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SASSCAL Southern African Science Service Centre for Climate Change and Adaptive Land Management

GFA CONSULTING GROUP

Innovative Technologies to Improve Climate Resilience in the Zambian Agricultural Sector (InTeCRes)

1. Introduction

The *Innovative Technologies to Improve Climate Resilience in the Zambian Agricultural Sector (InTeCRes)* project is part of the German Bilateral Cooperation Programme funded by the German Federal Ministry of Food and Agriculture (BMEL). The project is being implemented by the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL), as the coordinating partner, in collaboration with the Agricultural Knowledge and Training Centre (AKTC), Golden Valley Agricultural Research Trust (GART), National Remote Sensing Centre (NRSC), Stellenbosch University (SUN), Zambia Agricultural Research Institute (ZARI), Zambia Air Services Training Institute (ZASTI) and Zambia Meteorological Department (ZMD). The implementation of the project is overseen and supported by the GFA Consulting Group GmbH as the general agent acting on behalf of BMEL. The project activities are hosted by AKTC at the GART Chaloshi Farm in Chisamba.

2. Project duration

From 1st June 2019 to 31st December 2019.

3. Focus area

The project will build the capacity of emergent farmers in the utilisation of novel and innovative technologies to improve crop productivity and farm management in the face of climate change. The target group will be farmers, including those that are currently being supported by the AKTC, technical staff and students from partner institutions and universities/colleges respectively. As a way of ensuring sustained capacity, technical staff from the partner institutions will be trained in drone operations, processing of drone-acquired remote sensing data, operation and maintenance of the Automatic Weather Station, and acquisition and operation of precise soil sensing equipment.

4. Background and context

Climate change has affected farm productivity in many ways ranging from crop failure of rainfed crops to emergence and proliferation of crop pests and diseases. In Zambia, as in many other countries, adoption of advanced farming methods and techniques is low, especially among small-scale farmers. Changing rainfall regimes have adversely affected productivity, particularly of small-scale farmers that produce the major proportion of staple crop. The resilience of farmers and their capacity to maintain productivity under these changing conditions can be improved by adoption of novel technologies that will enhance their capacity to plan adequately and improve their decision-making. By making accurate predictions, farmers will be able to plant their crops at the dates that are right for best crop

performance and devise mechanisms and strategies to avoid crop losses as a result of weather-related pest infestations, droughts and floods.

Some of the technologies that can be adopted to improve farmer productivity -with evidence of successful implementation to support agricultural productivity and farm management - include automated weather equipment delivering data and information for planning and early response; earth observation data for farm monitoring and management, and precise soil mapping for improved soil and fertility management. The limited utilisation and capacity to employ these technologies is not only lacking at the farm-level but also amongst providers of extension services. Therefore, building of capacity, and for it to be sustained, the capacity of emergent farmers must be built together with that of strategic players in the provision of extension and early warning services and farmer support. In Zambia, ZMD provides early warning services in the form of daily, weekly and seasonal weather forecasts and weather crop bulletins. ZMD is managing a network of both manual and automatic weather stations that transmit weather data in near real time. Through different partnerships, ZMD has been growing and modernising its network through installation of modern equipment. For example, with support from SASSCAL the network was expanded by the installation of 19 automatic weather stations that transmit data which is made available through the ZMD portal and the SASSCAL WeatherNet.

Early warning, in addition to other services, are delivered to small-scale farmers by the Ministry of Agriculture through its various departments and units. ZARI, which is the research arm of the Ministry of Agriculture, is a fully-fledged research institute and has been conducting research ranging from integrated soil and fertility management, plant breeding and crop improvement, and farming methods. In addition to ZARI, other research institutes were created to deliver focussed evidence-based services. One of such research institutions is GART, a public-private sector partnership, which was created to promote sustainable agriculture through adaptive and applied research. The two institutions, ZARI and GART, have experience in delivering research-driven farming methods to farmers, but with limited use of precise soil sensing equipment. The two institutions will collaborate with SUN to train staff and build the capacity of the institutions to deliver precise soil sensing services to the emergent farmer community in Zambia.

The use of drones in agriculture in Zambia is limited, mainly due to costs and lack of technical capacity and regulatory requirements. ZASTI provides aviation training including drone pilot training. In collaboration with the NRSC; a semi-autonomous government agency responsible for the promotion and delivery of geospatial and earth observation services in Zambia., ZASTI will provide drone pilot training and support the acquisition of multispectral images for farm monitoring and management. Processing, demonstration and delivery of farm management drone-acquired remote sensing data will be provided by the NRSC.

The AKTC will host the project activities at the GART Chaloshi Farm and will provide linkage to the target emergent farmers.

5. Objectives

The objectives of the project are:

i. To strengthen Zambia's vulnerable agricultural sector by building scientific and technical capacities in the application of innovative technologies for improved crop production and farm management under climate change conditions.

ii. To build the capacity of emergent farmers to use precise soil scanning equipment and drone technology for crop and drought monitoring and efficient farm management under climate change conditions.

iii. To build the capacity for climate and weather information-based farm decision making and planning in response to changing rainfall patterns and other weather conditions.

6. Approach

The project will be implemented in three phases (Fig. 1).

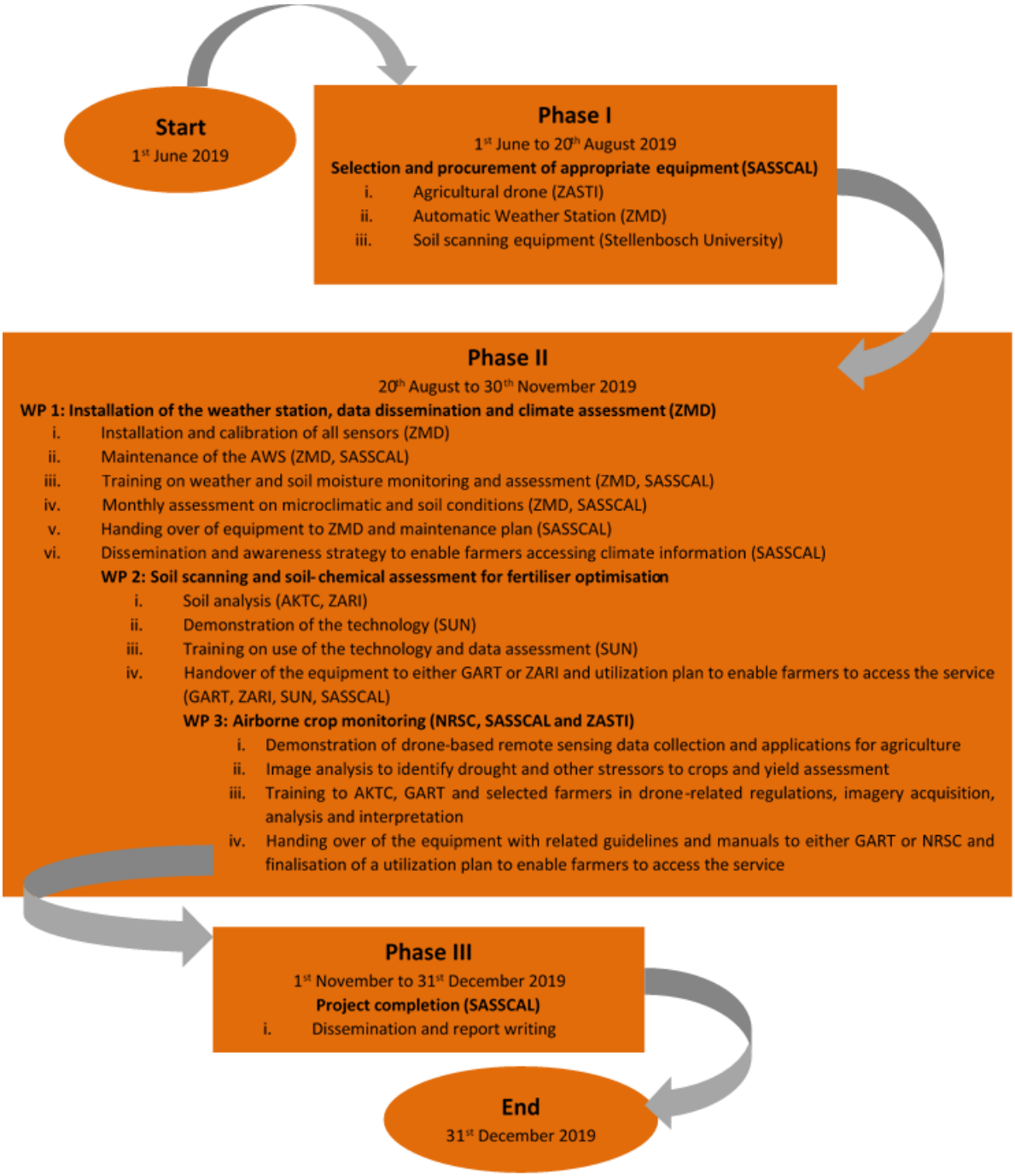

Figure 1. InTeCRes Project Activity Plan

The first phase, involving selection of the appropriate equipment, procurement and planning of activities, commenced on 1st June 2019. These were firmed up during the project's induction meeting that took place on the 24th of June 2019 at Zambia National Node office (Fig. 2).

Figure 2. InTeCRes Project Team after the Inception Meeting

Three key pieces of equipment - a drone complete with sensors and image processing software; an automatic weather station; and soil sensing equipment are expected to be procured by 20th August 2019. The weather station will be installed and managed by ZMD. The site at which the weather station will be installed has already been selected (Fig. 3).

Figure 3. InTeCRes Project Team during the AWS site selection at AKTC

The second phase will comprise of the following three work packages:

i. WP1: Installation of the weather station, data dissemination and climate assessment.
ii. WP2: Soil scanning and soil-chemical assessment for fertiliser optimisation.
iii. WP3: Airborne crop monitoring

The weather station will be installed, and data will be made available to AKTC in real-time and monthly assessments of weather conditions will be provided. The data will further be used to assess and document soil, water and microclimatic conditions during days of farm activities. All activities will be demonstrated to AKTC and GART staff members as well as farmers who will be trained in weather monitoring. ZMD will receive training in data analysis and assessments whilst ZARI will receive training in soil moisture monitoring. The station will be embedded in both the SASSCAL WeatherNet, a regional network of about 160 automatic weather stations, and the national observation network operated by ZMD. Weather information will be disseminated to farmers and awareness will be raised amongst farmers to strengthen their access to weather information.

Soil scanning technology will be introduced to AKTC and GART as well as farmers from the region, to demonstrate its potential for improving fertiliser applications. The work package to build the capacity in soil fertility management and demonstrate field scale characterisation under both rainfed and irrigated growing conditions will include training and demonstration on use of soil scanning equipment by Stellenbosch University. The soil analysis before the field demonstration will be collaboratively done by AKTC and ZARI.

In the Third Phase, after the selection of the best drone technology suitable for agricultural monitoring and management by ZASTI, with support from NRSC, ZASTI will provide training to technical staff from NRSC, ZARI, GART, AKTC and selected farmers in flying of drones and acquisition of data. The acquired data and demonstration of data utilisation on farm will be done by the National Remote Sensing Centre. With consideration of the best utilisation plan, the equipment will be handed over to respective institutions at the end of the project.