



Mission report

CS3 – Mozambique

September – October 2022



Overview

The mission was implemented in Mozambique (Maputo and Nampula Provinces) involving the entire CS3 team: Sant'Anna School of Advanced Studies (SSSA), Institute of Agrarian Research of Mozambique (IIAM) and PLAN. The mission had the notable involvement of the Mozambique National Institute of Meteorology (INAM), which is not formally part of CS3.

The mission lasted from September 12th to October 12th, 2022, for a total duration of 31 days for some of the researchers from SSSA and IIAM. The schedule was arranged so that different activities were run at once, involving different members of the team.

The objectives of this mission were the following:

- Collect and analyze relevant data to inform CS3 activities;
- Showcase and conduct training for the CS3 climate service at INAM;
- Prepare the ground for the 2023 FOCUS-Africa Project Workshop

A detailed schedule of the mission is included in *Annex A*. The objectives listed above are detailed below according to their relevance for each of the four research strands of CS3: 1. *Stakeholder engagement*, 2. *Genomics*, 3. *Agrobiodiversity testing* and 4. *Climate analysis*

Strand 1 - Stakeholder engagement

Partners involved: SSSA, IIAM and PLAN

This strand of research aimed at collecting relevant quali-quantitative socio-economic data to inform the design of appropriate climate services. It followed two main activities.

1. Key informants interviews

This activity was aimed at mapping stakeholders that are key to the development of CS3. Based on a pre-mission snowball stakeholders mapping, a dozen key informants' interviews were organized at national and local level, aimed at defining the CS stakeholders' map and better understanding the flow of the climatic information towards end-users. These included interviews with the INAM, the world food program, the Ministry of Agriculture, as well with local governmental offices in Nampula and Nametil, close to our priority intervention area. See *Annex A* for a detailed list of the meetings held. Interviews were key to understand the status of climate service deployment in the country and to establish connections that will then be leveraged to maximize the impact of FOCUS-Africa activities. Notably, we were able to attend a yearly governmental, multi-stakeholder event where INAM and associated offices release the outlook of the rainy season. This event was instrumental to gather precise information about the status of climate information use in the country and to identify areas of improvement where CS3 could significantly contribute.

2. A household level survey

Under Strand 1 of CS3, we aimed at implementing a survey in the Mogovolas District, located in the Nampula Province, in north-eastern Mozambique (Fig.1). This district is the key target of our activities and the survey was intended to capture salient characteristics of local farmers that will be at the center of our climate service development.



Figure 1. Sampled areas (adapted from Manuel et al, 2020)

The survey was directed at 248 households in 4 out of 5 *postos* (administrative units, Fig. 1) in the District, following a convenience sample design. The criteria for the selection of the convenience sample included:

- Agroecological diversity,
- Population density/gender balance
- Production of at least one of the target crops (*cowpea* and *rice*)

The selection of households for the survey was carried out in the weeks and months preceding the mission.

The survey was designed to collect data relative to the current socio-economic situation in the study sites, production, use and preferences for cowpea and rice varieties, use of climate information, food security and gender. The team conducting interviews included 10 local enumerators (Fig. 1a). Each questionnaire had a target duration of one hour, requiring extensive training for enumerators before the campaign (Fig. 1b). To address this need, preparatory activities were developed including three contents and protocols pilotings (two in the Maputo Province and one in the Mogovolas District) and a 3-days enumerator training. A meeting with the local chiefs of Namachepa and Rieque (villages in Nametil that were already visited last year) was organized to present the results of the 2021 mission and to follow-up on the project activities. During this event, we had the possibility to interact with local chiefs and show them preliminary features of the climate service being developed in CS3. Chiefs were eager to receive information and manifested keen interest in the potential developments. Currently, data collected in the survey is being analysed. See more details in the climate data strand section.



Figure 2. Pictures from the survey: a. The survey team meeting a local community; b. Survey piloting in Umbeluzi, Maputo; c. Enumerator training; d. and e. Interviews with producers

Strand 2 – Genomics

Partners involved: SSSA and IIAM

Under this research strand, we aimed at to conduct a training on genotyping and landscape genomics and extracting DNA from selected cowpea and rice varieties. The activities were conducted between 12th to 23rd September.

1. One day workshop involving presentations and hands on training session

The SSSA led a training workshop on 12th September 2022 at IIAM that tackled basic principles of genetics/genomics and application in smallholder agriculture. A session involving hands-on training using example data was conducted. In attendance were the IIAM team involved in CS3 as well as other scientists stationed at the campus. We also involved technicians from IIAM in laboratory activities as part of support, capacity building and knowledge exchange.

2. Laboratory activities involving seedling harvesting and DNA extraction

DNA extraction was conducted at IIAM laboratory facility by the IIAM and SSSA team. Before the start of the mission, 350 and 450 rice and cowpea seeds were germinated in small pots until the emergence of leaves, which are the raw material used for DNA extraction. Seedlings were collected, flash-frozen at -80°C, and extracted using silica filters designed to yield high quality DNA for sequencing. We aimed at high quality DNA usually indicated by the parameter 260/280 ratio (optimum value is 1.8) and at least a minimum concentration of 20ng/μl. We managed to process 331 rice samples and 445 cow pea samples, which exceeded the target for both rice and cowpea, that in the grant agreement amounted to 250 samples each. DNA extraction was sufficient with high quantity and quality achieved with 260/280 ratio between 1.7 and 1.8 for all samples. For cowpea, the highest concentration was 187 ng/μl with only 5 samples had below 20ng/μl. For rice samples the highest concentration was 85ng/μl with 5 samples below 10ng/μl. DNA was shipped back to Italy is being now sent out to the sequencing

facility IGA (Udine, Italy). Genotyping will involve ddRAD sequencing, a method which detects small genetic differences amongst alleles (single nucleotide polymorphisms, (SNP)), across the entire genome. The resulting data will be used to connect genetic agrobiodiversity to climate diversity in Mozambique in the effort of identifying genetic elements conferring adaptation to climate constrains.

NOTE: During the Survey conducted in Strand 1 (above) additional seeds were collected from participating farmers. Approximately 260 cow pea and 260 rice samples were collected and are stored at IIAM gene bank. This material is useful and will be further exploited to understand on farm diversity as well as capture farmer preferences.



Figure 3. Pictures of the genomic activities: a. Training workshop; b. IIAM and SSSA team working in the laboratory; c. IIAM Biotechnology lab; d. - e. Cow pea and rice plantlets growing in the green house prior to DNA extraction

Strand 3 - Agrobiodiversity testing

Partners involved: IIAM, SSSA

The mission had limited involvement with Strand 3, if not for the selection of experimental fields where rice and cowpea genotypes will be grown and characterized between December 2022 and May 2023. The SSSA team visited three field facilities in the Nampula area and identified the IIAM research station in Nampula city as the most appropriate for conducting the cowpea experiment. After discussion with the IIAM team, we decided that the second experimental field will be located in a IIAM research station at Chokwe, which is closer to Maputo. By this, we will target different agroecologies, a first step necessary to scale up CS3 innovation beyond the piloting area of Mogovolas.

Strand 4 – Climate

Partners involved: SSSA, PLAN

The goal of the mission for this research strand was to interact, collect feedback and discuss with climate service producers and users on the developed prototype climate service product. Two main activities were conducted

1. Training workshop

A training workshop was conducted on predicting rainy season characteristics at INAM headquarter in Maputo during Sep 19th and 20th. Experts from INAM, IIAM and WFP participated. Topics such as concept and operational practice of agroclimatic indicators; FAO water balance model and uncertainty in agrometeorological predictions were covered during the workshop. In addition, demonstration of the developed tools and hands on exercise on estimating and visualizing water balance and rainy season characteristics was also part of the training workshop.



Figure 4. Pictures of the training workshop at INAM: a. A training session; b. The group attending the workshop

2. Meeting with chiefs

One of the developed prototype climate service products (map of agronomic onset of the rainy season) was presented to farmers and local leaders during a meeting held in Nametil, Nampula Province. Discussion was held on the nature of the uncertainty of the climate product and preferred modality and timing of the delivery of the climate product. During the discussion, farmers reflection and interest was captured.

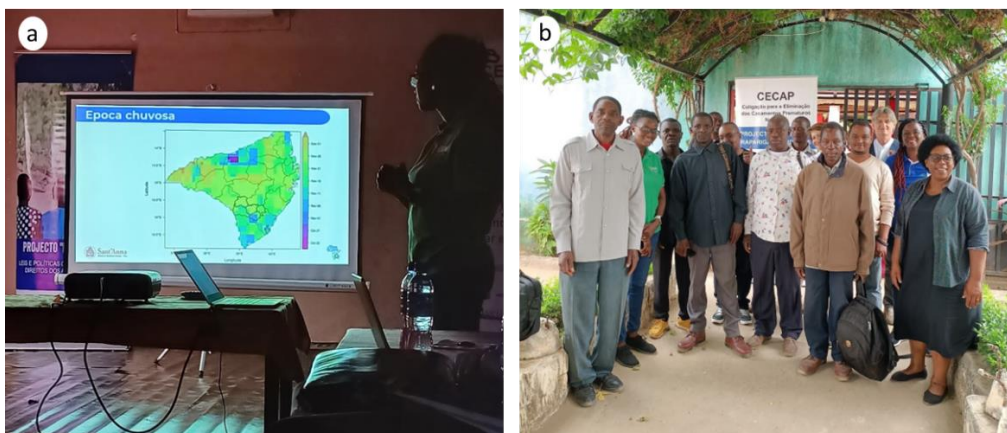


Figure 5. Pictures of the meeting with farmers and chiefs: a. Presenting session; b. The group attending the meeting

Preparatory activities for the 2023 Project Workshop

The mission was a relevant interaction opportunity for SSSA and the local partners, in view of the 2023 consortium meeting. Several meetings were held to discuss the logistics of the workshop. Moreover, new collaborations were established with relevant stakeholders (e.g., WFP and Ministry of Agriculture), which were alerted about the stakeholder meeting session to foster their direct involvement in the project.

Results, key challenges and improvement avenues

The mission can be considered a success, given that all the expected results have been achieved. For Strand 1 (Stakeholder engagement), some critical issues have emerged during the survey. These issues, and the related improvement avenues, have been explored through a participatory approach during the final survey assessment session, attended by SSSA, PLAN and the enumerators. The following points were highlighted:

- In-field activities would improve by increasing the engagement of the local PLAN offices. Being well rooted in the project areas, they could easily facilitate the logistics and the interaction with the local communities
- More time should be allocated for the data collection, in order to prevent logistical issues and to analyse and, if necessary, correct the collected data, ultimately enhancing their general quality
- Different protocols should be followed for interacting with different communities (e.g., isolated vs well connected, engaged vs not engaged in development projects)

Besides the many results achieved, the mission has strengthened personal and professional relationships among the CS3 partners, improving the effectiveness of the project activities, as well as of the organisational arrangements for the next consortium meeting.

ANNEX 1. Schedule of the mission work

Date	Activities in Maputo	Activities in Mogovolas District
12/09/2022	<ul style="list-style-type: none"> • Meeting with Focus Africa CS3 team from Mozambique at IIAM • DNA extraction at IIAM laboratory 	
13/09/2022	<ul style="list-style-type: none"> • DNA extraction at IIAM laboratory • Questionnaire translation at IIAM 	
14/09/2022	<ul style="list-style-type: none"> • DNA extraction at IIAM laboratory • Survey revision at IIAM • Meeting at INAM 	
15/09/2022	<ul style="list-style-type: none"> • DNA extraction at IIAM laboratory • 1st Survey Piloting (Umbeluzi, Maputo Province) • Participation to the Launch of Seasonal forecast at INAM 	
16/09/2022	<ul style="list-style-type: none"> • DNA extraction at IIAM laboratory • Meeting at WFP with Silvia Pieretto and Francesco Stompanato • Survey revision and KOBO programming at IIAM 	
17/09/2022	<i>N/A – Saturday</i>	<i>N/A – Saturday</i>
18/09/2022	<i>N/A - Sunday</i>	<i>N/A - Sunday</i>
19/09/2022	<ul style="list-style-type: none"> • DNA extraction at IIAM laboratory • Meeting with Zulmira Mumino (Ministry of Agriculture - Department of Early warning) • Visit at Umbeluzi Agricultural station (IIAM) and meeting with the Rice Program team • KOBO programming revision at IIAM • SSSA Training at INAM 	
20/09/2022	<ul style="list-style-type: none"> • DNA extraction at IIAM laboratory • 2nd Survey Piloting (Marrcuene, Maputo Province) • Meeting with Prof Rogerio Chiulele at Eduardo Mondlane University • Meeting with Prof. Benedito Cunguara, at Eduardo Mondlane University • SSSA Training at INAM 	
21/09/2022	<ul style="list-style-type: none"> • DNA extraction at IIAM laboratory 	<ul style="list-style-type: none"> • Revision with Plan (materials, location, checklist) • Meeting with INAM (Nampula) • Meeting with Nampula Province Secretary
22/09/2022	<ul style="list-style-type: none"> • DNA extraction at IIAM laboratory 	<ul style="list-style-type: none"> • Meeting with Mogovolas District secretary • Enumerator training – Day 1

		<ul style="list-style-type: none"> Meeting with Namachepea and Rieque Chiefs to present the 2021 Mission's results 3rd Survey Piloting
23/09/2022	<ul style="list-style-type: none"> DNA extraction at IIAM laboratory 	<ul style="list-style-type: none"> Enumerator training - Day 2 Meeting with local breeders from IIAM (Focal point for cowpea in Nampula) Meeting at IIAM's Nametil Station to discuss the field experiment
24/09/2022	<i>N/A – Saturday</i>	<ul style="list-style-type: none"> Enumerator training - Day 3
25/09/2022	<i>N/A - Sunday</i>	<i>N/A - Sunday</i>
26/09/2022	<i>N/A - Holiday</i>	<i>N/A - Holiday</i>
27/09/2022		<ul style="list-style-type: none"> Survey – Day 1 Meetings with local chiefs and/or other local authorities
28/09/2022		<ul style="list-style-type: none"> Survey – Day 2 Meetings with local chiefs and/or other local authorities
29/09/2022		<ul style="list-style-type: none"> Survey – Day 3 Meetings with local chiefs and/or other local authorities
30/09/2022		<ul style="list-style-type: none"> Survey – Day 4 Meetings with local chiefs and/or other local authorities
1/10/2022	<i>N/A – Saturday</i>	<ul style="list-style-type: none"> Survey – Day 5 Meetings with local chiefs and/or other local authorities
02/10/2022	<i>N/A - Sunday</i>	<i>N/A - Sunday</i>
3/10/2022		<ul style="list-style-type: none"> Survey – Day 6 Meetings with local chiefs and/or other local authorities
4/10/2022	<i>N/A - Holiday</i>	<i>N/A - Holiday</i>
5/10/2022		<ul style="list-style-type: none"> Survey – Day 7 Meetings with local chiefs and/or other local authorities
6/10/2022		<ul style="list-style-type: none"> Survey – Day 8 Meetings with local chiefs and/or other local authorities
7/10/2022		<ul style="list-style-type: none"> Survey – Day 9 Meetings with local chiefs and/or other local authorities
8/10/2022	<i>N/A – Saturday</i>	<ul style="list-style-type: none"> Survey – Day 10

		<ul style="list-style-type: none"> • Meetings with local chiefs and/or other local authorities
9/10/2022	<i>N/A - Sunday</i>	<i>N/A - Sunday</i>
10/10/2022		<ul style="list-style-type: none"> • Survey – Final data revision and survey assessment with enumerators
11/10/2022		SSSA's team departure to Maputo
12/10/2022		SSSA's team departure to Italy

SSSA TEAM:

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