schedule: 10% on completion

Steps 2 and 3: Document review and/or interviews to harvest outcomes

Output: Completed data base with quantitatively and qualitatively verifiable outcomes

Outcome: CCAFS evaluation focal points are familiar with the approach; knowledge on CCAFS outcomes shared across wider CCAFS team (and possibly informants)

Payment schedule: 40% on completion

Step 4: Substantiation

Output: Stakeholder verification of the accuracy of selected outcomes so that the data will be credible-enough evidence with which to answer the evaluation questions

Outcome: Sufficient credibility of outcomes data; knowledge on outcomes shared with external stakeholders

Payment schedule: 20% on completion

Step 5 and 6: Analysis, interpretation, report, de-briefing

Output: Report with evidence-based answers to the evaluation questions and discussion points

Outcome: CCAFS has a deeper understanding of the results of their work and their contribution to specific outcomes

Payment schedule: 30% on completion

9.2. Researched cases with confirmed use of tools and informants

Case Number[2]	Title[1]	Informant(s) / Affiliation	Location of research or outcome
GCM Climate Portal | Species/habitat modeling			
B22 (SMART[3])	US Fish and Wildlife Service co-funds a study on climate change influences on ecosystem vegetation in southern USA that employs CCAFS' GCM Climate Portal	**Michael Jennings**, Research Professor, University of Idaho, USA	USA
S01 (SMART)	Australian National Resource Management groups start incorporating climate change effects into their planning based on analyses using CCAFS' Climate Portal.	**Benjamin Ford**, Research Assistant, University of Western Australia	Australia
S04 (SMART)	The next South African National Biodiversity Assessment (to be published 2019) is likely to include biome change predictions assessed through CCAFS climate data.	**Danni Guo**, Senior Scientist, South African National Biodiversity Institute, South Africa	South-Africa
S08 (SMART)	A Mexican NGO engages with climate researchers to produce advocacy material on threatened cloud forests after becoming aware of their research informed by CCAFS' GCM Climate Portal.	**Rocío Ponce-Reyes** Postdoctoral Research Fellow at CSIRO, University of Queensland, Australia	Mexico
S02	Researchers from University of Southern Queensland, Australia and the University of Massachusetts, USA, published research on climate change effects on the potential distribution of the economically important Chinese Caterpillar Fungus in Nepal.	**Uttam Shrestha**, Vice Chancellor's Research Fellow, University of Southern Queensland, Australia	Nepal
S10	Amber Wright, Department of Biology, University of Hawaii, Manoa, compared CCAFS' GCM Climate Portal CMIP3 data to WorldClim CMIP5 data to test the robustness of habitat suitability scores for reptile and amphibian species management in California	**Amber Wright**, Assistant Professor, Department of Biology, University of Hawaii, Manoa, USA	California, USA
S09	Researcher at the European Commission (EC) used GCM Climate Portal for habitat suitability modeling to increase awareness within the EC of forest threats caused by tree pests resulting from climate change.	**José I. Barredo**, Scientific Officer, European Commission - Joint Research Centre, Belgium	Europe
S13	A researcher from the Environment Agency in Abu Dhabi, United Arab Emirates, used GCM Climate Portal for species / habitat modeling of reptile species.	**Husam El Algamy**, Senior Biodiversity GIS analyst, Environment Agency, UAE	United Arab Emirates
GCM Climate Portal | Climate change impact study			
S05a (SMART)	NGOs in Timor-Leste adapt in their planning to respond to climate events predicted through climate modeling using CCAFS' GCM Climate Portal.	**Samuel Bacon**, Australian agricultural aid worker, Seeds for Life, Timor-Leste	Timor-Leste
S05b (SMART)	Government of Timor-Leste co-funds climate risk adaptation measures after being informed by research employing CCAFS' climate data.	**Samuel Bacon**, Australian agricultural aid worker, Seeds for Life, Timor-Leste	Timor-Leste
S11 (SMART)	Indian Cabinet approves a water-energy nexus program that is partly informed by data from CCAFS' GCM Climate Portal.	**Prabhat Ojasvi**, Principal Scientist, Indian Institute of Soil and Water Conser-vation, ICAR, India	India
S12 (SMART)	The Argentinian Government publishes research informed by CCAFS' GCM Climate Portal in a book on Argentinian agricultural production and climate change.	**Juan Cruz Colazo**, Soil Scientist, San Luis Research Station, INTA, Argentina	Argentina
S03a	Policy makers and other key stakeholders did not make use of the findings of research showcasing the impacts of climate change in sorghum growing areas in Kenya using GCM Climate Portal data.	**Charles Kigen**, Environment Lecturer, Moi University, Kenya	Kenya
S03b	Potential local and international funders did not financially support research employing CCAFS' GCM Climate Portal to predict future changes in pasture suitability areas in Kenya resulting from CC.	**Charles Kigen**, Environment Lecturer, Moi University, Kenya	Kenya
GCM Climate Portal | Climate risk screening			
S07	A financial institution in Asia allocates additional budget for climate change adaptation to projects identified through CCAFS' GCM Climate Portal analyses.	**Ji Changyuan**, Freelance consultant, Beijing, China	Asia
GCM Climate Portal | Climate information services			
A02	The national meteorological agency ANACIM used CCAFS' GCM Climate Portal to enhance the early warning system in Senegal, but then shifted to CORDEX.	**Ousmane Ndiaye**, Agence Nationale de l'Aviation Civile et de la Météorologie (ANACIM), Senegal	Senegal

Case Number[2]	Title	Informant(s) / Affiliation	Location
MarkSimGCM | Species/habitat modeling			
Pub1	Researchers from the University of Oxford, UK, used MarkSimGCM for species distribution modeling mapping global environmental suitability for Zika virus.	**Publication**: https://elifesciences.org/articles/15272	Global
Pub2	Researchers from ICAR India used MarkSimGCM data in analyses demonstrating potentially higher incidence of a moth pest species of pigeon pea in India.	**Publication**: **Srinivasa Rao M**. et al, 2016. Agricultural and Forest Meteorology	India
Pub3	Researchers from ICAR India used MarkSimGCM data in analyses demonstrating potentially higher incidence of tobacco caterpillar on peanut crop at six locations in India.	**Publication**: **Srinivasa Rao M**, et al. 2016. PLoS ONE 10(2)	India
MarkSimGCM | Climate change impact study			
S15	Researchers at the Soils, Water and Environment Research Institute, Agricultural Research Center (SWERI), Egypt, were not motivated to integrate climate change into their own work after learning about a colleagues' study on the effects of climate change on future water requirements of various crops in Egypt that employed MarkSimGCM.	**Samiha Ouda**, Professor, Soils, Water and Environment Research Institute, Agricultural Research Center (SWERI), Egypt	Egypt
B17	Researchers from a Colombian university used MarkSimGCM to assess the impact of climate change on the forests of the city of Bogotá.	**Johny Rodríguez**, Universidad Nacional Abierta y a Distancia Colombia, UNAD	Colombia
S14	Researchers from McGill University and the Ministry of Forests, Wildlife and Parks, Canada, employed CCAFS' MarkSimGCM to research the influence of climate change on cultural ecosystem services.	**Jason Samson**, Senior Associate, McGill University, Canada	Canada
B47	USAID Feed the Future (FTF) program valued (an older version of) MarkSimGCM for their program design in the areas of livestock production.	**Joyce Turk**, Senior Livestock Advisor, USAID, USA	FTF countries
PT1	ILRI used an older version of MarkSimGCM for vulnerability mapping work they did for DFID in 2006.	**Philip Thornton**, CCAFS Flagship leader, ILRI	Africa
Climate Analogues | Identification of climate analogue sites			
A13 (IP/OH)[4]	Seeds for Needs (S4N): Farmers' network participating in the Seeds for Needs program in India expanded from 30 participating farmers when starting in 2012, to 5000 in 2013/2014, and the network has grown to 15'000 farmers involved at the present. The national program covers more than 600 villages of 49 districts of seven states in Eastern, Central and Northern parts of India. The farmers test and grow seed varieties partly selected using CCAFS' Climate Analogues tool.	**Prem Mathur**, formerly Regional Representative Central/ South Asia, now Honorary Research Fellow; and **Sarika Mittra**. **Arnab Gupta**, **Neeraj Sharma**, Bioversity Intl., India	India
B10 (extended SMART)[5]	Farmers engaging in CCAFS' 'Farms of the Future' project in East and West Africa participated in learning journeys designed partly based on Climate Analogues analyses and adopted new farming practices and technologies aimed at strengthening communities' resilience and adaptive capacity.	**Osana Bonilla-Findji** , Phillip Kimeli, Mary Nyasimi, Maren Radeny, Catherine Mungai, John Recha. Mathieu Ouedraogo, Abdoulaye S. Moussa	West and East Africa
PW1 (SMART)	Farmers in Sierra Leone started growing cash crops from climate analogue sites identified through CCAFS' Climate Analogues tool.	**Paul Wagstaff**, Agriculture Advisor at Concern Worldwide	Sierra Leone
PW2 (SMART)	Concern Worldwide includes Climate Analogues analyses into their country strategy for Liberia.	**Paul Wagstaff**, Agriculture Advisor at Concern Worldwide	Liberia
PW3 (SMART)	DFID is funding a project led by Concern Worldwide which is piloting an advanced version of the Climate Analogues tool for their climate related work in Chad and Sudan.	**Paul Wagstaff**, Agriculture Advisor at Concern Worldwide	Chad / Sudan
B42 (SMART)	Fundación Ecohabitat collaborates to develop a tool for local adaptation planning in Colombia integrating climate predictions modeled with CCAFS' Climate Analogues tool.	**Deissy Martínez Baron**, CIAT/CCAFS, **Luis Ortega Fernandez** and **Liliana Paz**, Fundación Ecohabitat, Colombia	Colombia

1: Additional cases were researched where usage of the tools could not be confirmed
2: Case numbers refer to the numbers used in the CCAFS outcome database. Cases labeled with 'S' stem from the survey.
3: Cases that could be developed into SMART outcomes are indicated accordingly (see outcome narratives in Volume 3).
4: IP-OH: the Seeds for Needs India case was assessed using an Impact-Pathway OH approach (Section 5.4.2).
5: The Farms of the Future case was developed into an extended outcome.

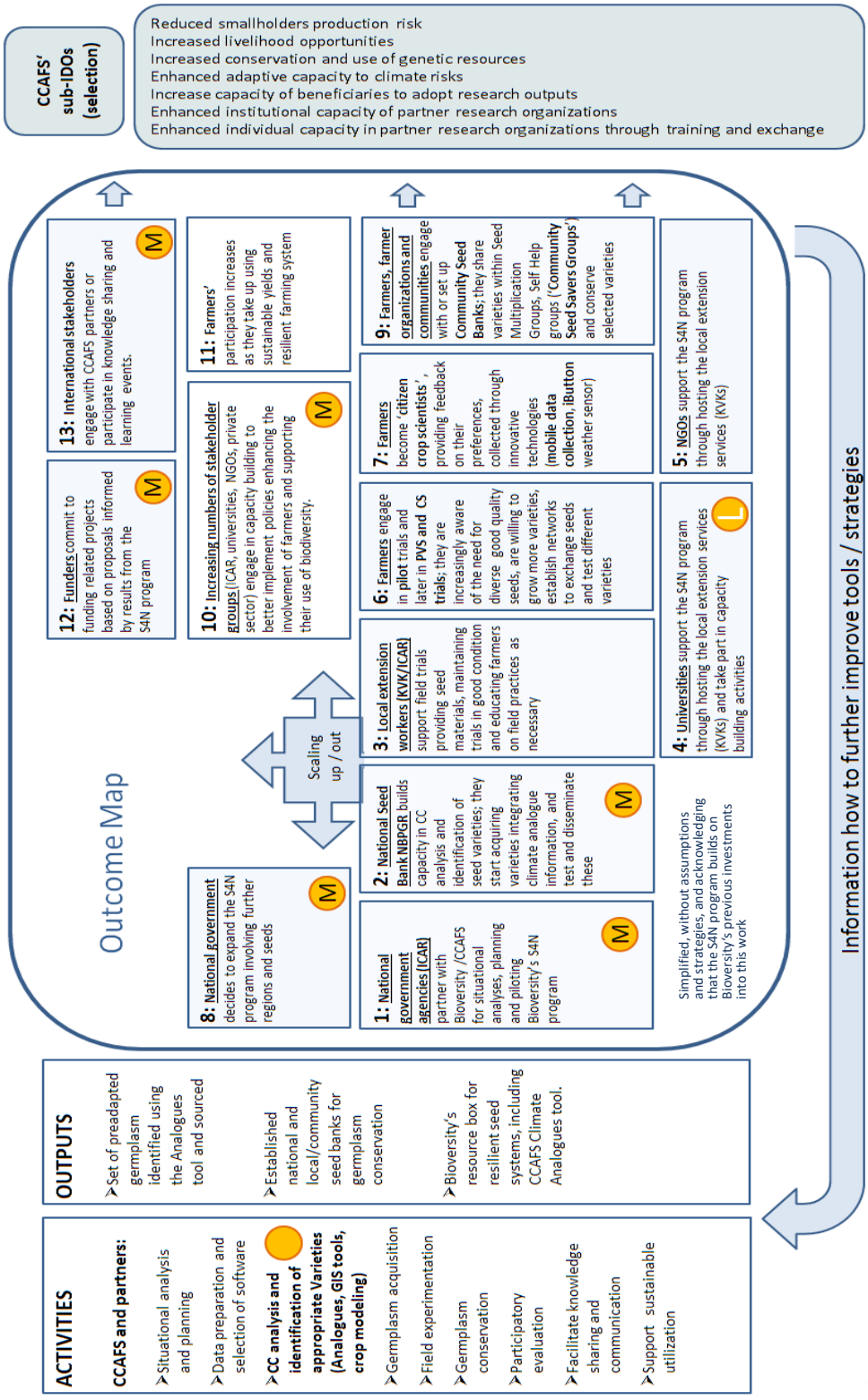
9.3. Contributors to the 14 SMART outcomes

Contributors[1]	Total no. outcomes (14)	GCM Climate Portal (8)	Analogues (6)
Academia: S01 University of Western Australia; S08 University of Queensland, Australia;	**2**	2	
Government institution: S04 SANBI S05a/S05b Seeds of Life; S12 INTA;	**4**	4	
Academia & Government institution: B22 University of Idaho & US Fish and Wildlife; S11 Indian Institute of Soil and Water Conservation (ICAR); Indian Institute of Management; Indian Institute of Technology	**2**	2	
CSO: PW1/PW3 Concern Worldwide; B42 CCAFS-CIAT (CGIAR Center)	**3**		3
CSO & Academia: PW2 Concern Worldwide, ICRAF (CGIAR Center), Tufts University, Al Massar Charity Organization	**1**		1
B10 'Farms of the Future' umbrella outcome, multiple contributors: **CSOs**: CGIAR Centers: CIAT, ILRI, ICRISAT **Government institutions**: ISRA Senegal, INRAN Niger, IER Mali, INERA Burkina Faso, CSIR/SARI Ghana, KALRO Kenya **Academia**: NRI	**1**		1
A13 'Seeds for Needs' umbrella outcome, multiple contributors: **CSOs**: Bioversity International (CGIAR Center), Ashok, NEFORD, ASA, DRI, HPPI, Gene Campaign **Government institutions**: ICAR (NBPGR, DWR, IARI), NARC **Academia**: PAU, BHU	**1**		1

1: CGIAR Centers and CCAFS partner organizations indicated in blue (according to CCAFS online partner database)

9.4. Impact Pathway for the Seeds for Needs India program

Using the Impact-Pathway-related Outcome Harvesting' (IP-OH) approach developed for this study, outcomes harvested through document reviews were clustered by similar type of societal actor and change in order to formulate more general 'umbrella outcomes. These were then arranged into an 'Outcome Map' and, together with activities and outputs depicted in an Impact Pathway (IP) diagram very roughly reflecting the causal chain of results observed. This diagram was used in interviews with informants to harvest more and substantiate evidence along this 'Outcome Map'. In iterative cycles the IP diagram was thus improved and the causal assumptions assessed, A particular emphasis was put on the contribution, requesting informants to specify exactly for which outcomes the climate product was important and, where this was the case, to rate its importance (**L** = low importance; **M** = medium importance).



9.5. Relevance of 14 SMART outcomes to CCAFS' sub-IDOs

No.	Code	Sub-Intermediate Development Outcomes (sub-IDOs)	No of outcomes
1	1.1.1	Increased household capacity to cope with shocks	1
2	1.1.2	Reduced smallholders production risk	9
3	1.2.1	Improved access to financial and other services	1
4	1.2.2	Reduced market barriers	
5	1.3.1	Diversified enterprise opportunities	3
67	1.3.2	Increased livelihood opportunities	
7	1.3.3	Increased value capture by producers	
8	1.3.4	More efficient use of inputs	
9	1.4.1	Reduce pre- and post-harvest losses, including those caused by climate change	1
10	1.4.2	Closed yield gaps through improved agronomic and animal husbandry practices	4
11	1.4.3	Enhanced genetic gain	
12	1.4.4	Increased conservation and use of genetic resources	2
13	1.4.5	Increased access to productive assets, including natural resources	7
14	2.1.1	Increased availability of diverse nutrient-rich foods	2
15	2.1.2	Increased access to diverse nutrient-rich foods	
16	2.1.3	Optimized consumption of diverse nutrient-rich foods	
17	2.2.1	Reduced biological and chemical hazards in the food system	
18	2.2.2	Appropriate regulatory environment for food safety	
19	2.3.1	Improved water quality	
20[1]	2.3.2	Enhanced conservation of habitats and resources	6
21	2.3.3	Enhanced genetic diversity of agricultural and associated landscapes	
22	3.1.1	Land, water and forest degradation (including deforestation) minimized and reversed	2
23[1]	3.1.2	(Enhanced conservation of habitats and resources)	6
24	3.1.3	Increased genetic diversity of agricultural and associated landscapes	
25	3.2.1	More productive and equitable management of natural resources	6
26	3.2.2	Agricultural systems diversified and intensified in ways that protect soils and water	
27	3.2.3	Enrichment of plant and animal biodiversity for multiple goods and services	5
28	3.3.1	Increased resilience of agro-ecosystems and communities, especially those including reduced smallholders	7
29[2]	3.3.2	Enhanced adaptive capacity to climate risks	14
30[3]	3.3.3	Reduce net greenhouse gas emissions from agriculture, forests and other forms of land-use	1

31[3]	A.1.1	(Reduced net greenhouse gas emissions from agriculture, forests and other forms of land-use)	1
32	A.1.2	Increased above- and below-ground biomass for carbon sequestration	
33	A.1.3	Improved forecasting of impacts of climate change and targeted technology development	5
34[2]	A.1.4	(Enhanced capacity to deal with climactic risks and extremes)	14
35[7]	A.1.5	Enabled environment for climate resilience	
36[8]	B.1.1	Gender-equitable control of productive assets and resources	
37[8]	B.1.2	Technologies that reduce women's labor and energy expenditure developed and disseminated	
38[8]	B.1.3	Improved capacity of women and young people to participate in decision-making	
39	C.1.1	Increase capacity of beneficiaries to adopt research outputs	8
40	C.1.2	Increased capacity of partner organizations, as evidenced by rate of investments in agricultural research	2
41	C.1.3	Conducive agricultural policy environment	2
42	C.1.4	Conducive environment for managing shocks and vulnerability, as evidenced in rapid response mechanisms	1
43[4]	D.1.1	Enhanced institutional capacity of partner research organizations	1
44[4]	D.1.2	(Enhanced individual capacity in partner research organizations through training and exchange)	1
45	D.1.3	Increased capacity for innovations in partner research organizations	
46	D.1.4	Increased capacity for innovation in partner development organizations and in poor and vulnerable communities	7

1, 2, 3, 4: sub-IDOs with similar meaning
5: Shaded: the 12 sub-IDOs selected by CCAFS for Phase II 2017-2022
6: Grey: sub-IDOS where none of the 14 SMART outcomes mapped onto
7: We did not map the outcomes onto sub-IDOs that seemed too generic (1.3.2, A.1.5)
8: We did not assess the outcomes with respect to the cross-cutting sub-IDOs on gender/youth (B.1.1-3)