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Evaluating User Satisfaction with Climate Services in Tanzania 2014 - 2016

Summary Report to the Global Framework for Climate Services Adaptation Programme in Africa

CICERO
Center for International Climate Research

GFCS GLOBAL FRAMEWORK FOR CLIMATE SERVICES

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Title: Evaluating User Satisfaction with Climate Services in Tanzania 2014 - 2016: Summary Report to the Global Framework for Climate Services Adaptation Programme in Africa

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Abstract: This report summarizes findings from qualitative research undertaken by the Center for International Climate Research (CICERO) and the University of Dar es Salaam (UDSM) in Tanzania between 2014 and 2016 under the Global Framework for Climate Services Adaptation Programme in Africa (GFCS-APA). This research has aimed to support the programme's internal monitoring and evaluation efforts by establishing a baseline and conducting follow-up research aimed at understanding how potential users of climate services at the local, district and national levels can be supported to access and apply climate information and services in decision-making concerning agriculture and food security, disaster risk reduction and management and health. Findings draw on interviews and focus group discussions with potential users and intermediaries of climate services in Kiteto and Longido districts, and key informant interviews with climate service co-producers, intermediaries and users at local, district and national levels. Following the approach taken in the baseline report, we assess the 'usability' of both scientific climate information and services and indigenous knowledge in relation to user perceptions of the credibility, salience, and legitimacy of this knowledge, also known as the knowledge system criteria (Cash et al., 2003, Tang and Dessai 2011). Findings from research conducted in 2016 are presented in relation to qualitative indicators and sub-indicators of "user satisfaction" that were developed and applied in the baseline report (Daly, West and Yanda, 2016). The indicators address respondents': perceptions and experiences of institutional coordination and steering mechanisms for delivering climate services across scales (indicator 1); awareness of and access to climate information and service channels (indicator 2); satisfaction with the information and services developed and received (indicator 3), and views and experiences concerning the role of indigenous knowledge (IK) about the weather, climate and related adaptation options (indicator 4) in local decision-making processes. The findings suggest that while efforts at co-producing user-oriented climate services under the GFCS-APA have strengthened institutional coordination and steering mechanisms for climate services development at the national level and enhanced awareness of and access to climate information and service channels amongst some stakeholders, access to salient, credible and legitimate climate information and services remains highly uneven at the local level. Disparities in levels of basic service provision, mismatches in the timing and resolution of seasonal forecasts, and difficulties in understanding and translating forecast information into actionable advice, continue to undermine the usability of scientific climate and meteorological information within and across villages in the two districts studied. Gender roles and gendered disparities in literacy in some cases further undermine women's abilities to access climate services and constrain their ability to understand and interpret climate information. Despite these limitations, respondents at the local level generally consider scientific information about the weather and climate to be potentially "useful" information that can complement traditional forecasts and local and indigenous sources of knowledge about weather, climate and related adaptation options. However, the findings suggest that substantial barriers exist to coproducing, institutionalizing, scaling up and sustaining decision-driven climate information and services that meet expressed stakeholder needs, that cut across sectors, and that are widely accessible and usable. The findings illustrate some of the challenges encountered to co-producing usable climate information and services within a multiagency climate services programme targeting diverse stakeholders and sectors. Consolidating and sharing learning from the pilot phase of the GFCS-APA will constitute an important first step towards developing more credible, salient and legitimate processes for co-producing usable climate services going forward. With this in mind we offer ten recommendations for enhancing user satisfaction with climate services in Tanzania in the future.

Language of Report: English

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Executive Summary

This report summarizes findings from qualitative research undertaken by the Center for International Climate Research (CICERO) and the University of Dar es Salaam (UDSM) in Tanzania between 2014 and 2016 under the Global Framework for Climate Services Adaptation Programme in Africa (GFCS-APA). The aim of the research has been to contribute to the programme's monitoring and evaluation efforts in Tanzania by establishing a baseline and conducting follow-up research aimed at understanding how potential users of climate services at the local, district and national levels can be supported to access and apply climate information and services in decision-making concerning agriculture and food security, disaster risk reduction and management and health. In addition to conducting baseline research at the national level and in selected villages within districts that were targeted by the programme partners in 2014/15, CICERO and UDSM were tasked with conducting follow up research in 2016 to qualitatively gauge user satisfaction with climate services that were developed and disseminated under the pilot phase of the GFCS-APA. This report summarizes and compares findings from the research conducted in 2016 with the findings reported on in the baseline report. The report contributes to the programme's internal monitoring and evaluation (M&E) activities as a deliverable towards indicator 1.4.2 "User satisfaction with climate services".

Data collection methods in 2016 consisted of focus group discussions (FGD) with potential users and intermediaries of climate services in Kiteto and Longido districts, and key informant interviews with climate service co-producers, intermediaries and users at local, district and national levels. We assess "user satisfaction" with climate services in relation to qualitative indicators and sub-indicators that were developed and applied in the baseline report (Daly, West and Yanda, 2016). The indicators concern respondents': perceptions and experiences of institutional coordination and steering mechanisms for delivering climate services across scales (indicator 1); awareness of and access to climate information and service channels (indicator 2); satisfaction with the information and services developed and received (indicator 3), and the role of indigenous knowledge (IK) about the weather, climate and related adaptation options (indicator 4). A description of the indicators and sub-indicators addressed in the report is provided in Figure 2 (page 6). Summary tables and findings relating to each indicator can be accessed directly at the following links:

1. Institutional Coordination and Steering Mechanisms
2. Awareness of and Access to Climate Information and Services
3. User Satisfaction with Climate Information and Services
4. Role of Indigenous Knowledge

Following the approach taken in the baseline report, we assess the 'usability' of both scientific climate information and services and indigenous knowledge in relation to user perceptions of the credibility, salience, and legitimacy of this knowledge, also known as the knowledge system criteria (Cash et al., 2003, Tang and Dessai 2011).

Key findings

Respondents reported a number of improvements since the baseline including enhanced institutional coordination and collaboration amongst national programme partners, greater awareness of climate-health linkages and efforts to integrate these into relevant national planning and policies, and improvements in the communication of climate information to district-level stakeholders through an expansion of climate service channels. Awareness of and access to climate information and services has moreover improved at the district and village levels amongst those who have taken part in programme trainings, who receive climate information via the FarmSMS service, and who interact regularly with the extension service in their communities. Notwithstanding these improvements,

access to climate information and services remains highly uneven within and across villages in the targeted districts. The findings suggest that awareness of, access to and the potential usability of, climate information and services are highest in villages where prior interventions and capacity building (by programme partners and others) have taken place, where the infrastructure to support general service provision (roads, mobile and radio networks) are functioning, and where extension officers are appropriately motivated and resourced. There are large variations in all of these factors in the two districts studied. Disparities in access to climate service channels, mismatches in the timing and resolution of seasonal forecasts, and difficulties in understanding and translating forecast information into actionable advice, continue to undermine the usability of scientific climate and meteorological information at local levels. In addition, gender roles and disparities in literacy continue to undermine women's access to climate services and constrain their ability to understand and interpret climate information. Despite these limitations, respondents at the local level generally consider scientific information about the weather and climate to be potentially "useful" information that can complement traditional forecasts and local and indigenous sources of knowledge about weather, climate and related adaptation options. Employing multiple communication channels and combining scientific forecasting information and advisories with local knowledge, alternative livelihood options, technologies, and complementary advice and information were noted to improve the salience, credibility and legitimacy of climate services efforts and their potential usefulness and applicability. Notwithstanding this, the findings suggest that there remain substantial barriers to co-producing, institutionalizing, scaling up and sustaining decision-driven climate information and services that meet expressed stakeholder needs, that cut across sectors, and that are widely accessible and usable. Consolidating learning from the pilot phase of the GFCS-APA will constitute an essential first step towards developing more credible, salient and legitimate *processes* for co-producing usable climate services in the future. In conclusion, we offer ten recommendations that may contribute toward strategies for enhancing user satisfaction with climate services in Tanzania going forward.

Acronyms

CCAFS	CGIAR Research Program on Change and Food Security
CCCS	Centre for Climate Change Studies
CICERO	Centre for International Climate Research – Oslo
CMI	Chr. Michelsen Institute
DED	District Executive Director
DRR	Disaster Risk Reduction
FGD	Focus Group Discussion
GFCS	Global Framework for Climate Services
GFCS-APA	Global Framework for Climate Services Adaptation Programme in Africa
IIED	International Institute for Environment and Development
IK	Indigenous Knowledge
LUANAR	Lilongwe University of Agriculture & Natural Resources
M&E	Monitoring and Evaluation
MAFC	Ministry of Agriculture, Food Security, and Cooperatives
MALF	Ministry of Agriculture, Livestock and Fisheries
MAM	March-April-May Season
MDAs	Ministries, Departments, and Agencies
MLFD	Ministry of Livestock and Fisheries Development
MLHHSD	Ministry of Lands, Housing, and Human Settlements Development
MoW	Ministry of Water
MoHSW	Ministry of Health and Social Welfare
MoHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
NFCS	National Framework for Climate Services
NEMC	National Environment Management Council
NGO	Non-Governmental Organization
OND	October-November-December Season
PDT	Project Delivery Team
PSC	Programme Steering Committee
PICSA	Participatory Integrated Climate Services for Agriculture
PMO – DMD	Prime Minister's Office – Disaster Management Department
PMO-RALG	Prime Minister's Office – Regional and Local Governments
RBA	River Basin Authority
TANDREC	Tanzania Disaster Management Committee
TMA	Tanzania Meteorological Agency
UDSM	University of Dar es Salaam
UNFCCC	United Nations Framework Convention on Climate Change
VEO	Village Executive Officer
VPO – DoE	Vice President's Office – Division of Environment
WFP	World Food Program

1 Introduction and Background

1.1 Overview of Rationale and Approach

The Global Framework for Climate Services Adaptation Programme in Africa (GFCS-APA) was initiated in 2014 with funding from the Government of Norway with the goal of piloting the concept of climate services in two countries in Africa: Malawi and Tanzania. A total of NOK 60 million was made available to seven international partners and their local collaborators in the two countries, with the initial phase of the programme scheduled for completion at the end of 2016. The programme was led by the World Meteorological Organization (WMO) and implemented jointly by WMO, the CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS); the Center for International Climate Research (CICERO); the Chr. Michelsen Institute (CMI); the International Federation of Red Cross and Red Crescent Societies (IFRC); the World Food Programme (WFP); and the World Health Organization (WHO). The aims of the programme were to develop, implement and evaluate a joint programme of climate services[1] in both countries to support adaptation in the areas of agriculture and food security, health and disaster risk reduction (DRR) and management. The national counterparts in Tanzania comprised the Tanzania Meteorological Agency (TMA), local branches and implementing partners of the above multilateral agencies, including the Tanzania Red Cross Society (TRCS), Tanzania Ministry of Health and Social Welfare (MoHSW), WFP Tanzania Office, and the University of Dar es Salaam (UDSM) Centre for Climate Change Studies (CCCS). The local partners formed the Project Delivery Team (PDT), which was chaired by TMA and which coordinated and led the programme activities at the national level.

The national and international programme partners have implemented a range of activities aimed at developing and strengthening national systems for climate services provision between 2014-2016 under the pilot phase of the GFCS-APA, with the overarching goal of making these services accessible and applicable to a range of stakeholders and decision-making contexts and thereby increasing the resilience of people most vulnerable to the impacts of weather and climate-related events. However, given its short duration, the programme partners established an M&E approach that focused on evaluating the outcomes, rather than the long-term impacts of the programme activities (Tasokwa and Tostensen, 2016). This resulted in the development of a shared programme-wide M&E framework with 16 indicators to monitor progress toward these outcomes, with evaluation of user satisfaction with climate services at national, district, and local levels contributing to this broader effort. Within this framework, CICERO and UDSM were tasked with evaluating progress made in Tanzania in relation to indicator 1.4.2 *User Satisfaction with Climate Services*, whereby users at the national, district and local levels from the target sectors express satisfaction with the climate services provided to them.

[1] Climate information encompasses statistical analysis of historical trends, as well as forecasts and predictions about future weather and climate. Various definitions of climate services exist. The WMO (2015) defines climate services as the provision of climate information in such a way as to assist with decision-making (WMO website, accessed 8 Nov 2015). The European Commission defines climate services broadly as "transforming climate-related data and other information into customised products such as projections, trends, economic analysis, advice on best practices, development and evaluation of solutions, and any other climate-related service liable to benefit that may be of use for the society." (European Commission 2015). According to Hewitt et al. (2012), a successful climate service must be: "based on scientifically credible information and expertise, have appropriate engagement from users and providers, have an effective access mechanism and meet the users' needs."

Since terms such as "user satisfaction" are subjective and multidimensional, CICERO and UDSM employed a qualitative research design to collect data on indicators and sub-indicators that were developed and elaborated in a baseline report (Daly et al., 2016). Data collection and analysis aimed to document respondents': 1) views on institutional coordination and steering mechanisms; 2) Awareness of and access to climate information and services; 3) Perceptions of the usability of climate information and services and 4) Perceptions and use of indigenous knowledge of weather, climate and related adaptation options. To identify the aspects of perceptions of the 'usability' of information, and following the baseline report, we have utilized the framework of the knowledge system criteria of credibility, salience, and legitimacy by Cash et al. (2003) (**Figure 1)**. Credibility here refers to the scientific adequacy, trustworthiness, and reliability of knowledge. Salience refers to the relevance of knowledge to practical decision-making. Legitimacy refers to the openness and fairness of knowledge, meaning that it incorporates diverse perspectives and is equally beneficial to all users. These three criteria have been widely used within academic literature to understand knowledge use relating to complex environmental and sustainable development questions that necessitate the integration of multiple sources of knowledge at different scales (see for example: Hegger and Diperink 2014, Schuttenberg and Guth 2015), including within efforts to develop usable climate services (e.g., Cash 2006, Tang and Dessai 2011). It is widely understood that knowledge must meet all three criteria for it to be usable within decision-making, although there may be overlaps and trade-offs among these. Understanding the dynamics between the credibility, salience, and legitimacy of climate services may help in identifying pathways for improving user satisfaction with climate services at multiple scales (Daly et al., 2016). The knowledge system criteria hence provide a useful framework for evaluating user satisfaction with climate services within the GFCS APA.

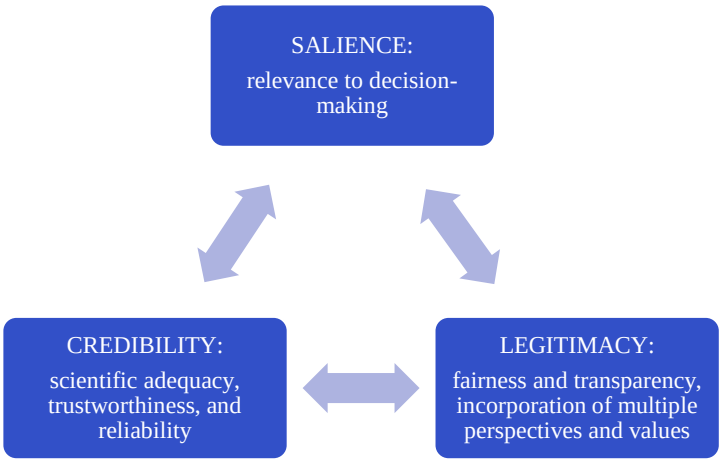

Figure 1: The knowledge system criteria and definitions[2].

2 The multi-directional arrows between the criteria illustrate that there exist mutual relations, as well as tensions and tradeoffs, between the various criteria.

1.2 Methods

The findings in this report draw on qualitative data collection methods, including focus group discussions (FGD) with local stakeholders constituting potential beneficiaries and intermediaries of climate services in Kiteto and Longido districts and key informant interviews with extension officers, district-level staff, and implementing partners at the local and national levels who were involved in co-producing climate services targeting national and local-level stakeholders within the various sectors. Qualitative methods lend themselves to a deep understanding of the complexities of user satisfaction with climate services and provide a complementary perspective to quantitative approaches to surveying stakeholder needs and practices and evaluating the potential impacts of climate services (Tall and Njinga, 2013) in particular sectors or at particular institutional scales (Stats4SD and Cramer-Njihia Consultants, 2017). Information about the perceived salience, credibility, legitimacy and usability of climate services are not only important for improving user satisfaction with existing information products and services; ideally such information can inform the design of more inclusive, sustainable and user-driven *processes* for co-producing climate services in the future.

Data collection took place between August 15 – 29, 2016 and consisted of: i) focus group discussions with men and women farmers, pastoralists/livestock keepers and agro-pastoralists in six villages in Longido and Kiteto districts, four of which were known to have been targeted by programme efforts and two that were not (see **Table 1**, below); 2) focus group discussions and key informant interviews conducted at the district level in Longido and Kiteto, and; 3) key informant interviews with implementing partners at the local and national levels. Altogether, 12 FGDs were conducted at the sub-national level, two at district level (1 in each district) with officers representing various sectors, and the remaining 10 conducted in six villages in the two districts. All FGDs were conducted with the assistance of an interview guide (see **Appendix I**) that was designed to elicit open discussion on topics related to the indicators outlined in **Figure 2** and that could be flexibly adapted to accommodate or pursue particular themes as appropriate.

Tables 1 and 2 provide a comparative overview of the location and nature of data collection efforts in 2016, compared to in 2014/15 for the baseline.

Table 1: Overview of villages in which data were collected for the baseline and in 2016

Longido District		**Kiteto District**	
Baseline	Final	Baseline	Final
Orkiju Longishu, Armenie, Elang'atadapash, ..Sokon, Kimokouwa, and Orbombo villages	***Orkiju Longishuu**** **Engarenaibor*** and Eorendeke villages	Olgira, Sunya, Engusero, Mbigiri, Njoro, Laalala *Ndaleta* and *Ilera* villages	***Ndaleta**,* **Makame*** and *Ilera* villages

* Villages where GFCS-APA interventions were known to have taken place
Italicized villages are those from which data were collected in both rounds of fieldwork

Table 2: Overview of data collection methods employed in the baseline and in 2016

Scale	Baseline	Final
National	Key informant interviews with national programme partners and selected government ministries, departments and agencies and a review of national policy documents	Key informant interviews with national programme partners; observations of and participation in various stakeholder meetings and programme activities at local, national and international levels
District	Key informant interviews with district-level staff representing various sectors and local NGOs	Focus group discussion with district-level staff representing various sectors, local NGOs and local project staff
Village	Focus group discussions, key informant interviews and household interviews with men and women farmers, pastoralists and agro-pastoralists	Focus group discussions with men and women farmers, pastoralists and agro-pastoralists and key informant interviews with intermediaries that took part in PICSA3 trainings

Focus group discussions at the village level generally consisted of between 8 and 15 participants, although in one case, the number of participants surpassed 20. Eight of the FGDs at village level (four in two villages in each district) were conducted with men and women separately, while two (in Engarenaibor village, Longido, and Ndaleta village, Kiteto) involved a mixture of men and women participants. Participants in gender-segregated FGDs were identified with the help of village officials and extension officers with the aim of including participants of different ages, occupations and socio-economic backgrounds. Conversely, in the mixed FGDs, participants were invited based on their participation in activities that were considered to be of particular interest to the project[4]. In addition to village-level FGDs, two FGDs were held at the district level. In Longido, 7 officers representing agriculture and livestock-keeping, health, forestry and beekeeping, economics and environment departments and the district water authority participated in the FGD, while in Kiteto there were 8 participants representing agriculture, livestock-keeping, wildlife, land-use planning, health, water resources and community development. The district-level FGDs covered the same broad topics as were addressed at the village level, with supplementary questions pursued as appropriate.

Key informant interviews followed a flexible approach that varied according to the professional role of the respondent and their knowledge and awareness of particular themes (PICSA trainings, programme implementation experiences) that were deemed to be of relevance to the M&E topics discussed in this report. At the sub-national level, key informant interviews were conducted with four intermediaries that took part in the PICSA training (three agriculture and livestock extension officers and one Red Cross volunteer), and with additional district-level stakeholders[5] to gauge their knowledge and experiences concerning climate service provision at the local level. At the national level, six key informant interviews were conducted with programme implementing partners including TMA, the Tanzania Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC)[6], hereafter referred to as the 'Ministry of Health', WFP Tanzania and

3 Participatory Integrated Climate Services for Agriculture

4 The mixed FGD in Engarenaibor village, Longido, targeted members of an IK forecasting group that was established under a separate initiative involving TMA and IIED, while the mixed FGD in Ndaleta village, Kiteto, targeted Red Cross volunteers, members of a village savings and credit group, and members of a local farmer field school that had to various extents participated in trainings and initiatives connected to climate information and services that were disseminated under the GFCS-APA.

5 Including with the climate change focal point for Longido District, and with the chief district water engineer and representatives of two local NGOs in Kiteto district.

6 Formerly known as the Ministry of Health and Social Welfare (MoH&SW)

TRCS, who were deemed to constitute the primary co-producers, intermediaries and users of the climate services that were developed under the programme at the national level.

FGDs and key informant interviews at district and village levels were conducted by two female researchers from CICERO, with facilitation provided by two male Kiswahili and Maa-speaking research assistants, one a Master student from the University of Dar es Salaam and one employed at a local NGO in Longido District. The fact that local level focus group discussions were conducted primarily in Maa, with Swahili when requested, ensured that women were equally able to participate and understand in these discussions. This provided an advantage over other M&E approaches undertaken within the programme that were not conducted in local languages (Coulibaly et al., 2015; Stats4SD and Cramer-Njihia Consultants, 2017). The research assistants translated from/to Maa, Kiswahili and English during FGDs and interviews, and assisted with practical, administrative and logistical arrangements connected to the fieldwork. In addition, the UDSM assistant was hired to transcribe and translate local-level audio-recordings of FGDs and key informant interviews into English. Interviews with programme partners at the national level were conducted in English and aimed to gain partners' views, perspectives and experiences with developing user-informed climate services within their respective organizations, and their experiences as partners in the GFCS APA programme more widely.

All focus group discussions and interviews were audio-recorded and transcribed. Transcriptions were supplemented by detailed note-taking during interviews and observations and informal discussions undertaken during field tours by the authors and field assistants at the local level. Transcribed interviews were analysed and coded in relation to the main indicators and sub-indicators listed in **Figure 2** (following page) that the research set out to examine. These relate to stakeholder perceptions of institutional coordination and steering mechanisms, their awareness of, access to and use of climate information and services, and the perceived credibility, salience, and legitimacy of this knowledge, as well as experiences with and perceptions of indigenous knowledge. The authors' participation in and observation of various stakeholder meetings and programme activities, including UDSM's participation in the Project Delivery Team (PDT) at national level, and CICERO's participation at Programme Steering Committee (PSC) meetings at international level, and as an observer of parts of the process to develop the national seasonal (OND) forecast in 2015, yielded further observations, interactions, conversations, and insights that have contextualized and informed the findings.

The summary findings presented in the tables in this report address all indicators at the national, district, and local levels with less detail provided with respect to Indicator 4, because the baseline report provides an extensive description of the role that IK currently plays in local decision-making processes in the target districts. These findings remain relevant to co-production of climate services within the GFCS APA but were not targeted as an intervention of the program. In addition, we have added findings related to institutional coordination aspects at national and sub-national levels under sub-indicator 1.2, since these aspects were highlighted by respondents as being important at all levels during data collection in 2016.

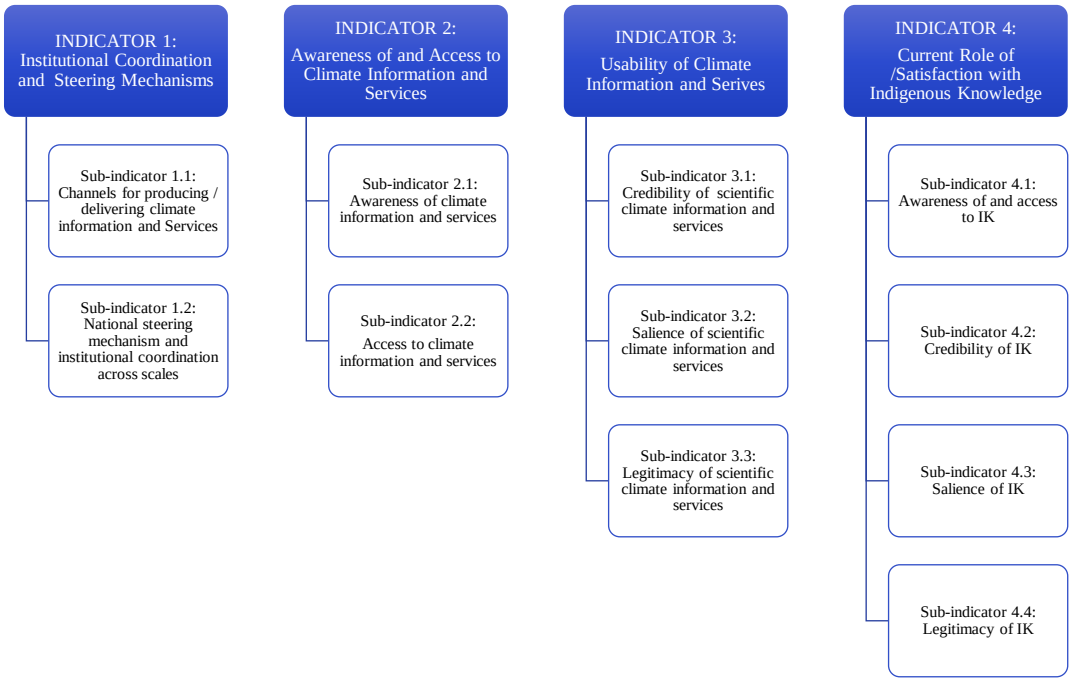

Figure 2: Indicators and Sub Indicators for Assessing User Satisfaction with Climate Services

1.3 Caveats

An important caveat to note is that the climate services that have been developed under the GFCS-APA and that are discussed in this report have been operating in a pilot capacity – generally for less than two years (although in some cases longer), and in limited geographical areas or at particular institutional scales. This renders assessments of their outcomes, let alone impacts, across sectors and scales somewhat premature. By design, these services have built upon or extended previously-developed sectoral and other institutional collaborations between various organizations and governmental and non-governmental (including research) partners and initiatives at local, national and international levels. The provision of sub-national climate services (trainings, SMS messages, radio service) have moreover overlapped to various extents in time and space and been implemented in local contexts where a multiplicity of development actors and initiatives are also operating. This makes it nearly impossible to untangle and attribute "user satisfaction" with climate services across scales solely to the GFCS-APA efforts, or to efforts by any one partner or organization. At the national level, we consider the main users of the climate services that have been developed under the GFCS-APA to have constituted the implementing partners, who have, to various extents, also been co-producers, intermediaries and providers of climate services. At the sub-national level, it proved difficult to gain an overview of the actual reach of particular services over and above general enrollment numbers (total number of people registered for the SMS service, total number of extension officers trained in PICSA), and estimates of potential numbers of grassroots actors reached through the presumed onward training and sharing of this information, which were available from programme reporting documents. For these and other reasons, we employ the term "potential" users and intermediaries when referring to the district and local-level respondents that were consulted as part of the research.

1.4 Background on Districts

As noted in the baseline report, most residents in both Kiteto and Longido Districts practice livestock keeping and/or farming as their main livelihood; however, there are significant differences in terms of the combination of livelihood strategies within and between the districts. These differences have implications for local level vulnerabilities as well as how climate risks are understood and experienced. Kiteto District is located in central Tanzania, in the very southern portion of Manyara Region. The district is generally semi-arid to arid, but there is significant climate variability within the district itself. The northern part of the district is part of the arid Maasai Steppe, receiving an average of 350-400 mm of rain per year, with significant rainfall observed from January through March, while the central and southern portions of the district receive an average of 500-650 mm of rain per year with significant rainfall observed from November through May (Malisa 2014). The predominant livelihoods for residents in Kiteto District are: pastoralism (60%), agriculture (22.8%), and agro-pastoralism (17.2%).[7] Longido District is located in far northern Tanzania bordering Kenya. The district is also semi-arid to arid, with an average of 300-600 mm of rainfall per year (Homewood 2009); however, a much larger portion of the district is arid when compared with Kiteto. District officials reported that 95% of people living in Longido identify as pastoralists, 4% as farmers, and 1% are engaged in small business or petty trade. However, it is important to point out that even those who identify as 'pure' pastoralists often engage in some agricultural activities, although the importance of agriculture for their livelihoods varies substantially.[8]

7 KINNAPA (2011), A profile of KINNAPA development programme, Kiteto District, Manyara Region, Tanzania

8 Chevenix Trench et al. (2009) found that about 67% of households in Longido were cultivating, generally alongside livestock keeping, in 2002/03, but that this was highly variable within the district. Primary constraints that shaped variability of engagement in agricultural activities across the district included low returns related to poor agro-climatic potential, high levels of wildlife damage (i.e. elephants), and lack of adequate labor pools (in that order).

2 Findings for INDICATOR 1: Institutional coordination and steering mechanisms

2.1 SUB-INDICATOR 1.1: Channels for Producing and Delivering Climate Information and Services

2.1.1 National-level channels

Several new channels for producing and delivering climate and meteorological information and associated advisories have been piloted, modified or extended by national and international partners under the pilot phase of the GFCS-APA activities in Tanzania since the baseline. The main thrust of these efforts has been to incorporate and combine climate information produced by TMA, such as downscaled seasonal forecasts and associated advisories, into pre-existing trainings, services and capacity-building efforts by the implementing partners that have targeted actors at the grassroots level. Efforts have also been made by some partners to incorporate longer-term climate change concerns and to avail historical climate information and data as part of their sectorial-focused climate service efforts at different scales. The diverse mandates and working modalities of national and international operational partners, and their interest in availing synergies and adding value to ongoing investments, commitments and partnerships in the region, have shaped the climate service channels that have been developed. These factors have to various extents limited the potential for jointly targeting specific end-users of climate services that cut across the programme's focal areas of health, agriculture and food security and DRR. For example, the health sector partners, the Tanzania Ministry of Health, in collaboration with WHO, chose to focus on "pilot activities", while the agriculture and food security, and DRR partners (WFP, TRCS), TMA and local research partners focused on "pilot districts". The Ministry of Health, in collaboration with WHO, thus developed training, advocacy and awareness-raising materials on climate-health linkages for its staff and health workers at different scales. These activities further supported lobbying for inclusion of health-related concerns in national climate change policies and strategies, and the inclusion of climate change into health sector policies, activities and plans. The health sector partners' decision to focus on developing these channels reflects a need that they identified at the start of the programme for enhanced capacity-building among the Ministry's own staff on climate-health linkages. Similarly, TRCS incorporated seasonal forecast and longer-term climate information into their ongoing food security initiatives and contingency planning efforts at local levels in four communities in Kiteto district due to having previously identified this as a gap in their programming in those communities.

At the sub-national level, operational partners that pursued activities in "pilot districts" [9] (WFP, CCAFS and TRCS) have focused on incorporating seasonal and sub-seasonal forecasting products, tools, advisories and longer-term climate information produced by TMA into a range of information channels and services targeting grassroots actors. Starting in 2015, TMA began to downscale the seasonal forecast produced for the national, zonal and regional levels, to the district level in Longido

[9] The PDT selected Longido and Kiteto as the focal "pilot districts" for project activities in Tanzania at the start of the project. WFP and CCAFS later added Kondoa district to their portfolio of activities, and WHO added Kigoma. TMA also pursued activities aimed at enhancing marine forecasts in the Lake Victoria region.

and Kiteto districts. These downscaled forecasts were subsequently integrated by the project partners and their collaborators into i) a FarmSMS message service that is housed at the agro-met department at TMA; ii) trainings in Participatory Integrated Climate Services for Agriculture (PICSA) that were developed and implemented by CCAFS and University of Reading (UK), together with WFP and TMA, in Longido, Kiteto and Kondoa districts, and iii) a community radio service that was piloted by WFP, TMA and the Arusha-based "Farm Radio" in Longido district in 2016[10]. All three services aimed to reach potential climate service intermediaries within the districts, including agricultural and livestock extension officers, as well as men and women farmers, pastoralists/livestock keepers and agro-pastoralists.

The FarmSMS service aims to distribute sub-seasonal (10-day) and seasonal forecasts, as well as early warnings that include agricultural advice to local subscribers. As of September 2016, TMA estimated that approximately 3000 people in Kiteto and Longido had signed up for the service. PICSA is a series of training modules that aims to enhance understanding and use of climate information at the local level and empower extension officers, farmers and livestock keepers to incorporate climate and meteorological information into their professional, agricultural and livelihood decision-making. The training incorporates historical climate information and downscaled seasonal forecasts produced by TMA. PICSA trainings were provided to agriculture and livestock extension officers at village, ward and district levels in Longido and Kiteto (as well as in Dodoma and Kondoa districts) in 2014, 2015 and 2016. Those who received training were expected to train onwards what they learned to a given number of farmers and pastoralists (Gatheynya, 2017; Mwanga et al., 2017). Additional climate information channels developed by partners included trainings and lectures provided by TMA to school-going children and residents in both districts on climate change, and trainings on livelihood-related climate change vulnerability, impacts and adaptation options and risks conducted by TRCS as part of its contingency planning processes in four villages in Kiteto district[11].

2.1.2 District-level channels

The system for producing and delivering climate services to the district level that was described in the Institutional analysis (Yanda et al., 2015) and Baseline Report (Daly et al., 2016) is still in place in both districts, meaning that the primary way in which climate information is delivered to the districts remains through TMA via formal government channels and mass media (radio and television). However, there are several important differences observed in the channels for producing and delivering climate information in the two districts, since the baseline was conducted. The first is that most of the agricultural and livestock extension officers in Longido, as well as a select number of extension officers in Kiteto and residents in both districts, now receive SMS messages containing seasonal and sub-seasonal forecast information that are distributed in partnership with TMA (both districts) and Farm Radio International (Longido only), under the GFCS programme. Previously, much of the information was delivered either through top-down channels from national, to district, to village level that were slow and inefficient or through mainstream media (primarily radio). Extension officers who were interviewed reported sharing the information they received through the SMS service with other government officials in the village, who then share this information during village assemblies. Additionally, residents who were receiving the messages reported sharing the information with family, friends, and neighbors. The possibility of receiving climate information via SMS was perceived to be an important improvement in being able to access weather and climate information more rapidly and to minimize the delays experienced when information is delivered through bureaucratic processes. Nonetheless, district respondents in both Longido and Kiteto reported that there remains a need for improved distribution of forecast information horizontally (i.e. among departments) at the district level.

10 The community farm radio service was developed to communicate meteorological and climate information to people living in areas that lack a mobile phone network

11 In one of these villages – Ndaleta – seasonal forecasting information was further combined with a farmer field school and extension advice and inputs (seed and fertilizer) promoting improved maize production.

The PICSA training of trainers that was conducted in both districts was also seen as creating a new channel for delivering climate services. Many of the district level officials reported that they were able to sign up for delivery of forecasts by SMS through the PICSA training. However, in both districts, the length and technical complexity of the training and lack of adequate resources to sustain and transmit the training onwards, reportedly limited the dissemination of this information to farmers and livestock keepers on the ground as planned. Extension officers and Red Cross volunteers who were interviewed cited difficulties in training onwards all of what was learned in PICSA to others. This led some officers to condense the training or stick to modules that were more relevant and could be easily understood by farmers and livestock keepers. It was further reported that a lower proportion of extension officers had been trained in PICSA in Kiteto compared to in Longido district. A national programme partner noted:

"The problem which was really coming up [in relation to PICSA] is more on how to facilitate the extension officers in really reaching [communities] because in some areas this proportion of extension officers relative to areas of coverage [is very low]…and this was very vivid in Kiteto" – National-level GFCS partner

2.1.3 Village-level channels

Climate information from TMA continues to be made available at the local level through both formal and informal institutions, as well as through the mass media. However, as noted at the district level, there remain delays in communicating climate information via formal government channels from the districts to the village governments, who in turn have difficulty distributing it. This continues to limit the timeliness of information reaching grassroots stakeholders. Traditional media (radio, and in some cases TV), extension officers, village meetings and trainings remained the most frequently cited channels for accessing information about the weather and seasonal forecasts at the local level. Some residents also reported having participated in seminars and trainings on longer-term climate change provided by other NGOs (not involved in the GFCS programme). However, as reported at the district level, there are several important differences observed in the channels for producing and delivering climate information in villages in both districts compared to the baseline. The first is that a select number of residents in some villages are now receiving SMS messages that contain seasonal and sub-seasonal forecast information that are distributed by TMA. The second is that a number of local intermediaries (agricultural and livestock extension officers and Red Cross volunteers) have received training in PICSA, and report having trained condensed versions of this onwards to farmers and livestock keepers. Third, a separate project under Project Concern International (PCI) had started to produce pasture maps in Longido district. These maps, which rely on remote sensing data, indicate the relative quality of pasture in different areas in the district. The maps have been distributed since January 2016. During the dry season, hard copies of these maps are delivered to district and village offices every 10 days, where they are posted for residents to access them. In some villages, additional copies of these maps are further distributed to the sub-village level (Swahili: *kitongoji*) and further disseminated there.

Large differences in mobile phone and radio reception, road conditions, and coverage and presence of extension officers and NGOs within and across the districts continue to limit the availability and functioning of various channels across villages in both districts. Regarding climate services based on ICT, there is currently no Tanzanian radio station operating in Longido. Most residents reported listening to radio coming from Kenya (e.g. KBC). In other villages, such as Ilera village in Kiteto district, mobile and radio reception were reported to be working well, but radio ownership was reported to be low, and the village extension officer was reported to be living elsewhere.

2.2 SUB-INDICATOR 1.2: National steering mechanism and institutional coordination across scales

2.2.1 National-level findings

The Tanzania Disaster Relief Executive Committee (TANDREC) was adopted in 2014 as the national steering mechanism for climate services development and delivery in Tanzania. Since that time, it has convened once more on 4th of November 2016 to endorse the process to develop the National Framework for Climate Services (NFCS), following the presentation of the draft "Road Map" developed by a team of national experts[12]. At the November 2016 meeting, TANDREC requested to share the NFCS document with relevant departments and ministries for their review before endorsing it. Consultation workshops were subsequently held with national and district-level stakeholders to collect their inputs and feedback on the document. At the time of writing, TANDREC had yet to endorse the NFCS. While the development of a national steering mechanism for climate services in Tanzania is promising, as noted in the baseline, TANDREC's primary mandate is to oversee and coordinate national emergencies. The fact that is has met only twice in three years suggests that it can be challenging to regularly convene this high-level, inter-ministerial committee. This was confirmed by interviews with national-level partners, who cited the cholera outbreak in Tanzania in 2015-16, and the change in government staff following the 2015 general elections, as factors that have hampered TANDREC'S ability to convene more regularly.

In addition to the creation of a national steering mechanism for climate services development, formal and informal institutional mechanisms, processes and partnership-building efforts at the national level have improved the development and expansion of products, processes and channels for producing and delivering climate information, discussed under sub-indicator 1.1. National programme partners highlighted the important role played by the project delivery team (PDT) in this respect. The PDT was established at the start of the programme to oversee and coordinate the implementation of country-level project activities. It met on a quarterly basis, was chaired by TMA, and included national representatives of the international partners and/or their implementing partners as well as selected government representatives.[13] The PDT served as a formal institutional channel for national partners to meet, share and discuss meteorological, climate and sectoral information emanating from their different spheres of activity. It also aimed to strengthen institutional relationships and uptake of meteorological and climate information into sectorial planning activities. National-level partners noted that the establishment of the PDT enhanced interactions, collaboration and trust between them through its function as a dedicated platform for meeting and coordinating project activities. This was seen to constitute a major success of the pilot phase of the programme, as noted by one of the national partners:

"One of the good observations about the GFCS is that it has brought the implementing partners at the national level, it has brought us very, very close together" – National level GFCS partner

Formal channels were complemented by informal channels, including a 'WhatsApp' group, which helped national programme partners to keep in touch and stay informed of one another's' activities during field missions and trips. While communication and coordination were noted to have improved amongst the national level partners, feedback mechanisms from the local and district

[12] According to programme reporting documents, the NFCS drafting team included the Prime Minister's Office (Chair), Disaster Management Department (PMO-DMD), Ministry of Agriculture, Livestock and Fisheries (MALF), TMA and Centre for Climate Change Studies-UDSM. According to programme reporting documents, including PDT, Tanzania Meteorological Society, Government Ministries, Departments, Agencies, academic institutions, UN and international organizations and Non-Governmental Organizations (NGOs). A total of 203 comments have been received and incorporated in the framework.

13 By the end of the pilot phase of the programme, the Tanzania PDT comprised TMA, WMO, WFP, WHO, TRCS, UDSM, MALF, PMO-DMD, VPO, and MoHCDGEC.

levels to the national level were considered by several partners to be inadequate and ad-hoc. The following feedback illustrated this point:

"The problem is that at the central level, it could be good communication and feedback and so forth, but what is transpiring in the field, where you can capture information and get the feedback, I don't think that is adequate as it is" – National level GFCS partner

This is a notable limitation, given that the GFCS-APA aims to develop user-relevant and -informed climate services. In addition, a number of institutional factors, including the top-down design of the programme and its funding modalities (with partners maintaining separate budgets for their own activities), and the different priorities, planning horizons, and geographical and topical areas and mandates of work of the partners were noted to have limited the PDTs ability to play a stronger coordinating role at the national level and reduced incentives for partners to collaborate on jointly defined activities. Limited resources dedicated to obtaining user feedback, the fact that an M&E framework was added on to the programme after it had started, that research and operational activities operated in parallel, and the lack of formalized feedback targets and formalized mechanisms for incorporating stakeholder feedback and research findings into operational activities as they unfolded, were seen as key obstacles in this respect. Bureaucratic delays related to partner organizations' internal reporting requirements and procedures for transferring funds from international, to regional, to national and then to local operational partners, were moreover reported to have slowed down implementation in some cases.

All of these factors made it difficult for project partners to agree on common geographic and topical areas and institutional scales of work. As mentioned earlier, the health sector chose to focus on pilot *activities* aimed at capacity-building and awareness-raising activities regarding climate-health linkages at the national level, while other partners pursued activities in selected pilot *districts*. The following comment from a national partner illustrates some of the challenges they faced in relating to the top-down design of the programme:

"We were not involved in the set-up of the project, so it took us about 8 months to understand really what we are supposed to do" – National level GFCS partner

The climate services that were developed by TMA and project partners moreover build on a range of prior (and in some cases ongoing) national and international collaborations, initiatives and investments in climate services. For example, the FarmSMS service was originally developed by TMA in collaboration with Sokoine University of Agriculture (SUA) for communicating climate information directly to farmers via Short Message Service (SMS) technology. According to interviews with national partners, the service was first piloted by TMA, Sokoine and CCAFS in Lushoto in 2012. Similarly, the TRCS trainings and interventions in Kiteto built upon prior capacity building, community engagement and institution-building efforts pursued between 2012 and 2014 under a French Red Cross food-security project that was implemented in these villages. The PICSA tool was developed and piloted by CCAFS and the University of Reading in several other countries prior to its inclusion in the GFCS-APA. The health sector activities aimed to connect to prior investments in programmes such as ENACTS (Enhancing National Climate Services initiative) and 'maproom'[14] products that were developed by the International Research Institute for Climate and Society (IRI). Decisions around the climate services activities that were prioritized and pursued under the programme were therefore influenced by a number of prior investments and advances made by the programme partners related to the development of particular climate services tools and products. This created additional coordination challenges.

14 The climate and society maproom is a collection of maps and other figures that monitor climate and societal conditions at present and in the recent past. See: http://iridl.ldeo.columbia.edu/maproom/index.html

Finally, concerns were raised about the sustainability and impact of activities implemented under the programme. The lack of a physical presence by UN partners in the target districts, lack of institutionalization of PICSA trainings within the district extension services, and differential levels of "buy-in", commitment and investment by districts themselves in programme activities were seen as potentially reducing the sustainability and impact of programme efforts. The following comment illustrates this point:

"Normally UN agencies they don't implement directly. They tend to implement through some other local organization. So that I don't expect…. them to be implementing on the ground, rather than just coming, you carry out – if it is a training, conduct the training and then move out. So, in that way, that level, the [collaboration with the district] cannot be strong" - National level GFCS partner.

2.2.2 Institutional coordination at district levels

As noted in the baseline report, the district level is particularly important for climate services development in Tanzania, due to the country's decentralized governmental structure. It is here that government officials interface most directly with the local populations that are intended to benefit from climate services and where many national policies and plans are implemented. In addition to the continued lack of horizontal mechanisms for distributing climate information within the districts, a key finding from data collection in 2016 is that there are a number of overlapping interventions, initiatives, and programmes focusing on communication of climate information and capacity building in relation to climate adaptation in both districts. This has important implications for institutional coordination in climate services development and makes it difficult to assess the extent to which the GFCS programme efforts have contributed to enhancing user satisfaction with climate services at the local level, relative to other programmes and initiatives.

Stakeholders in both districts noted that programme efforts had built and improved upon existing structures and knowledge at the district level that existed prior to the GFCS-APA. For example, much of the institutional coordination at the district level in Longido occurred through modes of cooperation already established under the IIED devolved climate finance project, which was in the process of establishing a dedicated Climate Change Unit in the district headquarters to coordinate all climate-related activities in the district. Under this unit, there are plans already underway to establish a community radio station in the district as a mechanism for distributing information. An additional project that is coordinated by Project Concern International (PCI) is delivering grazing maps to villages during the dry season. These maps were visibly noticeable on information boards in villages in Longido district. Although the PCI project that is providing the pasture maps was new, it was also seen as establishing a means of delivering relevant and timely information. However, this project was largely undertaken in partnership with the Ministry of Livestock and Fisheries Development, rather than through cooperation with TMA. Thus, it will be important to establish effective ways of coordinating these efforts to leverage mutual opportunities and avoid duplication.

In Kiteto, TRCS activities conducted under the GFCS-APA built upon a previous food security project that was run by the Red Cross office at Kibaya town which started in 2012 with funding from the French Red Cross/Red Crescent society. Activities under this programme focused on four villages: Ndaleta, Makame, Olpopongi and Ndedo. A range of food security activities were identified, prioritised and pursued in consultations with communities under this project[15]. These were the same four villages in which TRCS interventions under the GFCS-APA took place. The latter focused on integrating seasonal forecasts and climate information into community contingency plans and adding value to existing food security interventions through the help of local

[15] The activities ranged from water conservation and construction of an earth dam (Olpopongi), the establishment of community savings groups (Vikoba) and demonstration plots for maize, sunflower and other crops using improved seeds and other agricultural inputs in Ndaleta village, the promotion of maize farming and oxen ploughing in Makame village, and the promotion of dairy goats in Ndedo village.

Red Cross volunteers and district extension services. On the one hand, building on previous initiatives has potential benefits in terms of building on and potentially adding value to existing capacity, community engagement and networks. In support of this, it was noted that the physical presence of the local Tanzania Red Cross office at Kibaya had helped to facilitate collaboration between national and district project partners. The following comment illustrates this point:

"The engagement [between the Red Cross and Kiteto district] has been very close….even these implementing partners who are not based in Kiteto…like for example TMA: they are not based in Kiteto; WFP: they are not based in Kiteto, but whenever they had to do something in Kiteto, they received the same level of collaboration, of course being connected by the Red Cross who are based there" - National-level GFCS partner

In addition, it was noted that the Red Cross donated a motorbike that it had acquired under the previous food security project, to the district extension services. This was reported to have facilitated that officers' ability to reach communities with climate and other information and advice under the GFCS programme and enabled him to follow-up and seek feedback from local stakeholders. On the other hand, the fact that the programme partners were building on pre-established projects and investments with different levels of coverage in the districts made it difficult to identify common goals and joint activities in specific geographic areas, rendering coordination difficult. In addition, this presented challenges for conducting programme "baseline" studies, and attributing changes in grassroots actors' access to and use of climate services to the GFCS-APA.

2.2.3 Institutional sustainability of PICSA trainings

It was noted that while the PICSA trainings were held in the districts, there was considerable scepticism about its sustainability. A district officer in Longido noted: "PICSA…let's just say that it was conducted, but it didn't bring good results because the groups didn't really spread. But the training was done, they held gatherings and conferences". While there is an intention to institutionalise the PICSA approach, this has not yet happened. It was largely viewed that PICSA had not put in place sustainable mechanisms to continue to carry out the trainings or to build on these capacities. As noted by one district-level focus group participant: "from my perspective, the main issue is the sustainability of the [GFCS] project. PICSA was very relevant to the community, but the problem is, how do we sustain the project in our communities?" These concerns were summed up by one respondent:

"But the problem with PICSA is that the extension officers have problems trying to gather farmers and pastoralists, because this will be during their agricultural and herding activities…My fear now [about the PICSA training] is about the sustainability among those who have been trained. It's starting to dwindle a bit. It's starting to dwindle, because even the amount of people who were gathered during that time, it wasn't representative. People all came only from one place. So, it's a really big challenge." – Longido District Officer

It was further noted that PICSA is a time-consuming training for extension officers to run. This created several issues in terms of perceived sustainability: 1) extension officers do not have adequate resources to enable them to continue to conduct the PICSA trainings for additional residents in their areas, 2) the training is four days long and there was scepticism about whether residents would be willing or able attend all four days of training, and 3) the previous two issues are exacerbated by the fact that many households in both districts are far apart, making it difficult to gather groups of residents for the trainings.

2.2.4 Institutional coordination at village levels

There are wide variations in institutional capacity and structures for consistently delivering and availing information and services of all kinds at the village level. In Longido, institutional coordination for sharing climate information at the village scale, where it is available, have

generally remained informal. For example, while some respondents who reported receiving SMS messages stated that they share information they receive, they do so in an ad hoc manner, generally showing these to family and friends. Similarly, village government representatives share weather and climate information during village meetings, but this is only when the receipt of climate information overlaps with an existing meeting. In villages in Kiteto where TRCS has been carrying out food security interventions, and where both Red Cross volunteers and extension officers were present, villagers were generally well-organized and informed of the availability of seasonal forecasts and other climate information. For example, in Makame village, both men and women FGD participants had held elections down to the sub-village level to elect trusted male and female residents specifically for enrolling in, accessing and communicating messages from the FarmSMS service to the community. Although men and women community members were very eager to access this information, lack of mobile reception in the village prevented the selected individuals from accessing the SMS alerts or advisories. Several people from Makame reported having travelled to a distant mountain where mobile reception was known to be intermittently available. However, they reported that they were unable to access the SMS information due to the lack of a hotline or pre-recorded message service that they could dial into.

In general, institutional mechanisms for delivering and following up on climate information and services are strongest in communities where prior interventions and capacity building (by programme partners and others) have taken place, where there is supportive village leadership, where active and engaged community groups exist, and where the infrastructure to support general service provision (roads, mobile and radio networks) are functioning. There are large variations in all these factors between villages within the target districts, and between the two districts. As noted by a national-level GFCS partner:

"The dissemination and accessibility of information in Kiteto is much more complicated than in Longido. And the other thing, of course would be…now the dissemination is from the part of [partners] and on the part of the infrastructure. And maybe the other issue is maybe also less awareness to the community over there, which could be attributed to the geographical location as well. The fact that it is easier to go to Longido than to Kiteto". National-level GFCS partner

The political priority given to basic service provision such as healthcare, education, water, and agricultural and livestock extension (including veterinary) services moreover varies greatly between villages on the ground. For example, agricultural and livestock extension officers were noted to play a key role as intermediaries in the delivery of climate information and services in many cases. However, they generally lack basic resources and means of transportation, leading to large variations in the frequency and quality of advisory services provided to local farmers and livestock keepers. While this is a broader issue nationally in Tanzania, which is outside of the scope of a project like the GFCS-APA, there is a clear need to strengthen financial and other resources available to the extension service to ensure that they can play a stronger role as climate service intermediaries.

NGOs also play important roles as service providers and intermediaries of climate information and services. However, NGOs are extra-governmental structures that are vulnerable to fluctuations in external donor funding and are hence not a substitute for investments in local government capacity. This was clearly evident in Kiteto district, where the TRCS climate service initiatives focused on just four villages. These were villages in which previous Red Cross food security interventions and capacity-building had taken place and where the institutional conditions for supporting access and uptake of climate services were arguably more favourable, compared to elsewhere. FGD participants in Ilera village, in Kiteto district, which was not a part of the TRCS food security initiative, but whose extension officer had reportedly participated in the PICSA training, reported low levels of access to climate information and low levels of satisfaction with institutional structures at the village level. A FGD participant lamented the fact that "the government is far

away"[16]. Residents reported that the former presence of the local NGO, KINNAPA had been instrumental in providing men and women residents with a range of support, trainings and services. Discontinuation of these activities combined with a reported lack of village leadership and an absentee extension officer were seen as preventing villagers from connecting with external information and initiatives of all kinds. This extended to the climate-related trainings, information and services that were disseminated under the programme. In both districts, it was reported that those who signed up for the SMS service at the village level were generally those that took part in programme trainings conducted by TMA or as part of PICSA. Hence, residents of communities that were not targeted for these trainings generally had no means of engaging with the project or accessing its climate services.

The potential for climate information and services to reach rural residents consistently and equitably thus arguably requires that access to such information and services are embedded and institutionalized at local levels. In the absence of such institutionalization, access to climate information and advisories based on such information will be ad hoc and dependent on linkages to external interventions and contacts, as described above. In Longido district, other projects have attempted to establish more formalized institutions to distribute climate information. The strongest example of this is the development of Divisional Adaptation Planning Committees (DAPC), which were established under the IIED devolved climate finance project[17]. These committees, which are made up of elected representatives from the community and technical experts from the district, are supported by administrative funding from the district and have been established to prioritise investments in public goods with the goal of strengthening local adaptive capacities in response to climate variability and change. Climate information is intended to play a key role in informing these investments. While these committees are still quite new, it will be important for the GFCS to link with these structures, both at the local and national levels, in the future. Additionally, The PCI project has also established an institutional mechanism (since January 2016) that enables the District to deliver hard copies of grazing maps to village and ward offices and onward to the sub-village level in some locations. This appears to have been generally successful in the first few months of the project (as of end August 2016), but it will be important to determine how this system will function in the long-term once project funding has run out. IIED has further attempted to establish a formal Indigenous Forecasting Group based in Engarenaibor, starting in 2014. This group was intended to meet on a bi-weekly basis to discuss forecasts produced by various members of the group and to transmit this knowledge to TMA. However, sustainable mechanisms were not put in place and the group stopped meeting on a formal basis shortly after being established. Finally, as noted in the baseline, there are several existing institutional mechanisms that can, and in some cases do, serve as delivery channels for weather and climate information at village scales, and that could be better harnessed in future climate service efforts. These include ward development committee meetings, village leadership meetings, and village assemblies. Customary leadership structures are also employed to deliver weather and climate information, since these tend to be highly trusted within communities, although they may meet less frequently than formal government leadership.

16 "Serekali ni mbali" [In English: the government is far away]

17 This project was originally implemented in three pilot districts: Longido, Monduli, and Ngorongoro. With the support of DFID's Assisting Institutions and Markets for Resilience (AIM4R) programme (2016 – 2021), IIED is working in partnership the President's Office of Regional and Local Governments (PO-RALG) and the United Nations Capital Development Fund (UNCDF) to scale the implementation of devolved climate finance and DAPCs to 12 additional districts. Tanzania is currently in the process of becoming an accredited implementing entity under the Green Climate Fund, with the goal of providing a sustainable source of funding for the DAPCs in the future.

Table 3: Summary of Findings on Institutional Coordination and Steering Mechanisms

INDICATOR 1: Institutional Coordination and Steering Mechanisms		
SUB-INDICATOR 1.1: Channels for Producing and Delivering Climate Information and Services		
Institutional Scale	**2014**	**2016**
National	• TMA is the main producer and provider of climate services and information at the national level. • Channels for receiving meteorological and climate information through formal government pathways were primarily through written letters and email. • Channels for receiving climate information through informal pathways were through television and websites.	•National partners and collaborators have piloted and expanded several channels for delivering climate information and services to local and district-level stakeholders, including an SMS service, participatory trainings and a community radio service, all of which incorporate seasonal forecast information provided by TMA. •Training, advocacy and awareness-raising materials on climate-health linkages have been developed and disseminated to health sector workers and policy makers at the national level.
District	• Primary channels for receiving climate information were written letters and email. • Television was the primary channel for receiving climate information informally.	•Primary channels for receiving climate information remain formal government pathways and informal media •SMS messages are now playing a role in delivering seasonal forecast information to officers who have signed up for this service. •A number of extension officers have been trained in the Participatory Integrated Climate Services for Agriculture (PICSA) tool.
Local	• Primary channels for receiving climate information were radio, television, extension officers, and village meetings, with radio being the most prevalent.	•Primary channels for receiving scientific climate information remain radio, extension officers and village meetings for seasonal and sub-seasonal forecasts, and NGO trainings for longer-term climate change •Few respondents reported having receiving SMS messages, participated in PICSA trainings or listened to the community radio programme
SUB-INDICATOR 1.2: National steering mechanism and national and sub-national institutional aspects		
Institutional Scale	**2014**	**2016**
National	• A steering mechanism (TANDREC) was adopted in August 2014, but has not met since to discuss issues related to climate services development; • The 'Road Map' for the National Framework for Climate Services (NFCS) is under development.	•TANDREC has convened once more since the baseline to consider the draft NFCS but has yet to endorse it; •Enhanced institutional coordination and collaboration were reported among national project partners, primarily through the PDT; •A range of factors have undermined project coordination across sectors and at sub-national levels
District	Not directly addressed in 2014	•Formal mechanisms for distributing climate information horizontally across district departments and for institutionalizing climate services into planning remain lacking; •Lack of district disaster management units/ departments are a barrier to responding to climate information; •GFCS-APA activities have built on a range of local initiatives that make it difficult to attribute outcomes specifically to the programme
Local	• Not directly addressed in 2014	•NGOs, extension officers, community groups, traditional leadership and village government play key roles in enhancing the uptake of climate information and services locally; •Respondents were unable to differentiate between GFCS trainings and trainings provided by other organizations and institutions

3 Findings for INDICATOR 2: Awareness of and Access to Climate Information and Services

3.1 SUB-INDICATOR 2.1: Awareness of Climate Information and Services

3.1.1 National-level awareness

Awareness of climate information and services remains high at the national level, and the project was noted to have supported more frequent and improved communication and interaction between the national and sectorial project partners, TMA and relevant government ministries, departments and agencies such as the Ministry of Agriculture, Food Security and Cooperatives (MAFC), and the Prime Minister's Office – Disaster Management Department (PMO-DMD). However, interviews in 2016 and discussions with national and international partners at various points indicate that there were varying levels of awareness within the different sectors about the linkages between climate change and their respective areas of work going into the GFCS-APA. Hence, while awareness of climate change information and climate services continues to be high among programme partners who are engaged in agriculture, food security and DRR-related activities, levels of awareness of climate information and climate services were reported to have improved considerably since the baseline within the health sector. This was reported to be the result of targeted efforts by WHO and MoH to build the capacity of the Ministry and health sector staff to understand and address climate-health linkages and to communicate and advocate for inclusion of health as part of national climate adaptation policies and plans. Efforts to include the health sector in Tanzania's National Adaptation Plan process indicate an improvement on the situation at the start of the project, when the concept of climate services was not reflected in any national policy or planning documents in the sectors of food security and agriculture, disaster management and risk reduction, and health (Daly et al. 2015).

National level partners considered one of the key successes of the GFCS-APA to have been in raising sub-national stakeholders' awareness about climate information and climate services. This was summarized by one respondent, who noted

"I think, overall, in my opinion, it is a very good project. Yeah, it's a very good project because information is power. So, when you give someone information, if it is a seasonal forecast, this person makes a decision based on that information" – National-level GFCS partner

Nonetheless, several respondents expressed a need to move beyond awareness and sensitization towards mobilizing resources to sustain the services that had been developed under the programme. The following comment expresses this point:

"To me I think as a pilot phase, I think they [grassroots actors] have a good level of sensitization, of awareness. Now it is to see how really the capacity of the district officers can be enhanced, how the districts themselves can put in more resources to make an extension [system] which is more useful to their farmers" – National respondent, GFCS partner

3.1.2 District-level awareness

There was little change in awareness of climate information and services at the district level in relation to the baseline: all officers in both districts were aware of the availability of climate information provided by TMA, and most were aware of the GFCS programme. However, there continued to be higher awareness about the programme among those working directly with climate change, agriculture, livestock-keeping, and water engineering and management (the latter are responsible for rain gauge measurements in some cases) in the districts, compared to officers working in other sectors, such as health, community development and beekeeping, forestry and natural resource management. All respondents were aware that forecasts from TMA are now available through SMS, which was a newly delivered service in both districts. Agriculture and livestock officers were aware of PICSA as an activity that was carried out under the GFCS and that had enhanced awareness of climate information, and several officers had participated directly in the training itself. In general, respondents noted that the primary benefit of the GFCS program was that it had created and enhanced awareness of climate change and about the availability of climate information.

It is important to note, however, that participants were often unable to distinguish PICSA from other climate adaptation-related initiatives being carried out in the districts. In Longido, these initiatives included: 1) a devolved climate finance project being coordinated by the International Institute for Environment and Development (IIED), 2) a project delivering grazing maps during the dry season coordinated by Project Concern International (PCI), and 3) a project trialling new crop and seed varieties to cope with and adapt to climate variability/change coordinated by UDSM and the Selian Agricultural Research Institute (SARI). In Kiteto, climate adaptation-related initiatives included trainings provided by TRCS, agricultural trainings and exchanges facilitated by the district extension service in cooperation with SARI, and trainings on climate change provided by two local NGOs[18]. The GFCS efforts were seen to have generally added on to and enhanced these activities by creating greater awareness about climate change and providing access to improved information generated by TMA at local levels. A local project partner in Kiteto noted that, thanks to the GFCS efforts, *"people now know about and believe in climate change"*. Respondents in Longido were, however, most familiar with the IIED project, since this was a project that had been running in the district for many years and has had climate adaptation as its focus.

3.1.3 Village-level awareness

At the village level, most respondents are aware of the meteorological and climate information emanating from TMA that is broadcast through traditional channels (radio, television), including daily weather forecasts, seasonal climate forecasts and extreme weather advisories, even if they were not always able to access this information (See Section 2.2). However, awareness of the climate services delivered under the programme was highly variable within and between villages. As noted under sub-indicator 1.1 (Section 2), there are large differences in the availability and functioning of various climate information and service channels in different villages, including in mobile phone and radio reception, road conditions, and in the coverage and presence of government and NGO programmes, and agricultural and livestock extension services that could potentially communicate and translate climate information to grassroots actors. There are moreover socio-economic, gender, and cultural differences that affect peoples' ability to access different climate information channels, and the extent to which different channels and messengers are considered trustworthy. While awareness of climate services and information varied within and across villages, there is generally high awareness at local levels that the climate and local weather patterns are

18 KINNAPA and NAADUTARO. KINNAPA Development Programme is a community-based non-profit organization that aims to enhance the quality of life for pastoralists, hunter-gatherers and small scale agriculturists in Kiteto district. The name KINNAPA is an abbreviation of the names of six founding villages: Kibaya, Kimana, Njoro, Ndaleta, Namelock and Partimbo. NAADUTARO has a vision to help pastoral societies with their survival options on secured land and environment. The name NAADUTARO is a Maasai name which means Pastoralists' Survival Options. Both NGOs are based in Kibaya, Kiteto.

changing. This high awareness is generally due to peoples' own observations, although in some villages respondents reported having taken part in trainings provided by NGOs.

In general, awareness of "novel" climate information products and services (PICSA and the FarmSMS) were highest in villages where prior capacity-building interventions had taken place, where multiple channels for communicating such information exist, where onward training of PICSA (and enrolment in the SMS service) took place, and where possibilities for residents to seek supplementary information and advice from intermediaries based on the climate information and advisories that they received, exist. A clear example of this is Ndaleta village, in Kiteto district. The village is located close to the district headquarters (Kibaya Town), has good radio, television and mobile reception networks, a visible and active extension agent, and Red Cross volunteers who act as climate information intermediaries. A contrast to Ndaleta is Makame village, which is also found in Kiteto, but which is located nearly 100 km from the district headquarters at Kibaya. The village lacks both mobile reception and radio network. The presence of the TRCS, and of agricultural and livestock extension officers, were reported to provide a crucial, if sporadic, channel for delivering climate information and services. In villages where few information and communication channels exist, respondents reported becoming aware of meteorological and climate information by chance or via intermittent radio signals or TV programmes while travelling to other parts of the district or region.

The existence of multiple interventions dealing with climate-related aspects of livelihoods at the local level makes it challenging to attribute increases in awareness of climate information or climate change solely to the GFCS efforts. This was most clearly evident in FGDs conducted in Longido district. Here, men in Eorendeke village noted specifically that the IIED project was a primary factor in increasing their awareness of the weather and climate information that was available to them and that they had been aware of weather forecasts through radio and TV since at least 2007. In contrast, women in Orkijuu Longishuu village seemed quite surprised about the idea that weather and climate forecasts were available through the radio and were quite interested in the prospect of being able to receive information this way. It is notable that in both districts, men and women respondents experienced difficulties in distinguishing between various climate-related training and awareness-raising activities conducted by different organizations. In several cases, there was confusion about the PICSA trainings, and trainings connected to other agricultural and livelihood-focused interventions and programmes that had taken place previously, or were operating simultaneously in the districts, but conducted by other organizations.

Table 4: Summary of Findings on Awareness of and Access to Climate information and Services

INDICATOR 2: Awareness of and Access to Climate Information and Services		
SUB-INDICATOR 2.1: Awareness		
Institutional scale	**2014**	**2016**
National	• All respondents are aware of climate information and some expressed awareness of the concept of climate services.	• Awareness of climate information, climate-health linkages and climate services has improved within the health sector and continues to be strong among project partners dealing with agriculture, food security and DRR.
District	• All respondents are aware of climate information, but few expressed awareness of the concept of climate services	• Awareness of climate information remains high, and most respondents are aware of the concept of climate services; • The PICSA training was considered to have enhanced awareness of historical climate information and seasonal forecasts among training participants.
Local	• Most respondents are aware of climate information, but none expressed awareness of the concept of climate services	• Most respondents are aware of climate information generally, but awareness of the specific services delivered under the programme is highly variable within and between villages
SUB-INDICATOR 2.2: Access		
Institutional Scale	**2014**	**2016**
National	• Climate information was available to all respondents. • All respondents reported TMA as the primary source of climate information. • Other news outlets, international climate prediction centres, and academic institutions were also listed as sources of climate information.	• Climate services targeting different institutional scales and sectors have been developed and disseminated by programme partners; • National operational partners, alongside TMA, arguably constitute the primary co-producers, users and intermediaries of these services at the national level under the pilot phase of the programme.
District	• Climate information was available to all respondents • All respondents were able to access climate information, but not always consistently. • All respondents reported TMA as the primary source of climate information. • Other governmental institutions (e.g. MoW, NEMC) were also cited as sources of climate information, along with NGOs and academic institutions.	• Climate information was available to all respondents, but not always consistently • All respondents reported TMA as the primary source of climate information. • Other governmental institutions were also cited as sources of climate information, along with NGOs and academic institutions • The FarmSMS and PICSA trainings were considered to provide welcome additional channels for accessing climate information for those who have signed up for or participated in them.
Local	• Availability of and access to climate information was highly variable both within and across sites. • Access to climate information was generally less than half of respondents across sites, with women reporting lower levels of access than men. • Respondents reported TMA as the primary source of climate information, although NGOs were also important sources of information about long-term climate change.	• Availability of and access to climate information was highly variable within and across sites • Women generally reported having lower levels of access to the range of available climate information and service channels, compared to men • The primary sources of climate information varied within and across villages according to the availability of different services, and means of accessing them

3.2 SUB-INDICATOR 2.2: Access to Climate Information and Services

3.2.1 National-level access

Collaborations between TMA, the national operational partners (WFP, TRCS, MoH) and the international programme partners and collaborators under the GFCS-APA were noted to have expanded the range and types of available channels for obtaining climate information and services across institutional scales compared to the situation previously (Yanda et al., 2015). The climate services and training tools developed have generally consisted of incorporating TMA meteorological and climate information, such as downscaled seasonal forecasts and historical climate data, into existing or prototype services and training tools that were developed by national or international programme partners and collaborators. These services and tools were subsequently disseminated through national and local partners to stakeholders and constituents on the ground in particular geographic areas or within particular sectors. For example, WFP and CCAFS climate service activities focused on agricultural and food security aspects of local livelihoods and aimed to enhance access to climate information and services to grassroots actors and potential intermediaries (extension officers and district staff) at the sub-national level. The climate service developed involved combining a pre-existing tool, PICSA, which was developed by University of Reading and CCAFS, with TMA information, including newly downscaled seasonal forecasts and historical climate data. In general, the operational partners noted that access to TMA information and services, both at the sub-national level and within their organizations had improved because of interactions and platforms established between the national partners under the pilot phase of the programme. For example, it was noted that the MoH's access to TMA products and information had improved because of MoH's participation in the national project delivery team. It was noted that TMA products and information could potentially be combined with the web-based "maproom" interface developed by IRI at Columbia University and employed elsewhere by WHO

3.2.2 District-level access

Awareness of climate information at the district level remains high. However, access to this information continues to be uneven, with greater access reported among agriculture and livestock officers compared to health, water, community development and other district officers. Among district-level respondents, access to climate and meteorological information was reported to have improved notably as a result of enrolment in the FarmSMS message service, participation by some district staff in the PICSA trainings, and the establishment of informal lines of communication (via mobile phone and email) with TMA. Such improvements were primarily reported by agriculture and livestock-keeping officers who were targeted by trainings, signed up for the FarmSMS service and/or that had direct contact with TMA as part of their institutional mandates or participation within the programme. However, district officers working outside agriculture and livestock-keeping, including within sectors such as health, community development and natural resource management, reported facing challenges to accessing climate information consistently. This was seen as a constraint to mainstreaming climate change into cross-sectoral decision-making and planning at the district level. Hence, while the representative from the Health Department in Longido noted that she had received trainings about climate change through other programs, she was not currently receiving any forecasts or other climate information through formal channels. Similar concerns were raised by health, community development and forestry officers in Kiteto. This may be explained, in part, by the fact that respondents noted that only those people who had attended the PICSA training were accessing the forecasts through SMS messages on their phone, since this is where they had the opportunity to register their phone numbers with TMA. In general, the lack of a horizontal mechanism for sharing climate information across all offices and sectors within the district constrains widespread access to this information and prevents integrating climate concerns consistently into planning. The fact that registration for the SMS service is based on individuals, rather than offices or institutions, may further interrupt flows of information over time. For example, high turnover in staff was reported at the district level in Kiteto following the 2015 general elections. In the absence of procedures for institutionalizing enrolment in the SMS service, there is a danger that new staff will not sign up to receive the SMS messages.

It was further pointed out that there is no dedicated Disaster Management Department at the district-level that could be mandated to distribute warnings. Additionally, the issue of budgetary constraints was seen as prohibiting the delivery of the forecast information to sub-district levels. A lack of resources to facilitate motorbikes, petrol, bicycles and other forms of transportation by extension officers to communities and households that are located far apart, was reported as a particular constraint. In Longido, since many residents live in areas that do not have mobile network, community radio was seen as the best solution to enabling improved dissemination to villages. Respondents noted that the long-term plan in Longido District was to install a community radio station at the district headquarters. It was unclear whether the community radio station being referred to, was the one being piloted by WFP and Farm Radio International (based in Arusha), by TMA, or by other organizations. A UNESCO radio service was mentioned by several respondents at the village level, and district officers in Longido reported that they are currently working with IIED to move forward with a plan for the community radio. This is another example of the importance of ensuring coordination across multiple initiatives.

3.2.3 Village-level access

While there have been improvements made in awareness of climate information, a key challenge remains to transmit it to the village level. This challenge was similarly noted in the Baseline Report and many of the challenges have yet to be addressed fully. Despite the expansion of the SMS service, the introduction of a community radio programme (in Longido) and the fact that PICSA trainings were conducted in both districts, wide disparities in access to both traditional and new forms of climate information and services continue to be noted within and between villages.

Some villages in Kiteto, including Makame village, lack both radio reception and mobile network access, and are located in remote locations, far from the district headquarters. And while extension officers and local NGOs continue to play key roles as intermediaries in the delivery of climate information and services and in packaging information into understandable and usable formats for local stakeholders, the coverage and visibility of extension officers were reported to vary widely at local levels. The most frequently accessed type of climate information mentioned in relation to all channels by respondents in 2016 was advisories and early warning information connected to high forecasted rainfall in the districts in 2015, an El Niño year. Own observations, and NGO trainings remained the dominant source of information about longer-term climate change in both districts. In villages lacking NGO projects or efforts that the GFCS climate service efforts could tap into, and with limited mobile and radio reception and an absence of extension officers, limited possibilities exist for residents to consistently access any kind of climate information. In such cases, residents reported accessing climate information via sporadic trainings provided by local NGOs, or intermittent radio messages accessed while travelling outside the village.

The findings suggest that there is the potential for the SMS channel to continue to expand in the future if there is sufficient demand and enough individuals are trained on how to sign new recipients up for the alerts. At the same time, it is important to note that many portions of Longido district and parts of Kiteto still lack reliable mobile network services, which places limitations on the expansion of this mode of delivery. In Longido, extension officers reported sharing information received via the SMS service directly with other government officials in the village, who then share this information with residents during village assemblies. Additionally, several residents in Longido and in Ndaleta village in Kiteto, who were receiving the SMS messages, reported sharing the information with family, friends, and neighbours. In an encouraging sign, respondents in Orkijuu Longishuu village (Longido) reported that they knew very well how to help someone else sign up to receive the SMS messages. However, Red Cross volunteers in Ndaleta village reported that it is time-consuming and expensive to reach all households with this information. They recommended extending both the SMS service and PICSA trainings to sub-village leaders to facilitate a more thorough and equitable flow of information within the community, as well as posting district letters on the village notice board.

An important assumption in relation to the PICSA training, is that those who have received the training will “train onwards” what they learn to farmers and pastoralists in the regions in which they

work (Gatheynya, 2017; Mwanga et al., 2017). However, as mentioned earlier, our findings indicate that there are challenges to ensuring the onward training of the PICSA tools, which poses barriers to access of climate information at the village scale. Interviews with extension officers and with stakeholders and partners at district and national levels, raised concerns about the extent to which extension officers were in fact able to train onwards what they learned to residents.

Gendered differences in access to, and preferences for, different channels continue to be noted in both districts. For example, while men in Ilera village noted that they had sporadic access to the ward extension officer and regularly listened to the radio, women in the same village noted that they had had no previous interaction with extension officers. They further reported that radio messages are infrequent, and most women don't own radios. When asked whether text messages would be a preferred channel for receiving information about the climate and weather, women respondents noted that an SMS service could be used "for those who can read the messages". Cultural preferences were also noted, whereby, for example, Maasai women in one village in Kiteto stated that they would prefer, and trust messages received by either radio or via government authorities. In other villages, female Maasai respondents noted the importance of face-to-face or community forums for communication of climate information and weather forecasts, indicating a preference for oral, over written, methods of communication. The fact that few women were included in training opportunities was repeatedly emphasized and was a clear point of contention between participants in one mixed FGD where both men and women participated (See Sub-indicator 3.3 for additional discussion). This underscores the continued importance of employing multiple communication channels to ensure equitable and broad-based access to climate information and services at the village level.

Moreover, despite perceptions that the delivery of climate information had increased in a general sense in some locations, there were still significant differences between the channels through which men and women were able to access this information. In Longido, radio was seen by far as the best way of distributing climate information. However, even if a community radio station was established and information delivered in Maa language, it was noted that there would still be gendered imbalances in access. In nearly all cases, the men own the radios and would, therefore, have control of them. It is also important to note that many women in both Longido and Kiteto do not speak or read Swahili, the language in which climate information messages are currently communicated. In this sense, the use of SMS and Swahili-language radio programmes excludes many women. SMS messages were considered to primarily benefit men, as well as those who are educated – i.e., those who can read and speak Swahili. As noted in the Baseline Report, respondents again stressed that the time of day that the information is delivered by radio or television is also very important to ensure that women will be able to access it. It was therefore recommended that weather forecasts, seasonal forecasts, advisories, and climate forecasts when applicable, should be aired multiple times a day.

4 Findings for INDICATOR 3: User Satisfaction with Climate Information and Services

4.1 SUB-INDICATOR 3.1: Credibility of Scientific Climate Information and Services

4.1.1 Credibility at the national level

Credibility remains a fundamental determinant of perceptions of the usability of climate information and services. However, the way in which different actors define and assess credibility, continues to vary across scales. Some national partners noted that the credibility as well as the salience of climate information and products developed under the programme had improved due to investments in building TMA's technical capacities to downscale the seasonal forecast to the district level, as noted by one respondent:

"Before the project, actually, we were receiving information [from TMA], but they have seemed long-term. They have not had the resolution that was more relevant, because it was mainly a blank kind of seasonal forecast covering three or four regions, and so forth…but now… I do think that was one of the areas of improvement … by building that capacity, that internal [TMA] capacity to downscale the forecast will make it more relevant to different groups." – National-level GFCS partner

However, compared to the baseline, there was also increased recognition among national partners that scientific and indigenous forms of knowledge are complementary, and that combining them may enhance the credibility and salience of climate information and services at local levels. Partners' efforts to obtain feedback from communities and extension officers during physical meetings and trainings were moreover considered to have enhanced both the credibility of the processes, and the salience of the actual climate information and services that were developed for particular sectors. However, the absence of dedicated platforms for climate service producers and end-users to interact regularly and a lack of clear and consistent protocols and mechanisms for ensuring that stakeholder feedback and research findings informed partner and programme activities, were considered by some partners to constitute key drawbacks that had undermined efforts to develop user-informed climate services. As noted in the baseline report, communication between TMA and relevant institutions and decision-making bodies at the national, district, and local levels is constrained by bureaucratic processes and the lack of mandate and resources to create and sustain the necessary institutional mechanisms or platforms to facilitate interaction between producers and potential users of climate services. This limits the development of long-term relationships that are needed to enhance the credibility of processes for generating usable climate information and services.

4.1.2 Credibility at the district level

Compared to the baseline, when most of the respondents noted that there is currently little trust in the accuracy or precision of the seasonal forecasts that they receive, levels of trust in scientific climate information at the district and local levels were reported to have improved somewhat, although with differences within and across districts. In Kiteto, seasonal forecast and early warning messages emanating from TMA were perceived to have become more credible over the course of

the GFCS project due to efforts to downscale the forecasts. This was especially noted to have been the case in 2015, an El Niño year, in relation to warnings of flash flooding and heavy rainfall during the OND ("Vuli") rain season, events which were reported to have occurred as forecasted. One respondent noted: "the forecast [in 2015] was true, so people are really starting to believe it". In Longido, there was no significant perception in a change in the credibility of the climate information being provided by TMA since the baseline data collection. However, respondents perceived a more general increase in the credibility of the forecasts over a longer period (i.e. a decade or more). For example, one respondent recounted a story of how complaints about the quality of the climate information have decreased:

"At the beginning, TMA delivered information and it created a lot of complaints in the pastoral community. They [TMA] said it was going to rain at the beginning of March. But then there was no rain. Because really, the information was too general. It's possible that it will rain in West Kilimanjaro. It will rain over there. Then people were saying that they were deceived. But starting in 2004 or 2005, the information from TMA has been very good. It's been very good because they say [the rain] will start, and really it will start. So, people's complaints have decreased." – Longido District Officer

This increase in the credibility of the information being provided by TMA was believed to be due to the use of more up-to-date technologies to produce the forecasts. Additionally, the provision of a rain gauge and a new automated weather station were considered as important toward helping to improve the credibility of the scientific forecasts, both because these provided improved data for TMA and because it enabled district officers to be better able to interpret forecasts so that they were able to trust them. However, in both Longido and Kiteto, lack of access to the automated data produced at the district headquarters, and lack of instrumentation for observing and measuring other types of variables than rainfall (such as windspeed), were noted as drawbacks that affect the credibility of available local climate information. Notably, a new weather observation station was being installed at the Longido district headquarters in late 2016, which may help to alleviate this in the future.

The perceived credibility of scientific climate information and seasonal forecasts, and services based upon them, continue to be closely related to the perceived credibility of the underlying data and the processes that are used to generate them. As noted in the baseline, there is a tendency in some cases for people to take information coming from the government quite literally or to treat it with more certainty than is warranted. This may lead to heightened expectations and credibility that do not correspond with the inherent uncertainty that is attached to weather and climate forecasts. Issues of uncertainty were addressed in the PICSA training modules dealing with historical climate information and seasonal forecasting probabilities. Several respondents who took part in the trainings noted improvements in their abilities as intermediaries to communicate the uncertainty in the scientific forecasts to local farmers and livestock keepers. This in turn helped to dispel unrealistic notions or expectations about "certainty" attached to the forecasts. However, it was noted that the issue of uncertainty and probabilities in forecasts and climate information were difficult for farmers and livestock keepers to grasp "on paper" in a one-off training. Rather, understanding these issues requires a hands-on and long-term approach to testing and evaluating them in practice. An extension officer in Kiteto relayed his experiences of working with farmers in Ndaleta village as part of a farmer field school over several seasons. Initially, the farmers had rejected the agricultural advice that the officer had given them based on the seasonal forecast in 2014, when the forecast turned out to be "wrong". However, the following season, the forecast was "correct". It was only after observing the differences between local rainfall patterns, and the seasonal forecasts (produced for the whole district) over several seasons, that farmers were able to understand the concept of "probabilities" in the forecasts. This helped to build farmers' confidence in making decisions about when and what to plant under uncertainty, including the uncertainties contained in the forecasts.

As reported on in the baseline, sparse weather observation networks can reduce credibility of seasonal forecasts and scientific climate information. For example, if forecasts are based upon data from stations that do not reflect the local climatology, they can be considered untrustworthy by

extension officers and residents living in those regions. This was noted to be the case in parts of Longido, such as Engarenaibor, because there was only one functioning weather station in the district (at the time of the interviews), which did not capture intra-district weather and climate variability. To overcome this challenge, a female extension officer reported replacing the downscaled seasonal forecast used with a seasonal forecast based on indigenous knowledge provided by local IK forecasters within the PICSA training. She reported that this was necessary to enhance the credibility of the training. In Kiteto, respondents emphasised the importance of "triangulating" the forecasts coming from TMA by comparing and combining them with forecasts for neighbouring districts and regions such as Dodoma and Moshi. It was noted the station at Moshi has a longer series of rainfall data compared to other stations, leading to enhanced confidence in forecasts that are based on this data.

4.1.3 Credibility at the village level

Views about the credibility of available climate information and services at the village level in 2016 were mixed, both within and across villages. Although thresholds for the credibility of scientific climate information remain in relation to the perceived credibility of IK, men and women respondents in both districts expressed an interest in receiving scientific climate information and seasonal forecasts which they could evaluate alongside IK forecasts. This indicates that there are higher levels of receptivity towards scientific climate information and interest in the potential usability of this knowledge, compared to what was reported in the baseline. Nonetheless, perceptions of the credibility of scientific climate information are quite nuanced and exhibit a great deal of complexity. While many respondents reported continuing to rely on IK, others noted that the seasonal forecasting information provided by TMA in recent years has become more credible. For example, during focus group discussions in Eorendeke and Engarenaibor, Longido district, individuals across several focus groups noted that the 2016 March-April-May (MAM) forecast had indicated a higher likelihood of above average rainfall. The observed heavy rainfall and flash flooding, which destroyed some structures and killed several people, was seen as evidence that the forecast was correct. At the same time, people stated that the information coming from TMA is "just a forecast" and that it is still wrong a lot of the time, so they would determine whether to use the information on a case by case basis. Residents in villages located in western Longido furthermore pointed out repeatedly that the weather in their portion of the district did not resemble the weather patterns in Tingatinga (eastern Longido), where the district's only long-term weather observation station is located. As a result, respondents noted that the forecasts produced by TMA, even if downscaled to the district level, were not accurate in their areas, and could not be trusted.

However, similar arguments were also put forward in relation to IK, with some respondents noting that sometimes IK is "true" and other times it is not. It was reported in several cases that indigenous knowledge is becoming less reliable due to climate change and that there will be a need to rely more on scientific knowledge (SK) in the future, even though people are not ready to fully trust such information just yet. Yet, while some groups argued that climate change can reduce the accuracy of indigenous knowledge, men in Eorendeke applied the same logic to scientific climate information, noting that, because of climate change, they felt that information produced by TMA has become less credible. Respondents in Ilera village, Kiteto, similarly noted that sometimes the scientific forecast is correct, and they get rain, while at other times, it is not correct. In some villages, such as Ilera, in Kiteto district, female FGD participants noted that they rely mainly on IK due to lack of access to scientific information about the weather and climate. Given the reported challenges to relying upon and using both types of knowledge, and despite differences in views about the relative importance of SK and IK, there was increasing interest in and awareness of the potential value of combining and/or employing scientific and indigenous knowledge about the weather, climate and related adaptation options, in parallel, to overcome the potential shortcomings of each.

The channels and processes relied upon to generate and deliver climate information and services to the village level remain important determinants of whether residents will trust this information. Similar to findings in the baseline report, women in Longido and in parts of Kiteto indicated that receiving information about weather or climate in face-to-face and oral formats would be most

likely to increase trust. In Eorendeke, women emphasized that they would be much less likely to trust information delivered through their phones or TV. In Ilera, female Maasai respondents noted that not everyone is able to read the information provided in an SMS. Consequently, messages delivered via radio and district letters (local authorities) were considered to be more trustworthy than information delivered via SMS. This is consistent with findings from other studies (e.g. Daly, 2016), but contradicts findings in Coulibaly et al. (2015) which concluded that women in Longido preferred to receive climate information through voice messages on their phones[19]. In Makame village, the process of selecting men and women 'messengers' from sub-villages to receive TMA SMS information was perceived to have been conducted in an open, fair and transparent manner, which enhanced the credibility of the GFCS efforts. The fact that the selected messengers included men and women of different socio-economic strata, was further emphasised as contributing to the legitimacy of processes for delivering climate information and services to the village. This was even though at the time of fieldwork, Makame residents were not able to receive the SMS service, due to the absence of a functioning mobile network. With respect to IK, women in Ilera village noted that the credibility of IK derives from the fact that those providing the information (generally elders) are trusted. Men in the same village further noted that an IK forecaster is not a "traditional leader" as such, but rather a "professional person who has knowledge." Several extension officers who were interviewed shared experiences or concerns related to the potential risks to their reputations and credibility when communicating district-scale seasonal forecasts at very localized levels. In cases where the forecasts turn out to be incorrect, this can reflect poorly on the personal credibility of extension officers in the eyes of local farmers and livestock-keepers that they normally advise.

The need to 'ground-truth' the scientific climate information that is received remains paramount to enhancing the credibility of this information at local levels. In general, trusting new climate information was often seen as being based on being able to personally observe its outcomes, rather than relying on the advice of 'experts'. For example, women in Eorendeke and men and women in Makame felt that it is necessary to continue to use both SK and IK and to compare which is more credible based on empirical observations of the outcomes. Similarly, respondents in Longido noted that the pasture maps provided by PCI (not a GFCS initiative) were still quite new, and it would be necessary to assess whether these were "true" through their own observations over the coming months. While new rain gauges have been installed in both districts under the programme, there remains a desire for gauges at the village level that could be used to evaluate forecasts and predictions. Several examples were provided of practical experiments aimed at enhancing farmers' confidence in using seasonal forecasts to make agricultural decisions. In general, it was noted that it is not a simple process to convince people to adopt new practices. There is a need to learn from others. A respondent in Ndaleta village noted that:

"Those who have received training trust and believe the forecasts, but those who haven't received the trainings might not believe it. Especially if they get information that it will rain, and then it doesn't rain".

Farmer field schools were perceived to be successful in both districts in this respect. An extension officer in Kiteto, who received PICSA training, explained how through a close dialogue with farmers, access to appropriate advice and inputs, and learning-by-doing approach over several seasons, farmers gained confidence in employing the seasonal forecasts to help them make decisions about what and when to plant.

19 It is important to note that technologies for leaving voice messages on mobile phones are not yet available in Tanzania and many respondents may not be familiar with concept of "voice messages." Further, surveys were conducted in Swahili and not Maa, and many women in these districts are not proficient in Swahili. So, it is possible that there were difficulties among female respondents in accurately understanding what a "voice message" was. This may have affected responses and could help to explain the conflicting findings between the two studies.

Table 5. Summary of Cross-Scale Findings on Credibility of Climate Services

Indicator 3: Satisfaction with Climate Information and Services		
Sub-indicator 3.1 Credibility		
Institutional scale	**2014**	**2016**
National	• TMA's position as the only national agency authorized to provide climate information enhances its credibility. • General trust in scientific methods by most national respondents enhances credibility of climate information and services. • Limited observation networks and technical capacities due to financial constraints were seen as a challenge to credibility. • Lack of legal or institutional mandates to facilitate sustained interaction to enhance trust and relationships between producers / users were seen as a challenge to credibility.	• TMA efforts to downscale the seasonal forecast to the district level were seen by some partners to enhance the credibility of this information for end-users. • Lack of institutional mandates and mechanisms to facilitate sustained interactions and communication between climate service providers and stakeholders at different scales remain challenges to credibility. • Combining scientific and indigenous knowledge was recognised as potentially enhancing the credibility and salience of climate services.
District	• Credibility is the most fundamental determinant of perceptions of usability; however, perceptions of credibility are dynamic and non-linear. • Mixed levels of trust in scientific methods imply that the use of 'science and technology' increases credibility for some users but may decrease it for others. • Unrealistic expectations of the certainty attached to scientific information pose challenges to perceptions of credibility of climate information and services. • The complexity of translation (e.g., from English to other languages, from technical terminologies to more simplified language) can pose challenges to credibility. • Mismatches between the spatial scales at which forecasts are produced and the scales at which users can validate them and lack of capacity to validate forecasts at more localized scales pose challenges to credibility. • The indicators used within scientific predictions were not well understood and were not seen as robust, posing challenges to credibility. • Respondents cited the need for empirical evidence to 'demonstrate' the value / benefit of climate information *in practice* to build long-term perceptions of credibility.	• The perceived credibility of the information, products, processes and communication channels and actors that are employed to develop and deliver climate services remain fundamental determinants of perceptions of usability • Seasonal forecast and early warning messages emanating from TMA were perceived to have become more credible in recent years (Since 2007, and particularly in 2015, an el Nino year), but perceptions vary on an individual basis • The PICSA training modules on historical climate information and seasonal forecasting probabilities helped to dispel unrealistic notions or expectations about the "certainty" attached to scientific information and forecasts, enhancing the credibility of information and intermediaries delivering it • Mismatches between the spatial scales at which forecasts are produced and the scales at which users can validate them, continue to pose challenges to credibility • Scientific forecasts relying on rainfall data from stations that are not representative of the local climatology are considered untrustworthy by extension officers and residents alike • Triangulating climate information, forecasts and advisories from different sources and for different regions was noted to increase the credibility and trustworthiness of this information • There is a continued need for empirical evidence to 'demonstrate' the value/ benefit of climate information in practice in order to build long-term perceptions of credibility
Local	• In most cases, climate information has not reached the threshold where it is perceived to be at least as credible as other information / knowledge already used at local levels; current thresholds for credibility are generally in relation to the perceived credibility of IK.	• Current thresholds for credibility of scientific climate information remain in relation to the perceived credibility of IK; many respondents recognize that there are challenges to the credibility of both types of knowledge. • Views about the credibility of climate information at local levels were mixed. A number of respondents noted that the seasonal forecasting information

	• The need for empirical evidence of the value / benefit of climate information *in practice* was the most important challenge to credibility. • Low levels of trust in scientific methods are a current challenge to credibility of climate information and services. • Lack of integration of climate information delivery within customary decision-making and localized information vetting processes is a challenge to credibility. • Perceptions about the certainty of information 'coming from the government' may result in treatment of climate information as deterministic, rather than probabilistic, which is a challenge to credibility. • Unrealistic expectations of the certainty attached to scientific information pose challenges to perceptions of credibility of climate information and services.	provided by TMA in recent years has become more credible, compared to previously. Others reported continuing to rely on IK. • Higher levels of receptivity towards and trust in scientific climate information and in the potential usability of this knowledge were reported among both women and men • The need for empirical evidence of the value / benefit of climate information in practice remains a pre-requisite for enhancing credibility. Several examples of practical experiments with climate information were given • Combining scientific knowledge about the climate with appropriate local and external inputs, knowledge and technologies (seed, livestock-keeping advice) were noted to improve the credibility of the information for decision-making

4.2 SUB-INDICATOR 3.2: Salience of Climate Information and Services

4.2.1 Salience at the national level

Timely delivery is an important component of salience. Infrastructural challenges and resource constraints continue to pose challenges to the timely delivery of climate information and services at local levels. However, national respondents noted that improvements had been made in the timeliness of communicating climate information from the national to the district level. Efforts to integrate TMA downscaled seasonal forecasts with agricultural and livelihood advice in the PICSA trainings, within ongoing NGO efforts in Kiteto district, were noted to have enhanced the salience of programme efforts. Similarly, steps to redesign the health partner activities to better align with existing levels of knowledge and capacity on climate issues at the national level within the MoH were noted to have increased the salience of climate service efforts targeting this sector. National-level partners moreover considered the climate information and services developed under the programme to be generally relevant and useful for farmers and livestock keepers in the target districts and villages. Several partners noted that the salience of climate information and services had improved due to TMA's efforts to downscale the seasonal forecast and to consult with sectorial partners at the national and district levels during the provision of the national-level seasonal forecast to develop advisory statements to accompany them. Notably, downscaling seasonal forecasts was considered to increase the relevance of the forecasts for both grassroots actors, as well as national ministerial, NGO and UN partners working with health and disaster preparedness and contingency planning related to food security and agriculture:

"On the one side is to what extent this information [downscaled seasonal forecasts] is going to help the people that are food insecure to lessen the impact. On the other hand, is how this information helps us to fine-tune our contingency plans, to have what we need and organize supplies, and so forth" – National level GFCS partner.

Health sector partners noted that TMA information is a relevant and salient aspect of national disease surveillance systems and epidemiology trainings for health officers linking climate and health issues, which were reported to be at a planning phase at the time of the fieldwork. However, it was noted that enhancing the credibility and salience of climate information and services still requires analysing health data alongside climate data to establish specific climate-health linkages. In

addition, the lack of institutionalized mechanisms for incorporating user feedback into the design of climate services at the beginning and throughout the programme was seen as undermining efforts to develop climate services that can respond to expressed user needs.

4.2.2 District-level salience

A number of potential users that were identified in the baseline report at the district level reported incorporating climate information and services into short-term decision-making in their sectors or fields of application. For example, district staff and extension officers who signed up for the FarmSMS service or received PICSA training reported using the training to provide advisories to farmers in relation to agricultural and livestock-keeping activities such as farm preparation, suitable crops and varieties, planning and allocation of pasture areas, timing for destocking, responses to livestock epidemics and disease outbreaks and timing of planting and harvesting, and food budgeting and storage. District water engineers and local project partners in Kiteto reported using historical climate information to identify sites and design parameters for the construction of an earth dam in Olpopongi village, and project partners reported that seasonal forecast information provided by TMA was used to inform and update village-level contingency plans regarding water resource allocation and utilization, and water storage and harvesting practices. It is notable that most of applications of climate information and services that were mentioned by district-level respondents refer to short-term, rather than long-term, planning.

District-level respondents noted improvements in the timeliness and frequency of delivery of seasonal forecast and other climate information from TMA to the districts because of more direct communication with TMA staff, and text messages received via the SMS service, which include seasonal, dekadal (10-day) forecasts and extreme weather advisories. Capacities to contextualize existing climate information were moreover reported to have been improved amongst those who took part in PICSA trainings. The PICSA training was seen as being very relevant to residents in the district, since it enabled systematic analysis of different livelihood decisions, even if this did not rely on climate information explicitly. For example, one anecdote recounted by a district officer was that through the participatory budgeting exercise, some participants had realized that even though they got better prices for their cattle at markets in Kenya, the costs of moving their livestock to far away locations outweighed the better price. Radio programs in which residents can listen to discussions and also call in with specific questions were also perceived to significantly increase the salience of climate information for agricultural decision-making in Longido district.

In some cases, climate information provided by TMA was also noted to have added value to improved agricultural inputs at the district level. For example, district officers in Kiteto felt that people now have access to better information, noting that whereas previously, people were receiving improved seeds, now they are also receiving information from TMA about when the rains will start. In Ndaleta village (Kiteto district), access to climate information and forecasts provided by TMA in combination with improved agricultural inputs such as seed and fertilizer were alleged to have doubled the harvest in demonstration plots for maize and other crops. However, it will be important to conduct carefully designed studies (with controls) to determine the relative contribution of different "inputs" towards reported agricultural productivity increases such as these. The potential for access to climate information to enhance the uptake of new technologies, and the types of livelihood benefits and risks this may involve for different types of farmers, moreover warrants further study.

In general, however, the lack of greater spatial and temporal specificity of the seasonal forecasts, and generalized nature of advice accompanying them, continued to be noted as a constraint to putting climate information and services into use. Even when respondents at the district level were able to understand the forecast information provided, it was not seen as effectively initiating action because the messages are repetitive and may not be seen as trustworthy. Therefore, people may not be willing to act on the information. For example, one respondent stated that "…people will see that this is same old message. Even if TMA says that there will be heavy rainfall and flooding in the mountains and valley areas, people will just return to normal. They will say that it is just gossip." Forecasts provided over the radio were deemed to be better in this respect because they provide

more meaning and context. The short format, generalized language and generic advice accompanying the FarmSMS messages were reported to make it difficult to apply them in the absence of further advice from an extension officer. Conversely, the length and technical complexity of the PICSA training and limited resources to transmit the training onwards, reportedly undermined the ability of extension officers to disseminate this information to farmers and livestock keepers on the ground. The production of forecasts according to administrative boundaries poses further challenges to the salience of the information in districts with large climatological gradients, which applies to both Kiteto and Longido districts. The reliance of several of the PICSA training modules on observational data from meteorological stations that were considered to be unreflective of the local climatology in Longido district was further reported as a barrier to the credibility and salience of the trainings in some communities. It was furthermore noted that the forecasts were very difficult to interpret for those who did not take part in PICSA trainings. In addition, the sustainability of the PICSA approach is undermined by the fact that neither WFP or CCAFS are physically present on the ground and the training has not been institutionalized within the district extension services to ensure continuity.

The pasture maps that were reportedly being produced and distributed down to sub-village levels (beginning in January 2016) in Longido District by Project Concern International (PCI) were seen as being much more useful and relevant than more generalized precipitation forecasts. One respondent explained that "…the [pasture] maps [provided by PCI] really help people. If you look at the map, you will know that the areas that are greenish, you can start to move." However, many respondents stressed the importance of considering indigenous knowledge alongside scientific forecasts, since these were also considered to be highly salient. With respect to the PCI grazing maps, for example, it was recognized that residents in Longido needed to rely on their own knowledge of the terrain and vegetation in the district to be able to effectively interpret the maps. Thus, a combination of scientific and indigenous knowledge is needed for these maps to be fully usable.

District-level respondents further highlighted several factors connected to the design and implementation of the GFCS programme that have reduced the salience of climate service activities on the ground in both districts. In general, the GFCS program was perceived to have taken a very narrow sectoral approach that excluded important sectors and salient local development priorities related to water, health, land use conflicts and planning, as well as linkages between these and agriculture and food security (which was perceived to have been the focus of programme activities). Moreover, an overemphasis on agricultural activities was considered to have reduced the salience of the PICSA training in both districts, since pastoralism is a key livelihood activity in both districts. By contrast, it was noted that the IIED project in Longido had taken a very "grass-roots" approach. A district-level respondent in Longido observed that:

"In the IIED project, there was greater participation and the project was broader. The IIED project was more effective as well, because we looked at people's livelihoods. They looked at how people were struggling to cope with climate change. IIED really went to the grass-roots level. IIED also looked at the resources that people have through resource mapping. So, I can say that IIED really brought good things. They started out with a study at the beginning that really contributed." – Longido District Officer

District officers in both Longido and Kiteto recommended that future GFCS efforts take a broader, multi-sectorial and livelihoods-based approach in order to enhance the salience of climate information and services in both districts.

4.2.3 Village-level salience

With a few exceptions, there has been little change in the perceived salience of climate information provided at the village scale in either of the districts. In general, the salience of climate information and services for local decision-making continues to be constrained by the infrequent delivery of seasonal and sub-seasonal forecasts, mismatches between the timing and resolution of forecasting

products and trainings in relation to key agriculture and livestock-keeping decisions and the generalized format and technical formulation of advice that accompanies the seasonal forecast. As observed during the baseline data collection, the primary concern in terms of enabling access to climate services was reported to be at the sub-district level. Respondents in both districts noted that although there are no longer the significant delays in receiving the forecast information at the district level as there were previously, the challenges of distributing this information to the wards and villages is still pervasive. The low proportion of extension officers relative to their areas of coverage, long distances between communities and district headquarters, and lack of transportation means for district and extension officers, exacerbate these challenges. It was reported that once the information reaches the village government, they have difficulty distributing it onwards, resulting in further delays in delivering the information:

"And when you go to the Village Executive Officer, they will have the same problem. Because they are supposed to inform people via a village assembly. From this village assembly, they need to disseminate this message" - Longido District Officer

In villages where respondents reported receiving the FarmSMS messages, it was reported to be costly and time consuming to convey this information to all residents. Similar challenges were reported in relation to onward training of PICSA. Problems continue to center around the lack of temporal and spatial specificity of the information provided and the lack of sub-seasonal updates to the forecast, as well as the fact that they provide general information, such as average amount of rainfall forecasted for the season, without information about its distribution. Men in Eorendeke (Longido) noted that they often hear that there will be rain, but there is no specific timeframe provided (e.g. date of onset). The pasture maps provided by PCI were considered more relevant since these are intended to be updated every 10 days during the dry season. The provision and delivery of downscaled seasonal forecasts in terms of administrative boundaries (e.g., regional and district borders) also continues to limit their salience. In cases where climate services rely on rainfall data from meteorological stations that are considered to be unrepresentative of the local climatology, the salience of climate information for local decision-making was reported to be very low.

The need to communicate and translate scientific climate information and services into forms and advice that are understandable to local populations remains an important determinant of usability at the village level. While capacities to contextualize climate information have been improved in some villages through PICSA trainings to extension officers, the technical language of seasonal forecasts and generic advice accompanying them, remains a barrier to putting climate information into use. In general, it remains difficult for potential users of climate information living in the districts to understand the meaning of "average", "above average", and "below average" rain conditions (as measured by TMA) and to determine what types of action should be taken based on these categories. The need for information accompanying radio, SMS and face-to-face trainings to be communicated in local languages (e.g. KiMaasai) was re-iterated by respondents in 2016.

Despite these challenges, in both districts and across villages, men and women FGD participants underscored the *potential* relevance of climate information and services based on scientific knowledge (SK) to inform agricultural, livestock-keeping and wider livelihood decisions. Extension officers in Kiteto noted that the best way of determining whether "users are satisfied" with climate information and services is to gauge the extent to which they have adopted agricultural, livestock-keeping and other advice based on those forecasts. Because a significant portion of residents in Longido engage primarily in pastoralism, in addition to some amount of farming, weather and climate forecasts, as well as the pasture maps, were considered potentially useful. However, in general, respondents emphasized that seasonal climate forecasts are more useful for farmers (i.e. to inform decisions about when to plant), while tools such as pasture maps produced by PCI were more useful for pastoralists. Despite this fact, examples were provided in several cases where individuals and communities had used the seasonal forecast and early warning information available to them to enhance their livelihoods or to avoid or reduce the impacts of extreme weather events. Examples of the latter included re-locating homes and livestock corrals, purchasing veterinary

medicines for cattle in the event of flash floods and heavy rainfall forecasts in 2015, and selling off livestock and stocking up on food to prepare for the forecasted drought in 2014. In Engarenaibor, IK specialists reported that they decided to switch to growing a short-maturing variety of maize, based on the training and scientific forecasting information they received in 2014 and availability of subsidized seeds provided by the government in connection with the training.

While these examples are encouraging, the salience of the programme's narrow sectoral focus on agriculture and food security and disaster risk reduction at sub-national levels, is questionable given the importance of livestock keeping among pastoral communities in both districts, and widely reported livelihood challenges associated with water shortages, due to climate change, in several village in Kiteto. Water shortages and attendant health implications were highlighted as major challenge by women in Ilera and Makame villages. Women in Makame noted that although water is available, it is located far from the village center, and is collected via open wells, which were reported to be dangerous for women and children. Women in Ilera village noted that it is now necessary to walk for three hours round trip to collect water at the nearest borehole, or to purchase water from those who bring it from the well. The salience of climate services in this village was tempered by the priority placed by the women for development assistance concerning water services[20] and support for alternative livelihood activities. Challenges associated with local land-use conflicts and lack of communication means (mobile and radio reception) were also emphasized. Consistent findings across all data indicate that there is a need to take a wider livelihood approach to the provision of climate information and services and to assess the relative benefits of investments in climate information and services relative to other types of investments at the local level that are arguably foundations for reducing vulnerability and improve well-being. Without major investments to address basic local development challenges, it is difficult to see how grassroots residents will be able to consistently access, or apply, climate information and services to reduce their vulnerability or enhance their resilience in the face of climate change.

As noted in the baseline, there is a continued need for complementary data and information to enable the effective use of climate information for adaptive decision-making within particular contexts and across time scales. Indeed, the provision of this contextual (non-climatic) information is a key aspect of what differentiates a 'climate service' from pure 'climate information.' Combining scientific knowledge about the climate with IK, and with external and locally appropriate inputs, knowledge and technologies (for example seed, livestock-keeping advice) were noted to improve the salience of the information for decision-making in a number of villages. For example, in Engarenaibor, the ward extension officer reported having substituted the SK-based seasonal forecast provided as part of the PICSA training, with the IK-based forecast, in order to enhance the salience of the trainings. In Ndaleta village, the application of seasonal forecasting information was noted to have added value to the agricultural trainings and inputs (maize and sunflower seed, fertilizer) provided to local farmers by the government extension service and NGOs. With respect to the PCI grazing maps, it was noted that users need to combine the information provided in the maps with their local knowledge of the terrain, types of grasses, and other information, to determine whether to act on the information included in the maps.

The importance of being able to empirically observe and validate climate information and services in practice, moreover remains critical to enhancing perceptions of salience and actual usability at the local level. Nonetheless, combining climate information with external advice and inputs may carry risks in cases where the inputs or advice are late to arrive, or fail altogether. In several villages it was noted that government seed vouchers were issued in combination with the seasonal forecasting or early warning advisory issued by TMA, but that the seeds (and in some cases fertilizer) arrived too late to be of use. The issue of "fake" maize seed was moreover raised as a concern in Ilera village, while in Makame, it was reported to take more than one month to order a tractor to prepare fields for planting. This indicates the need for greater coordination of agricultural trainings, inputs and advice.

20 "We are requesting water services. That is our first request" – female participant, FGD in Ilera village

4.2.4 Feedback on PICSA

Three extension officers and one Red Cross volunteer who participated in the PICSA training of trainers in Longido and Kiteto were interviewed, to understand their views on the value of the training and to understand their experiences in implementing the PICSA trainings in their communities. All felt that the PICSA training was very useful and that they had gained valuable knowledge. However, there were also many barriers to ensuring that the approach could be effectively implemented, widely distributed, and institutionalised that were identified. The participatory budgeting exercise was considered very useful and popular in Engarenaibor. In an example, it was noted that the budgeting exercise was very useful to help people evaluate strategies for selling cattle. While some people had travelled with their cattle to Kenya to sell in markets where they got a better price, after they calculated the costs associated with moving their cattle (e.g., fees, fodder, etc.) they realized that they were not actually making more money that way. In Eorendeke, it was noted that the alternative crop options provided in the crop matrix were not well suited to pastoral areas. For example, participants found recommendations for growing tomatoes in their areas to be unrealistic.

Additionally, while the PICSA training includes presentation of the seasonal forecast as an additional layer of information to inform decision-making, extension officers in Longido reported that they did not give this to participants in the training because they felt that the forecast was consistently inaccurate in their areas, which are in the western half of Longido. They felt that this was because there was only one functional weather station in Longido, which is located in the eastern half of the district and, therefore, the forecasts were not representative of conditions in their area. In Engarenaibor, even when people were able to interpret the historical climate data to determine that crops other than maize and beans might be more viable based on the historical data, they were not willing to switch because they were not able to use the other crop options for household consumption, so these were seen as undesirable. In Eorendeke, people were reluctant to sell cattle in order to start small side businesses to diversify their livelihoods for cultural reasons. Therefore, it will be important to recognize social constraints on adaptive strategies and that inputs of climate information do not always result in behavioural change.

Finally, officers in both districts underscored that the length of the PICSA training presented challenges once they returned to train others in the villages where they are based. Because populations in these areas are quite spread out, transport to bring participants to the training was considered a key challenge. While the officers were provided with a small amount of funding to help with transport and supplies (TZS 125,000 / extension officer), it was not enough money to bring people from far away locations for all five days. People also complained about the length of the training. Therefore, officers reported condensing the training – with two conducting the entire training in one day and another over three days. It was further relayed that insufficient funding was provided to enable the district officers to follow up on dissemination efforts after the training. Extension officers variously recommended shortening and simplifying the PICSA trainings (reducing the number of modules and activities), as it was seen as being too long to practically implement. They further recommended incorporating IK into the training, placing greater emphasis on livestock keeping, repeating the trainings, institutionalizing trainings within the district extension service to ensure greater sustainability, and providing more resources to extension officers to train onwards what they learned.

There were additional difficulties with some of the other components of the PICSA training. Extension officers in Longido reported that they were unable to use the seasonal calendar activity. For example, the officer in Engarenaibor noted that even she didn't understand how to undertake the seasonal calendar activity, so was unable to train others on how to do so. In Eorendeke, there was significant difficulty in helping participants to understand the resource maps and participants felt that sharing the details of their household in the budgeting exercise was invasive and refused to participate in the activity. For example, there is a taboo around discussing publicly the number of cattle you own, so people were suspicious of being asked to do so. Additionally, several officers

reported significant problems in using the graph of historical climate data, reporting that this was considered too complex and that people were not able to effectively interpret the information. As noted by one officer: “a large percentage of them [the trainees] didn’t understand anything in that graph.” Given that the interpretation of the historical data is fundamental to the entire PICSA approach, this illustrates that it may be worthwhile to spend additional time to provide training in this area to ensure that extension officers have a firm grasp on the concepts and to develop additional ways of helping them to explain the information.

Table 6: Summary of Findings relating to Salience of Climate Information and Services

Indicator 3: Satisfaction with Climate Information and Services		
Sub-indicator 3.2: Salience		
Institutional scale	**2014**	**2016**
National	• Many current users of, and potential applications for climate information and services have been identified. • Delayed delivery of climate information is a major challenge to the salience of climate information. • Delivery and use of climate information along with other types of information enhances the salience of climate information	• National and international operational partners, alongside TMA, arguably constitute the primary co-producers, users and intermediaries of climate services developed under the pilot phase of the programme • TMA efforts to downscale the seasonal forecasts to the district level were considered to enhance the relevance of the information for district and grassroots stakeholders • TMA efforts to downscale seasonal forecasts to the district level were considered to be relevant for agriculture and food security, disaster response and health planning activities at the national level
District	• Many current users of, and potential applications for climate information and services that have been identified • Delayed delivery, as well as the timing of the release of climate information in relation to key livelihood decisions, is a challenge to the salience. • Differences in the timing of decisions for different livelihoods result in varying perceptions of salience within and across districts. • Current lack of updates to the seasonal forecast and other sub-seasonal climate information products climate pose challenges to salience. • Mismatches in the user demand for and regular availability of existing climate information products is a challenge to salience. • Spatial and temporal distributions of precipitation throughout the season were highly relevant to decision-making; the current presentation of forecasts in terms of seasonal totals is a challenge to salience. • The production of forecasts according to administrative boundaries (e.g., regional or district border) may pose a challenge to salience, especially in districts with large climatological gradients. • The generalized nature of available climate information is difficult for district officials to interpret and limits their ability to tailor and provide specific advice for use at local levels.	• Use of the SMS service has enhanced the timely delivery of seasonal and sub-seasonal forecasting information and advisories from national to district levels • Use of the SMS service has enhanced the frequency of delivery of climate information and advisories to district-level stakeholders • Capacities to contextualize existing climate information for use at local scales have been improved through PICSA trainings • The programme was seen to have taken a narrow sectorial approach that overlooked salient local development issues • A range of issues, including overemphasis on agricultural-based livelihoods was considered to have reduced the salience of the PICSA training amongst pastoralists in both districts • The generalized language employed in advisories and limited temporal and spatial specificity of downscaled forecasts, delivered via SMS, pose challenges to salience • The production of forecasts according to administrative boundaries continue to pose challenges to the salience of the information in districts with large climatological gradients
Local	• The generalized nature of available climate information is difficult for village extension agents to interpret and limits their ability to tailor and provide specific advice for use at local levels • Lack of capacities to effectively tailor information for specific uses at local scales is a challenge to salience.	• Capacities to contextualize existing climate information at local scales have been improved in some villages through PICSA trainings • Delayed delivery, as well as the timing of the release of climate information in relation to key livelihood decisions, remains a challenge to the salience at local levels • Combining scientific knowledge about the climate with appropriate local and external inputs, knowledge and technologies (seed, livestock-keeping advice) were noted to improve the salience of the information for decision-making

4.3 SUB-INDICATOR 3.3: Legitimacy of Climate Information and Services

4.3.1 Legitimacy of processes and partnerships for climate services development and delivery

As noted in the baseline, the legitimacy of climate information and services are directly related to the legitimacy of the processes and knowledge that are involved in producing them. Legitimate processes for climate services development should aim to involve relevant stakeholders and must be seen to be inclusive, transparent and fair. Across scales, respondents highlighted a number of factors connected to the *process* of designing and implementing the GFCS APA that they felt had undermined the legitimacy of the pilot phase of the programme and partners' efforts to develop and sustain climate services that could respond to expressed stakeholder information and decision-making needs.

The top-down design of the programme, with no scoping phase and little involvement of national, district or grassroots stakeholders in determining priority sectors or activities, was seen as a key factor limiting the legitimacy and sustainability of climate services development and delivery at national and district levels. Lack of district involvement in defining programme priorities reportedly led to the exclusion of important sectors and local development priorities such as water and health, and insufficient attention to cross-cutting issues such as gender, land-use and diversified livelihoods. Failure to institutionalize programme trainings, such as PICSA, within the district extension services, and the fact that UN partners have no presence on the ground, were highlighted as hampering the programme's legitimacy and sustainability. The initial absence of a programme monitoring and evaluation (M&E) framework and mechanisms for ensuring that findings from programme M&E and research activities informed operational activities were noted to have undermined the expressed GFCS goals of developing user-driven, or at the very least, "user-informed" climate services. In addition, the sectorial and partner-based approach to implementing programme activities and lack of incentives for programme partners to collaborate to achieve jointly determined goals were highlighted as limiting the grassroots impacts of the programme and "user satisfaction" with the climate information and services that were developed and disseminated within it.

Respondents at the district level repeatedly noted the need for the GFCS to take a broader, livelihoods approach that is driven by feedback coming from the communities. This feedback should not only about their climate information needs, but also about other livelihood challenges that they are facing. Such an approach would be more likely to avoid perceptions that an agenda is being pushed that is not in line with their local concerns and interests. Both the IIED and PCI projects were seen as more connected locally since they had taken stock of challenges to livelihoods and had also sought to draw on knowledge and perspectives of traditional leaders, elders, and women. For example, in tandem with the provision of the pasture maps, PCI has been running programming to train women on small business skills so that they have other livelihood alternatives when men in the household are migrating with cattle during the dry season. This has helped to ensure that people feel like the projects are representative of their interests and concerns, thereby enhancing the legitimacy of the information the pasture maps provide.

At the village level, the legitimacy of climate information and services is closely connected to the perceived fairness and transparency of processes for accessing, delivering and communicating this information, as well as levels of trust in various information channels and intermediaries. In Longido, for example, traditional leaders (Swahili: *viongozi wa mila*, Maasai: *laigwenani*) play important roles in helping deliver important information that is trusted by villagers. Female Maasai respondents in some villages reported that information delivered orally was considered to be more trustworthy than information delivered in writing (including via SMS). In Makame village, the legitimacy of processes for delivering climate information and services were strengthened by the underlying participatory process that was conducted at village and sub-village levels for selecting men and women representatives to receive and communicate climate information. Conversely, in

Engarenaibor (Longido), the legitimacy and trustworthiness of scientific climate information and TMA as a trusted information provider, were undermined due to what local IK experts experienced to be an extractive, rather than collaborative, co-production process initiated under the IIED project in 2014 aimed at integrating IK-based and scientific-based observations and information into a consensus seasonal forecast. This demonstrates that efforts to co-produce climate advisories and services with residents must be undertaken carefully and only when there are sufficient human and financial resources to follow through.

4.3.2 Legitimacy of climate service access and use

The issue of differentiated abilities to access and use climate information at local levels remains an important issue to perceptions of legitimacy. Socio-economic and gender-related disparities in ownership and access to radios and TVs, lower levels of literacy among women, and cultural differences and gendered norms connected to household and livelihood activities, continue to differentiate access to climate information and services within and across households in both districts. In addition, pastoralists are generally less likely than other groups to be able receive climate information through the mass media, since they are often moving with their cattle through remote areas where they do not have reliable telephone networks or access to TV, radio, or newspapers. Wide variations in access to ICT infrastructure, extension officers, and basic levels of service provision persist between villages and districts. The challenge of limited radio channel and mobile network coverage in the districts are acknowledged in both Daly *et al.* (2016) and the CCAFS baseline survey (Coulibaly et al., 2015). Mass media and other digital communications have limited reach in both Kiteto and Longido. According to district officers, 40% of Kiteto District does not have mobile network coverage. Longido District faces similar challenges. Television and radio access is also limited in these rural areas. In addition, mobile phone ownership tends to be lower among women, compared to men, as documented in the CCAFS baseline and radio/ICT scoping study (Coulibaly et al., 2015; Hampson et al., 2014).

All these factors lead to gender and other disparities in capacities to access, understand, interpret and act on climate information, and constrain equitable and legitimate climate service delivery and use at local levels. Utilizing multiple channels, including traditional leadership, government extension agents and village assembly meetings, which can facilitate the delivery of information to a large proportion of men and women farmers and livestock keepers in rural communities, therefore remains essential. Attendance at such meetings and trainings does not require ownership or access to communication assets such as radio, cell phone, or TV.

As noted in the baseline, the potential for elite capture of training opportunities related to climate services also poses challenges to legitimacy. In both districts, there was a perception that only a very small sub-section of residents had been selected to attend trainings under the GFCS programme without ensuring broad representation across gender and socio-economic strata. This has decreased perceptions of the programme's legitimacy, since the information provided is perceived to have benefitted relatively few members of communities. As noted previously, the reported benefits of climate services that were disseminated to grassroots actors were reported to be greatest in areas that had good general levels of service provision, capacity-building and infrastructure, and where information was able to be combined with related agricultural, livestock-keeping and livelihood advice (and, in case of agriculture, technologies and inputs). In Kiteto, efforts to link TMA information with agricultural and other advisories connected to food security initiative implemented by TRCS focused on just four communities (Ndaleta, Olpopongi, Makame and Ndedo). Ndaleta, the village located closest to the district headquarters and where there are multiple existing channels of delivery of climate information, reported the highest levels of awareness of and access to climate information. Nonetheless, even in this village, there was a perception that the access, availability, and usefulness of climate information and services is limited by the small number of people involved in trainings and receiving the SMS service. Men in Orkijuu Longishuu stated that they continue to struggle to see how climate forecasts could be of direct use for pastoralists' activities. Insufficient attention to gender dynamics in pastoralist communities

where men are away tending livestock for long periods of the year, were further noted to have undermined the legitimacy of the PICSA trainings that were delivered in Longido district.

Finally, and critically, disparities in local capacities to act on climate information to reduce vulnerability and exposure to climate-related livelihood risks, pose fundamental challenges to the legitimacy of climate service efforts. Climate information alone (even if it is accompanied by advisories), is clearly insufficient to fully support adaptation (Vogel and O'Brien, 2006). Enhancing grassroot actors' capacities to access financial and other resources and inputs to act on climate information will be necessary to enable the pursuit of appropriate livelihood options, including climate-friendly agricultural and livestock-based practices.

Text Box: Exclusion of Women and the Legitimacy of Climate Services in Longido

In both of the women's focus groups in Longido, the fact that very few women were included in trainings and workshops was a point of contention. Men were seen as benefitting from these activities much more so than women. However, there are problematic power dynamics which arose in discussing women's exclusion from these activities. During one women's focus group where village government officials were also present, there were multiple efforts to discredit the women's claims that they were not able to equally benefit from the training provided under the program. In one instance, a village chairman countered the women's claims by stating that he always organizes meetings to share what he has learned. In another example, a village chairman told the women that they should "be patient," meaning that they will eventually get a chance to attend trainings. A sub-village chairman chimed in to say that "NGOs and others should only take people who are knowledgeable" to attend seminars, pointing out that the women barely know how to use their phones and, further, don't speak Swahili as evidence that they are not qualified to take part in the trainings. At another point, the women asked to change the subject of the conversation, illustrating the tension that discussing such matters openly in front of government leaders caused. These dynamics illustrate that there will be a need to take new approaches to broaden participation among women, including organizing women-only trainings that should be held in both Swahili and Maa languages and that are tailored to the specific needs and constraints that women face. This may help to increase the legitimacy of scientific climate information among women in these communities.

4.3.3 Legitimacy of advice accompanying climate information and the politics of climate service knowledge

At the local level, advisories are an important element of complete climate services delivery and district-level actors play a key role in helping to develop and deliver climate-related advisories. However, as emphasised in the baseline, it is necessary to recognize that there is potential for such advice to have political implications. If climate information or knowledge is perceived to be used in an unfair way or that it is biased to advantage particular groups within society, or to promote a particular policy agenda, it is unlikely that it will be used for decision-making. The GFCS-APA efforts build upon a wide range of capacity-building initiatives undertaken at local, district and national levels. While partnerships are clearly important to the success of climate services and to further innovation, greater attention to issues concerning the fairness and representativeness of the formal and informal institutions, networks, tools and initiatives that the programme efforts build upon is needed. Who is empowered or excluded from these initiatives, what messages are promoted, and who these messages serve, are important questions in this regard. As stated by several respondents, "knowledge is power". Climate information and services are no different – they can be used to support different agendas and messages, as discussed further below, concerning appropriate forms of agricultural technology, land-use, and societal transformation pathways, with implications for vulnerability and poverty reduction, inclusiveness, equity and sustainability.

While the GFCS was seen as having improved channels for delivering climate services at the district level, in both Kiteto and Longido, there was a widespread perception that climate service interventions under the programme promoted agricultural-based livelihood activities over pastoralism in these semi-arid regions. While farming is often pushed as an adaptive measure by the government or non-governmental organizations, this is not a neutral decision. Rather, the promotion of farming activities has deeply political implications and can potentially decrease the legitimacy of GFCS activities if these are seen as 'preferring' farmers over pastoralists. Pastoral populations in Tanzania face ongoing pressure to adopt more sedentary, agricultural livelihoods and are struggling to maintain access to the land and water resources needed to sustain their herds under increased pressure from agricultural populations (Homewood et al. 2009). The challenges are accentuated by heavy emphasis within national policy making to prioritize and promote agricultural activities in Tanzania (e.g. SAGCOT, Big Results Now) that may marginalize pastoral livelihoods.

An increased reliance on farming may also accentuate vulnerability and decrease adaptive capacities to climate-related changes. Semi-nomadic pastoralism evolved as an adaptive strategy to help manage impacts of high levels of inter-annual climatic variability and ecological heterogeneity in semi-arid Tanzania (Galvin, 2009). As one FGD participant noted, if there is no rain "the farm can't move!" In contrast, cattle can migrate to other locations where there is more rain and were seen as better able to cope. Promotion of maize farming in connection with climate information in semi-arid regions, such as in Makame[21], a largely pastoral village in Kiteto that receives less than 300 mm of rainfall per year, and where access to farming inputs and information are rendered difficult by the village's remoteness and lack of mobile or radio reception, is therefore questionable. Promotion of maize farming in pastoral regions moreover carries potential for exacerbating existing conflicts over land and water resources, which are reportedly already widespread and pervasive in Kiteto district. There is a clear need for more critical reflection on how the development, delivery and access to and use of climate information and services interface with struggles over access to livelihood and adaptation resources within and across households, and across institutional scales.

21 "Makame" literally means "place of drought".

Table 7: Summary of Findings relating to Legitimacy of Climate Information and Services

Indicator 3: Satisfaction with Climate Information and Services		
Sub-indicator 3.3: Legitimacy		
Institutional scale	**2014**	**2016**
National	• The problem of excluding key actors in the early stages of climate services development was realized and addressed, which is likely to enhance legitimacy. • Lack of linkages between TANDREC and other institutions and stakeholders may pose a challenge to legitimacy of climate services development. • Mismatches between climate adaptation planning and implementation and existing national policy priorities and capacities pose challenges to legitimacy.	• The top-down nature of the programme and exclusion of local partners in its original design were considered to undermine its legitimacy and sustainability • Lack of formalized mechanisms for incorporating stakeholder and end-user feedback into climate information and services development were considered to undermine the legitimacy of services for local decision-makers
District	• Mismatches between national recommendations and capacities at district and local levels to provide localized advice based on currently available climate information pose challenges to legitimacy. • Differentiated capacities to interpret and use climate information across socio-economic strata pose challenges to legitimacy. • Perceptions that climate information is produced for urban populations, rather than rural populations, pose challenges to legitimacy. • Opportunities for users to engage with experts and to contribute their own knowledge within knowledge production activities enhance legitimacy. • Mismatches between available climate information and local capacities to adapt to climate variability and change based on that information pose challenges to legitimacy	• Lack of institutionalization of programme trainings (PICSA) and services (SMS) at district levels pose challenges to the sustainability and legitimacy of climate services developed under the programme • Lack of district involvement in defining programme priorities led to the exclusion of important sectors such as water and health, and insufficient attention to cross-cutting issues such as gender, land-use planning and natural resource management, in district-level programme activities • Inadequate involvement of districts in programme implementation poses a clear challenge to the legitimacy and sustainability of programme efforts by reducing district's commitments to results, as well as undermining possibilities of coordinating with related initiatives to enhance impact
Local	• Differentiated capacities to access, interpret, and use climate information across socio-economic strata at the village level pose challenges to legitimacy. • Perceptions that climate information is produced for urban populations, rather than rural populations, pose challenges to legitimacy. • Lack of communication networks (e.g. mobile phone) pose challenges to legitimacy. • Differentiated control of ICTs and division of labour at the household level (with women having less control of ICTs and heavier workloads in the evening) results in gendered differentiation in access to climate information, which poses challenges to legitimacy. • The potential for elite capture of training opportunities related to climate services and lack of incentives to share information with all community members following trainings poses challenges to legitimacy. • Perceptions that the advice attached to climate information is 'biased' or 'political' pose challenges to legitimacy.	• Wide variations in access to ICT infrastructure, extension service, and basic levels of service provision between villages and districts pose challenges to equitable climate service delivery • Differentiated capacities to access, interpret and use climate information and services across socio-economic strata at the village level continue to pose challenges to legitimacy • The potential for elite capture of training opportunities related to climate services poses challenges to legitimacy • Perceptions that the advice attached to climate information is 'biased' or 'political' pose challenges to legitimacy • Differentiated levels of literacy, control of ICTs and division of labour at the household level (with women in some communities having less control of ICTs and lower levels of literacy compared to men) results in gendered differentiation in access to an ability to interpret climate information, which poses challenges to legitimacy • Mismatches between available climate information and local capacities to adapt to climate variability and change based on that information pose challenges to legitimacy

5 Findings for INDICATOR 4: Role of Indigenous Knowledge in Climate Adaptation Decision-making

5.1 Findings for SUB-INDICATOR 4.1: Awareness of and Access to Indigenous Knowledge for Climate Adaptation Decision-making

National-level respondents expressed increasing interest in and awareness of the importance and value of IK-use for local decision-making, compared to the situation in the baseline. For example, the national WFP respondent noted that they had become more aware of the importance of IK and the potential complementarities between IK and SK over the course of the project:

"Because of the division of labour within the project setting, we were not really directly looking at [IK] …it was something that was coming at the end when we were getting feedback from the beneficiaries, from the farmers. They were asking so many questions on how to deliver these things and what's the solution? They would say, the issue of complimentarity. They are not only relying on these formal forecasts, but also factoring in the IK, and acknowledging that this is an area that complements the formal forecasting" - national-level WFP respondent

However, lack of a formalized system of delivery continues to prevent consistent access to IK at the district and local levels. At the local level, linkages between experts on IK and other community members generally occur through informal institutions and interaction through day-to-day activities with family, friends, or neighbours. Here, a higher proportion of respondents reported being able to access IK, either directly, through their own observations, or by seeking out the advice of an IK expert. As reported in the baseline, in some instances, this information is also shared and discussed during formal village meetings with local government or customary leadership or both. However, there are not always systematic institutional pathways for delivering this information; consequently, access to IK continues to be variable within and across villages in both districts.

5.2 Findings for SUB-INDICATOR 4.2: Credibility of Indigenous Knowledge for Climate Adaptation Decision-making

Overall, the findings reported on in the baseline concerning the credibility, salience and legitimacy of IK for climate adaptation decision-making remain pertinent to this report. Thresholds for assessing the credibility of forecasts based on scientific knowledge (SK) generally remain in relation to the perceived credibility of forecasts based on IK. As discussed in relation to SK under sub-indicator 3.1, the credibility of IK-based forecasts generally derives from the fact that it is "tried and tested" knowledge that has been gathered over long periods of time. Another reason that IK is trusted is because it is perceived to be highly adapted to the local environment and fits local decision-making contexts. In addition, custodians of IK are generally elder members of the community who are experienced and widely trusted. As one FGD participant in Ilera village put it, an IK expert is a "professional person who has knowledge". Despite these advantages, there remain

significant differences in levels of trust in both scientific and indigenous knowledge about the weather, climate and related adaptation options across district and local levels. Some of these differences relate to uneven access to SK, vis-à-vis IK at the village level. In some cases, residents do not have consistent access to SK-based forecasts and relying on IK is the only option. For example, during focus group discussions, participants were asked to compare what kinds of information they trusted most – scientific or indigenous – but the women in Orkijuu Longishuu said that they were not able to compare, since they can't access the scientific information (see text box in section 3.3, above). In such cases, men and women respondents alike expressed a desire to have access to the SK-based forecasts alongside the IK-based forecasts so that they could evaluate them in relation to one another. When SK-based forecasts are available, they may turn out not to be correct, or local experiences and observations may contradict with what the scientific forecasts have predicted, leading to reduced credibility. However, it was also noted that IK-based forecasts may sometimes be "true" and other cases "not true". For these reasons, many local-level respondents felt that it will be necessary to use "useful" aspects of both SK and IK in order to address the shortcomings of each. At all levels, there was increasing recognition that combining useful elements of scientific and indigenous knowledge could improve the credibility of climate services, and that these are complementary forms of knowledge. Determining "how" to go about combining SK and IK was, however, noted to be challenge.

As reported in the baseline, climatic, environmental and wider social changes continue to affect the credibility of IK for decision-making at district and local levels. While many environmental and astronomical indicators were described for predicting climate parameters such as the onset and intensity of rainfall at local levels, it was noted that in many cases, the indicators themselves are no longer present or reliable. In addition to resulting from ongoing processes of environmental degradation, in some cases it was felt that indigenous knowledge was becoming less reliable due to climate change and that there will be a need to rely more on scientific knowledge in the future. Alongside environmental changes, ongoing processes of globalization, in-migration, uptake of formal religion, education, and increases in ICT use are eroding pathways for producing IK and passing it on to younger generations, remain key challenges, as reported in the baseline (Lori 2014). In addition, are affecting the credibility of IK, particularly among youth.

5.3 Findings for SUB-INDICATOR 4.3: Salience of Indigenous Knowledge for Climate Adaptation Decision-making

IK continues to be seen as locally relevant at district and local levels, particularly in terms of spatial specificity and timing. As reported previously, while scientific seasonal predictions for the OND are not available until the end of August or early September, respondents in Longido have reported that indigenous predictions can be available as early as July, which was more useful for key decisions (Daly 2014). IK forecasts moreover continue to be considered more salient than SK forecasts when it comes to predicting the *onset* of the rains. A vivid example of this was provided by IK forecasters in Engarenaibor, who received a visit by TMA and IIED in 2014. During the meeting, TMA provided the group with a seasonal forecast that anticipated that the onset of the rains would be in several weeks' time. However, a local IK expert declared that this forecast contrasted with IK-based observations, which suggested that the rains would start that very day – which they did! This anecdote was readily confirmed by a district officer who had accompanied TMA to the village at that time and recalled this incidence very well.

Importantly, decisions made based on IK concern not only weather but are integrated and contextualized with knowledge about other social and environmental factors that are relevant for determining potential adaptation options and courses of action. IK is generally also integrated within customary decision-making practices, which enhances the salience at the local level. As reported in relation to the credibility and salience of SK-based forecasts and climate information, many respondents expressed the view that combining scientific knowledge about the climate with IK-based knowledge, and access to appropriate local and external inputs, knowledge and technologies may offer opportunities for enhancing the salience of climate information and services

for decision-making. However, as reported above, the salience of IK is under continuous pressure due to ongoing processes of social and environmental (including climate) changes that are undermining the basis for IK indicators and knowledge transmission at local levels.

5.4 Findings for SUB-INDICATOR 4.4: Legitimacy of Indigenous Knowledge for Climate Adaptation Decision-making

Findings from the second round of data collection confirm that IK continues to be a legitimate for climate adaptation decision-making, particularly at the local level, where people continue to employ IK, even in cases where SK-based forecasts and information are made available. The legitimacy of IK at the local level continues to derive from the fact that it can be readily observed and validated and fits local decision-making contexts. In addition, IK experts and custodians are generally perceived to be experienced and trusted individuals. However, there is now also increasing awareness and recognition among national-level project partners that IK is legitimate and complementary to SK-based climate information. For example, TMA expressed a strong interest in scaling up its collaboration with local IK forecasters in several other regions in Tanzania, including Mahenge (Morogoro) and Iringa. This research has shown that SK and IK indicators are often complementary, rather than contradictory, and suggests that combining IK and traditional SK-based forecasts can improve the latter's salience and credibility. As in the baseline, many district-level respondents noted that they actively seek out and employ multiple sources of information about weather and climate. Agricultural and livestock extension officers perform important "boundary" work and are active in joint knowledge production, or "co-production" processes that involve combining, testing, adjusting and mediating between various types of scientific and indigenous forms of knowledge, technologies and expertise in practice. Their pragmatic focus, knowledge of local contexts and field-based expertise makes them ideally suited as climate service intermediaries. However, the extension services in both districts, as in the rest of the country, often lack sufficient financial and human resource capacities to fulfil this role.

In addition, efforts at combining scientific and local knowledge about the weather, climate and associated adaptation options need to be undertaken with care. Initial efforts made under the IIED devolved climate finance project to combine IK- and SK-based seasonal forecasts to produce a 'hybrid' forecast that would be more salient and credible to Longido residents, were reported to have been unsuccessful. While these attempts were designed ostensibly to increase the legitimacy of the seasonal forecasts, as well as their credibility and salience, they may have had the opposite effect. It was reported that TMA had initially visited Engarenaibor ward and requested IK experts from various villages to organize themselves to develop and send an IK-based seasonal forecast to TMA at regular intervals, with the intention that this would be compared and combined with the SK-based forecast produced by TMA. Despite having sent the IK-based forecast to TMA on several occasions, the group reportedly failed to hear back from TMA, or to ever receive either the standard SK-based forecast or the resulting combined SK-IK forecast. This resulted in the IK experts feeling disrespected and forgotten. Consequently, trust in TMA was diminished and the legitimacy of the process was undermined.

Table 8: Summary of Findings on the Role of Indigenous Knowledge

Indicator 4: Role of Indigenous Knowledge		
Sub-indicator	**2014**	**2016**
4.1 Awareness and Access	• Awareness of IK varied considerably across institutional scales. • IK was available to district level respondents, but not consistently or equally across all respondents. • Many district level respondents are already seeking out multiple sources of information and knowledge, including both indigenous and scientific. • IK is transmitted through both formal and informal institutions at local levels. • Access to IK was considered to be 'coincidental' or 'by chance'. • The lack of systematic mechanisms for delivery of IK was seen as the primary barrier to the availability of IK at all scales;	• Most national programme partners are aware of the importance and relevance of IK as a knowledge system that provides complementary information to scientific knowledge (SK) about the weather, climate and adaptation options at local levels • Agriculture and livestock extension officers are generally skilled at seeking out and combining multiple source information and knowledge, including both indigenous and scientific • The lack of systematic mechanisms for producing and delivering IK continues to constrain widespread availability and access to IK at local and district levels • In the absence of SK-based forecasts and climate information, local respondents reported relying on their own observations, IK-based advice from elders or on "God's will".
4.2 Credibility of IK	• There were significant differences in perceptions of the credibility of IK across district and local levels. • The majority of local level respondents exhibited higher levels of trust in IK than in scientific climate information. Among district level respondents, however, levels of trust in IK were highly variable. • The long-term basis of IK was perceived as a key to enhancing its credibility at both district and local levels. • IK was seen as complementary or beneficial to scientific climate information; efforts to engage both kinds of knowledge are likely to enhance credibility, particularly at local levels. • Lack of standardization in the production of IK poses a challenge to perceptions of the credibility of IK, particularly at the district level. • At both the district and local levels, climatic, environmental, and social changes pose challenges to the credibility of IK.	• IK is increasingly seen as complementary or beneficial to scientific climate information at the national and local levels • IK continues to be highly trusted at local levels, although ongoing processes of social and environmental (including climate) changes are undermining the credibility and reliability of IK indicators and knowledge transmission • Scientific climate information and forecasts are increasingly considered to be "potentially useful" - men and women respondents expressed increasing receptivity towards and interest in receiving SK-based forecasts and climate information which they could test in practice
4.3 Salience of IK	• IK was seen to be more relevant, particularly in terms of spatial specificity, at both the district and local levels. • IK about weather or climate was often accompanied by or is part of other complementary or contextualized knowledge, which enhances salience. • IK is also integrated within customary decision-making practices (both community and individual) which enhances the salience, particularly at the local level	• IK continues to be considered more relevant than SK in terms of spatial and temporal specificity at local levels • IK about weather and climate continues to be a part of other complementary local and contextualized knowledge, which enhances its salience for decision-making • The salience of IK is threatened by ongoing processes of social and environmental (including climate) changes that are undermining the basis for IK indicators and knowledge transmission
4.4 Legitimacy of IK	• IK was perceived to be more legitimate, particularly at the local level, because it inclusive of diverse perspectives. • IK was perceived to be more legitimate, particularly at the local level, because it is transparent (does not require technical instrumentation) and can be validated at local scales. • Linkages between IK and customary leadership structures and customary decision-making enhances the legitimacy, particularly at the local level.	• The legitimacy of IK has increased among national project partners due to recognition that local people continue to employ IK, even in cases where SK-based forecasts and information are made available • The legitimacy of IK at the local level continues to derive from the perceived legitimacy of IK experts and custodians as experienced and trusted individuals • The legitimacy of IK at the local level continues to derive from the fact that it can be readily observed and validated and fits local decision-making contexts

6 Conclusions

Findings from the second round of data collection indicate that there have been a number of improvements with regard to user satisfaction with climate services provided under the GFCS-APA since the baseline study was conducted. Respondents reported improved satisfaction with the climate services developed under the programme in some areas due to enhanced institutional coordination and collaboration amongst national-level partners, greater awareness of climate-health linkages and efforts to integrate these into relevant national planning and policies, and improvements in the communication of climate information and products to district-level stakeholders through an expansion of climate service channels. There is further evidence to suggest that access to climate information and services has improved at the district and village levels, particularly amongst those who have taken part in programme trainings, who receive climate information via the FarmSMS service, and who interact regularly with the extension service in their communities.

Notwithstanding these improvements, the findings suggest that access to climate information and services remains highly uneven within and across communities in the targeted districts. In general, we find that awareness of, access to and the potential usability of, climate information and services are highest in communities where prior interventions and capacity building (by GFCS-APA programme partners, as well as other actors) have taken place, where the infrastructure to support general service provision (roads, mobile and radio networks) are functioning, and where extension officers are appropriately motivated and resourced. There are large variations in all these factors between villages in the two districts studied. Disparities in access to various information channels, mismatches in the timing and resolution of forecasting products, and difficulties in understanding and translating forecast information into actionable advice continue to undermine the usability of scientific climate and meteorological information at both the district and local levels. At the local level, gendered roles at the household level and disparities in literacy continue to undermine women's access to climate services and constrain their ability to understand and interpret climate information. Despite these limitations, respondents at the local level generally consider scientific information about the weather and climate to be potentially "useful" information that can complement traditional forecasts and local and indigenous sources of knowledge.

The findings regarding IK that were reported in the baseline continue to hold relevance for co-production of climate services within the GFCS APA, even though the programme did not set out to incorporate or address IK in the information, services or products that it developed. While the importance and utility of IK for adaptation decision-making continue to be underscored, respondents clearly recognize that there are strengths and limitations to the use of both scientific and local and indigenous sources of information about weather, climate and environment change and that complementary and integrative approaches are needed. Employing multiple communication channels and combining scientific forecasting information and advisories with local knowledge, alternative livelihood options, technologies, and complementary advice and information were noted to improve the salience, credibility and legitimacy of climate services efforts and their potential usefulness and applicability. Notwithstanding this, the findings presented in this report suggest that efforts to enhance the provision of usable climate information, advisories and services in Longido and Kiteto districts under the pilot phase of the programme have yet to lead to widespread and consistent access to timely and reliable climate information at the local level. Consequently, the application of this information to decision-making in these two districts remains limited. The findings further illustrate some of the challenges encountered within the programme to co-producing demand-driven climate information and services and indicate that substantial barriers to institutionalizing, scaling up and sustaining climate service efforts remain. Consolidating and

communicating learning from the pilot phase of the GFCS-APA will constitute an important first step towards developing credible, salient and legitimate climate services in the future. Based on this analysis, we offer the following recommendations which may contribute toward efforts to enhance user satisfaction with climate services in Tanzania in the future.

7 Recommendations

Based on these findings, the following recommendations are offered for improving the salience, credibility, legitimacy, sustainability and impact of climate service investments and co-production efforts in Tanzania:

1. **Involve local government partners and grassroots actors** in the design and implementation of subsequent phases of the programme and place stakeholder knowledge, needs and priorities at the centre of these efforts. For all trainings related to climate services, it remains important to ensure that less powerful and marginalized segments of the population – especially women -- are included, not just local leaders.

2. **Enhance the capacity of climate service intermediaries to tailor climate information and advisories**. Advice provided within climate services should be appropriate to the local context in order to be credible, salient and legitimate, and fully usable. District and local level actors such as government extension, health and community development officers have in-depth knowledge of the local context and will be b|est situated to incorporate climate information and concerns into their activities and interactions with grassroots stakeholders. Performing this intermediary role will require continued commitment to enhancing the capacity of district and local actors to interpret climate information and formulate advisories, as well as dedicated resources and incentive structures that enable and reward sustained engagement with local stakeholders.

3. **Develop dedicated user interface platforms that are user- and decision-driven, rather than partner- or data-driven**. Such platforms should provide a place for climate service providers, intermediaries and end-users to interact regularly around decision- or problem-oriented questions and applications to which climate information and services could add value, recognizing that information about the weather and climate information is but one potential component of complex decision-making contexts. Stakeholder decision-making contexts should be placed at the centre of these activities with the aim of developing shared understandings of relevant entry points and types of information, expertise and knowledge (natural and social scientific, local, experiential, and indigenous, climate and non-climate) that could appropriately and feasibly be included and combined in a climate service.

4. **Adopt an inclusive and cross-sectoral approach to climate services co-development** to facilitate knowledge exchange, learning and enhanced awareness of relevant entry points for climate services. Alignment with complementary initiatives and investments within and across government ministries, departments, agencies, and local, national and international organizations is needed to create greater synergies, avoid redundancies, and facilitate coordination of climate services efforts and investments.

5. **Conduct research on social and ethical aspects of climate services use and application** by different actors in particular decision-making contexts (professional, livelihood, organizational and institutional settings). Better understanding of the complex social, institutional, economic and other contexts for climate service provision and use is needed to enable climate services to effectively respond to stakeholder needs. This research should acknowledge the roles of power and politics at multiple levels in shaping climate services access and use. It should moreover acknowledge the multiplicity of ‘logics’ that may inform various operational and livelihoods decisions, and seek to understand how

individuals, as members of households, extended families, communities, organizations, and so forth are able to draw on climate services to make decisions that enhance or reduce resilience and vulnerability.

6. **Continue to employ multiple channels of delivery** in view of disparities in access to various channels within and across villages and districts and to meet diverse local information needs, preferences and capacities. Not all communities or segments of the population are currently able to access ICTs. Employing complementary systems of delivery that build upon existing pathways for distributing information at local levels (e.g. ward development committees, government extension service, sub-village leaders, Red Cross volunteer networks, village assemblies, customary leadership structures) would maximize access to climate information at local levels.

7. **Design and sequence programme activities in ways that enable adaptive programming** so that findings and learning from ongoing research and monitoring and evaluation activities can be incorporated and continuously addressed throughout the programme. For example, this will involve well-planned inception activities, pre-planned and jointly agreed M&E approaches, and opportunities for reflexive evaluation of programme activities throughout the programme.

8. **Recognize the political nature of agricultural and livestock extension and livelihood advice that may accompany climate services** and the economic and social (including cultural and gender) challenges that may prevent grassroots actors from accessing and applying climate information. Support services that reduce livelihood vulnerability and enhance equitable access to various livelihood opportunities.

9. **Continue efforts to develop and formalize procedures for both vertical and horizontal distribution of climate information within government MDAs at all levels:** There is a continued need for the creation of standardized operation procedures and protocols at national, district, and local levels for systematic climate information delivery, both horizontally and vertically within and across institutional scales. These should include guidance on the timelines under which climate information should be delivered to ensure the timely delivery of information, as well as identify specific responsible parties. It is suggested that this could be a component of the development of the national 'Road Map' for climate services.

10. **Recognize opportunities for co-production among actors across multiple scales.** Within the context of the GFCS-APA, much of the discussion of co-production has focused on idealized 'end-users' (e.g., farmers, pastoralists) as the primary participants in processes of co-production with climate scientists. Our findings indicate that key opportunities exist for co-production among partners at the national and district levels. Thus, it will be important to reframe how co-production is approached, to recognize the multiplicity of actors who can potentially be involved and the dynamic nature of co-production processes.

APPENDIX I: Interview Guide for Focus Group Discussions at Sub-national Levels

INTERVIEW GUIDE FOR FOCUS GROUP DISCUSSIONS AT SUB-NATIONAL LEVELS, 2016

Location (district/village): Date:

Number of participants:

Characteristics of participants (gender, occupation, role in the community/at the district, and others as relevant)

Interviewer: Facilitator: Translator:

INTRODUCTION:

Thank you for joining this discussion. Our names are: _____. We are researchers and students coming from the Center for International Climate and Environmental Research in Oslo (Norway), the University of Dar es Salaam and _____. We are here today because we would like to learn more about your experiences with accessing and using information about climate and weather. This focus group discussion is part of a larger project that aims at improving the availability and utility of climate information for citizens in Tanzania. This project is conducted in partnership with other organizations, both at the national level and international level. If you agree to participate in this focus group discussion, we will be talking about topics such as the availability and need for information about weather and climate change in your area, and whether and how this has changed over the past several years. We will also be looking at the ways in which men and women access and use information about weather and climate change and how this can be improved. We expect that the discussion will last between 1,5 and 2 hours.

Your participation today is voluntary, and your responses will only be shared with the researchers who are involved in this project. We will not be using your names in any publication associated with the information that we collect today. There are no correct answers to these questions. In fact, we encourage open discussion and debate. So please feel free to answer honestly and freely. You are of course free not to answer any question and to leave the discussion whenever you like. However, your views and experiences are very important to us. We cannot promise that you will benefit directly from this research, but we hope that the information that we are collecting will help to improve climate services and development activities in this country. Before we begin, we would like to request your permission to tape record the discussions. Does anyone object to this? Are there any other questions before we begin?

Introduction round - group members introduce themselves

1. Awareness of and access to climate information, advisories and services produced and disseminated under the GFCS APA

1a) Have you heard about the GFCS APA? If so, can you explain what it is?

1b) Are you aware of TMA and the work it is doing?

1c) Have you heard about weather and climate information produced by TMA or other actors? If so, what types of information are you aware of? (*probe for seasonal forecasts, daily weather forecasts, sub-seasonal/dekadal forecasts, advisories/early warnings*)

1d) Have you been able to access climate information, advisories or services of any type, from anywhere? Please explain (*probe for: which information/service did you receive, from where/whom, and when was the last time you accessed this information/service?)*

1e) Are you aware of any climate-related information, advisories, trainings or services that have taken place specifically under the GFCS programme, in partnership with district or local actors?

Probe specifically for:

- *PICSA trainings*
- *Downscaled seasonal forecasts*
- *Community radio*
- *SMS service*
- *Others*

1f) Have you participated in the PICSA training? If so, when/where?

1g) Have you signed up to receive the SMS service? If so, when/how?

1h) Do you think that awareness of and access to climate information, advisories or services have been improved through the programme/partner efforts? If yes, in what ways?

1i) If you do not know about or receive any climate information or services, what do you think are the reasons for that? What barriers, if any, are preventing you from doing so? Please explain

1j) What kinds of information and communication channels or messengers are you most likely to use and trust? Please explain (*probe for: radio, SMS, NGOs, extension officers, government officials, and others, as relevant*)

2. Usability of climate information, advisories and services for professional and livelihood-related decision-making

2a) Has the relevance of the climate information/advisories/services you receive improved, stayed the same, or declined over the past few years? Please explain?

2b) Is the climate/weather information/advisory/service that you are receiving now more reliable (spatially and temporally) compared to before? If so, why do you think this is the case?

2c) Have you been able to use the scientific climate information, advisories and services that you receive? If so, for what purposes have you used them? Please be specific and provide an example

Probe for decision-making relating to agriculture, livestock-keeping and food security, health, weather emergencies, water, planning, and others as appropriate

2d) Does the information/advisory/service arrive in time for you to make decisions?

2e) Do you believe the information/advisory? Why or why not?

2f) Do you trust the information/advisory/service? Why or why not?

2g) What are your views on the PICSA training (where relevant)? Was it useful? Timely? Successful? Why or why not? Did you use what you learned in the training? If so, how?

2h) What are your views on the SMS service? Is it timely, useful, relevant? In what ways? Please explain

2i) If you are not able to use this information/these advisories/services, what barriers, if any, prevent you from acting on them? Please explain

3. Role of indigenous knowledge (IK) about weather, climate, and related adaptation options

3a) Do you think that indigenous knowledge about the weather, climate, and related adaptation options is useful and important? Why or why not?

3b) Are you able to access indigenous knowledge? If so, how, and what types of knowledge are available?

3c) Do you trust indigenous knowledge? Why or why not?

3d) Do you rely on local or indigenous knowledge to make decisions related to your profession/livelihood activities? If so, please explain. If not, why do you think that indigenous knowledge is not useful?

Probe: do you rely on any local or indigenous sources of information about the weather when you make decisions about agriculture or livestock keeping? For example: for deciding when to plant crops, choosing what kinds of crops to plant and what kind of seeds to plant, where to plant, when to move livestock, etc.? Why or why not?

Probe: Do you rely on IK about the weather/climate when making decisions related to your own or your family's health, safety and well-being? Please explain

3e) If you have received scientific information about the weather or climate, did this information agree or disagree with the indigenous knowledge you received? Please explain and give an example

3f) Have you observed any changes in the extent to which people rely on IK now compared to before? If so, what do you think is the cause of these changes?

3g) Which type of knowledge about the climate, weather and related adaptation options do you trust the most, indigenous knowledge, or scientific knowledge?

4. Views on how GFCS APA efforts and climate services can be improved

4a) What changes would you like to see regarding the provision of scientific information, advisories and services about the weather and climate in your district/village?

4b) Are there specific ways in which this information/advisories/services be made more useful and respond to your specific needs? Please explain

4c) What is your experience/ view of the collaboration between relevant partners in the GFCS APA (TMA, relevant NGOs) and your district/village? How could this collaboration be improved in the future?

4d) Are there other relevant (past or current) initiatives concerning climate services/climate change at the district/village level that are relevant to the GFCS-APA and from which the programme could learn? Please explain.

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CICERO has garnered attention for its research on the effects of manmade emissions on the climate, society's response to climate change, and the formulation of international agreements. We have played an active role in the IPCC since 1995 and eleven of our scientists contributed the IPCC's Fifth Assessment Report.

- We deliver important contributions to the design of international agreements, most notably under the UNFCCC, on topics such as burden sharing, and on how different climate gases affect the climate and emissions trading.
- We help design effective climate policies and study how different measures should be designed to reach climate goals.
- We house some of the world's foremost researchers in atmospheric chemistry and we are at the forefront in understanding how greenhouse gas emissions alter Earth's temperature.
- We help local communities and municipalities in Norway and abroad adapt to climate change and in making the green transition to a low carbon society.
- We help key stakeholders understand how they can reduce the climate footprint of food production and food waste, and the socioeconomic benefits of reducing deforestation and forest degradation.
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CICERO was founded by Prime Minister Syse in 1990 after initiative from his predecessor, Gro Harlem Brundtland. CICERO's Director is Kristin Halvorsen, former Finance Minister (2005-2009) and Education Minister (2009-2013). Jens Ulltveit-Moe, CEO of the industrial investment company UMOE is the chair of CICERO's Board of Directors. We are located in the Oslo Science Park, adjacent to the campus of the University of Oslo.

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