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Training needs assessment and proposed capacity development programme for agro-ecological zoning applications

The Department of Agricultural Land Management, Ministry of Agriculture and Forestry

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Abstract

Enhancing the skills of the technical staff belonging to the Department of Agricultural Land Management (DALaM) in Lao PDR requires Land Resource Information Management Systems (LRIMS) implementation. As such, the Training Needs Assessment (TNA) project is the first step towards achieving this target. The aim of the TNA is to develop and consequently transfer knowledge and skills of basic and advanced GIS training packages and relevant activities that will generate the technical capacities required to support the requirements of the SAMIS project; concomitantly, this will ensure that DALaM staff can effectively run and maintain the LRIMS. This document describes the conditions for the training assessment, not only for implementation of the LRIMS but also for developing the capacity of DALaM staff. DALaM staff need to develop expertise in terms of remote sensing, GIS technologies and any other relevant aspects of the SAMIS project. In particular, the technical staff of the DALaM GIS unit are responsible for this mission. This document is a roadmap for the SAMIS project and DALaM's strategic plan to develop staff capacity in a systematic way for the future.

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Abbreviations and acronyms

AEZ	agro-ecological zoning
ALUPC	Agricultural Land Use Planning Centre
CAS	Center for Agricultural Statistics
CBDS	Geo-Spatial Information Systems MAF Branch
DALaM	Department of Agricultural Land Management
DCCM	Department of Climate Change Management
DMH	Department of Meteorology and Hydrology
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GIS	geographic information system
IT	information technology
LCCS	Land Cover Classification System
LRIMS	Land Resources Information Management System
LUT	Land Utilization Type
MAF	Ministry of Agriculture and Forestry
MoNRE	Ministry of Natural Resources and Environment
NAEZ	National Agro-Ecological Zoning
NAFRI	National Agriculture and Forestry Research Institute
RS	remote sensing
SAMIS	Strengthening Agro-climatic Monitoring and Information Systems
SAR	Agriculture Production Systems at Risk
SAVA	Socio-Agricultural Vulnerability Analysis
TNA	Training Needs Assessment

1 INTRODUCTION

The Training Needs Assessment (TNA) is a major activity of the first year of Component 2 under the Strengthening Agro-Climatic Monitoring and Information Systems (SAMIS) project. It aims at developing technical knowledge and skills in remote sensing (RS) and geographic information system (GIS) technologies as well as database management, information technology (IT) capacities, Land Resource Information Management Systems (LRMIS), agro-ecological zoning (AEZ), Socio-Agricultural and Vulnerability Analysis (SAVA) and agricultural production Systems at Risk (SAR) for Department of Agricultural Land Management (DALaM) staff, especially the GIS unit. This project will support the DALaM staff responsible for implementing Component 2 and help them to carry out and maintain this system in the future.

1.1 Background of the SAMIS project

The SAMIS project is funded through the Global Environment Facility (GEF) in partnership and with co-funding from governments, partner programmes and donors at country and regional levels. The project is executed by the Food and Agriculture Organization of the United Nations (FAO). The goal is to enhance national- and provincial-level monitoring, analysis, communication and use of agrometeorological data and information for decision-making in relation to agriculture and food security, and to improve monitoring and analysis of agricultural production systems by strengthening LRMIS and AEZ to support agricultural policies and climate change adaptation. This project will improve adaptation to climate change and food security in Lao PDR. It has the following three components:

1. Agroclimate monitoring, analysis and advisory systems;
2. LRMIS and National Agro-Ecological Zoning (NAEZ); and
3. Knowledge management and dissemination.

1.2 Goal and objectives

The overall goal of this project is to develop capacity in the GIS unit and relevant partners (if required) to support the requirements of the SAMIS project, especially in Component 2 (LRMIS and NAEZ). The specific objectives are:

1. To develop and transfer knowledge and skills on basic and advanced GIS packages, IT capacities and relevant activities to support the requirements of the SAMIS project (LRIMS, NAEZ, SAVA, land cover) among staff from DALaM, especially for the GIS unit.
2. To ensure continuous use of introduced tools and methods among DALaM staff for sustainable and effective running and maintenance of the LRMIS.

2 APPROACH TO THE TRAINING NEEDS ASSESSMENT

The SAMIS project was initiated in the middle of 2017 and the subsequent Letter of Agreement was signed between FAO and DALaM on 5 April 2018 for the provision of support to the LRIMS of Component 2. Conceptually, the project began when an overview of the SAMIS project, Component 2 activities, was presented by Monica Petri, Project Coordinator, FAO in Laos on 28 July 2017. In addition, Gianluca Franceschini GIS/RS Technical Coordinator, Geo-Spatial Information Systems Branch (CBDS) from FAO headquarters in Rome, Italy travelled to Lao PDR to explain the details of Component 2 activities to DALaM's technical team at a training course conducted on 8 and 9 September 2017 at DALaM. The training covered the following topics:

- An integrated system for LRIMS, NAEZ and SAVA;
- From global to national AEZ;
- Introduction to metadata and reporting metadata;
- LRIMS modules;
- Data requirements; and
- Land cover mapping.

Later, Ece Aksoy (CBDS) conducted a training course from 1 to 8 May 2018 at DALaM's GIS unit to initiate the following technical capacity development activities:

- Data preparation;
- Projection systems and technical advice on best spatial projection for harmonizing LRIMS data;
- Theoretical training on metadata standards;
- Theoretical baseline AEZ study and sharing of best global practices on AEZ establishment;
- An analytical exercise using a Pakistan case study (crop suitability maps, agroclimatic/AEZ and agro-economic zoning); and
- Land utilization type (LUT) modules in LRIMS and AEZ.

The present TNA was developed in line with the consultants' meeting on LRIMS and AEZ at DALaM on 11 June 2018 and discussion among GIS staff on 16 August 2018. It targets capacity development of DALaM staff, especially GIS staff, to support the preparation and implementation of the LRIMS and other tasks under DALaM's responsibility for addressing Component 2 of the SAMIS project.

This TNA determines the training needs for Component 2 pertaining to DALaM staff (section 3.2) and the procedure for implementing the training process. The TNA is divided into in-country and overseas training needs to ensure that DALaM staff benefit from the project training process effectively.

3 RESULTS AND DISCUSSION

3.1 STRATEGIC WEAKNESSES OF THE GIS UNIT IN THE CONTEXT OF SAMIS REQUIREMENTS

Suboptimal understanding of GIS use among government staff working in the agriculture: DALaM has agreed to take the lead in data storage and sharing at the Ministry of Agriculture and Forestry (MAF) level.

However, this can only be accomplished if DALaM staff have at least basic understanding of GIS. This also includes staff at the National Agriculture and Forestry Research Institute (NAFRI), Center for Agricultural Statistics (CAS), Department of Meteorology and Hydrology (DMH), Department of Climate Change Management (DCCM), the E-government Centre and among provincial authorities (MAF and the Ministry of Natural Resources and Environment [MoNRE]).

The GIS unit has no leadership role: For the past few years the GIS unit has mostly provided a service role for catering to government or project requests. Instead, the GIS unit should have a recognized leadership role in the MAF and at the national level, but this is not the case. Consequently, staff self-esteem has been affected adversely. The role of the GIS unit can be strengthened via training on innovative technologies.

Suboptimal knowledge of advanced GIS tools: As DALaM was established in 2012, it is a young organization compared to the departments or institutes under the MAF. DALaM's mandate is to undertake: 1) soil surveys and agricultural land-use planning; 2) maintenance, improvement, demonstration and adoption of appropriate technology; and 3) agricultural land management. Under the Agricultural Land Use Planning Center (ALUPC), DALaM has established a GIS unit with varying degrees of technical knowledge and skills in geospatial sciences. However, currently, DALaM still lacks GIS expertise in specific capacities such as modelling, GIS database management, programming and so forth. Therefore, this TNA will

help the GIS unit to acquire further expertise in GIS at different levels, thus not only supporting the Component 2 mission, but also government activities. This will assist with monitoring of land-use/land-cover changes in terms of agricultural land management, land suitability evaluation or modelling, disaster analysis and other activities.

Suboptimal English language capacity: One of the GIS unit's main constraints is weak English language capacity in the contexts of daily working routines, reading software or manuals and communication with international experts. This undermines staff confidence and does not inspire our colleagues to work with the unit; it also inhibits information searching and accessing manuals or packages from Web sites for new information on geospatial science. In addition, suboptimal English language skills hinder opportunities for independent study. Improving English language skills will help to improve course comprehension during the period of this project.

Suboptimal knowledge of innovative GIS tools: The team at DALaM is not accustomed to working with innovative technologies and accessing the latest versions of software and hardware. This is because the GIS unit has had recurrent problems with infrastructure, not only with regard to building quality and provision of PCs for staff, but also poor internet connections. In a world that is becoming more connected daily, the staff cannot keep pace with innovation developments without reliable Internet access. Training on innovative technologies will allow them to consolidate these skills by and after the end of the project, for example in the map-making process, which can be concluded in one day rather than the months it took in the past. However, this is contingent on the provision of fast and dependable internet access.

Suboptimal policy, data management and data-sharing capacity: Data-sharing cooperation by all parties concerned in the context of natural resource information production is extremely limited. There is a need to raise awareness about the importance of sharing information on planning and decision-making by all relevant parties beyond the DALaM team per se, or the data produced by the project will not be used. In addition, by being able to focus on relevant planning on information use for policy-making the DALaM team will become a key unit at the national level.

Lack of knowledge about standard GIS methodologies: DALaM has been responsible for creating agricultural maps over the last few years. The general capacities for satellite image interpretation are available. However, there has not been any training about standardized procedures. The use of globally recognized processes is key for positive future use of the GIS capacities that will be developed by the project.

Suboptimal knowledge of Web tools and application (app) management: Via SAMIS, the DALaM GIS unit has accepted the challenge of hosting multiple data inputs from across sectors. Selected staff at DALaM will need to develop advanced capacity for server, web and app management in order to be able to maintain the LRIMS beyond the life of the project.

3.2 NECESSARY CONDITIONS

Table 1 presents the necessary conditions for addressing the weaknesses cited.

Table 1 *Necessary conditions to mitigate DALaM weaknesses*

Identified weaknesses	Solutions
Suboptimal understanding of GIS use among government staff working in the agriculture sector	Other entities beyond DALaM need to be trained in GIS technology. Develop DALaM capacity to manage decision-making apps. The DMH should be included in this training process as it produces agrometeorology information without being able to deliver results at the map-making level.
The GIS unit has no leadership role	DALaM needs to become an authority on the subject and employ high-level GIS experts. DALaM needs to be a recognized training agent for training multiple teams in Lao PDR on behalf of the MAF.
Suboptimal knowledge of advanced GIS tools	DALaM needs to become an authority on GIS and employ high-level GIS experts. Advanced capacity needs to be propagated among the team. The entire team needs to be able to fulfil multiple tasks with an array of sophisticated GIS tools.
Suboptimal English language capacity	All DALaM staff should be able to read English. Also, they should be able to take part in basic discussions that are conducted in English.

Identified weaknesses	Solutions
Suboptimal knowledge of innovative GIS tools	In order to be a recognized authority at the national level, the GIS team needs to be educated in and ready to adopt innovative technologies. A reliable Internet connection beyond the life of the project is imperative for sustaining throughput. Understanding innovations is essential for GIS staff to continue to study independently.
Suboptimal policy, data management and data-sharing capacity	In order to guide planning and policy-making, the GIS unit staff need to be trained in relevant modelling exercises. Also, the staff need to be informed about the value of data sharing and be able to explain technically what this can generate. Finally, selected senior staff should be able to present (simply) complex model information at the policy level. This also includes understanding policy-makers' needs and requests.
Suboptimal knowledge of standard GIS methodologies	Standard methodology, such as land-cover mapping with the Land Cover Classification System (LCCS), which is globally recognized, must be understood by GIS unit technicians.
Suboptimal knowledge of Web tools and app management	Selected staff must have the capacity to maintain and update the LRIMS on an ongoing basis.

To ensure the training programme achieves its goal, it will be divided into two groups: Group 1 for basic GIS packages and Group 2 for intermediate and advanced GIS packages.

3.3 CAPACITY DEVELOPMENT TOOLS TO DELIVER REQUIRED PRODUCTS

3.3.1 General training for basic GIS information (Group 1)

This training targets the minimal knowledge on GIS. In this context, other entities beyond DALaM need to understand the general theory of GIS and tool application. This includes the capacity to manage a decision-making app by administrative staff and by senior decision-makers. The DMH is also part of this group as it produces agrometeorological information without being able to deliver results at the map-making level.

As such, DALaM needs to become an authority on the subject and employ high-level GIS experts. Moreover, DALaM needs to be a recognized training agent for training multiple teams in Lao PDR on behalf of the MAF.

Group 1 will comprise participants from NAFRI, CAS, DMH, DCCM, the E-government Centre and decentralized authorities (MAF and MoNRE). The training can be conducted in the Lao language by DALaM experts. Training needs are listed in Table 2.

Table 2 *Training needs for remote sensing and GIS technologies (basic module)*

Courses	Description	Trainees	Training entity (teachers or professors)	When
Working with ArcGIS	• Display data • Querying the database • Working with the selection tools • Working with spatial data • Working with tables • Editing attribute data • Working with georeferenced data • Presenting data	DMH staff of Component 1 (12 people)	DALaM	2019

Courses	Description	Trainees	Training entity (teachers or professors)	When
Working with SAMIS	• What is LRIMS? • What are future scenarios? • What is AEZ? • What is SAVA? • What is SAR? • How to use the SAMIS app	NAFRI, CAS, DMH, DCCM, the E-government Centre and local authorities (MAF and MoNRE).	DALaM	2020
Working with the SAMIS app	Use of the SAMIS app and future scenarios	Senior decision-makers in MAF, MoNRE, parliamentarians, politicians	DALaM	2020/2021

3.3.2 Intermediate and advanced training on GIS (Group 2)

Group 2 comprises members of the DALaM GIS unit, but some members of the DMH team could be included for specific training required by SAMIS.

DALaM staff are not acquainted with advanced GIS tools so by the end of the SAMIS project, DALaM needs to be an authority on this technology and have high-level GIS experts. Also, advanced capacity needs to be diffused among the team so it can fulfill multiple tasks with diverse GIS tools.

Low English language capacity is a serious constraint among the team. All DALaM staff need to be able to read English. Also, they should be able to take part in basic discussions that are conducted in English and participate actively during missions overseas.

Owing to inexperience with innovative GIS tools, DALaM staff are unable to articulate issues with international experts. In order to be a recognized authority at the national level, the GIS team needs to be ready to adopt innovative technologies. A reliable internet connection beyond the life of the project is imperative for sustaining throughput. Understanding innovations is essential for GIS staff to continue to study independently.

All DALaM staff need to appreciate that GIS methodology is important for policy-making, data management and data-sharing. In order to be able to guide planning and policy-making, the GIS staff need to understand modelling procedures. Also, the staff need to be informed about the value of data sharing and be able to explain technically what this can generate. Currently, DALaM GIS staff cannot sustain a conversation about the advantages of free data access. Finally, selected senior staff need to have the capacity to present (simply) complex model information to policy-makers and politicians. This also includes understanding policy-makers' needs and requests and providing training for senior DALaM staff.

Standard methodology, such as land-cover mapping with the LCCS, which is globally recognized, must be understood by GIS unit technicians. Finally, selected staff need to be able to maintain and update the LRIMS on an ongoing basis.

Tables 3 and 4 show the training needs for remote sensing and GIS technologies in the above-mentioned contexts.

Table 3 *Training needs for remote sensing and GIS technologies (intermediate module)*

Courses	ArcGIS training	Trainees	Training entity (teachers or professors)	When
Spatial analysis	• Geoprocessing • ArcGIS spatial analysis	DALaM and DMH	National or international consultant or firm	Middle of 2019
Geodatabase	• Geodatabase basics • Building geodatabase schema • Geodatabase behaviour • Relationship classes • Topology rules	DALaM and DMH	National or international consultant or firm	Middle of 2019
ArcGIS extensions	• Network basics • Building networks • Connectivity rules • Network analysis • 3-D analysis	DALaM and DMH	National or international consultant or firm	Middle of 2019
English training	• Basic level	DALaM (13 staff)	English school	2018
English training	• Intermediate level	DALaM (13 staff)	English school	2019

Table 4 *Training needs for remote sensing and GIS technologies (advanced module)*

Courses	Topics	Trainees	Training entity (teachers or professors)	When
Agricultural land monitoring	• Calculating annual crop extent by using remote sensing and GIS techniques	Selected DALaM staff		End of 2019, after the production of the first land-cover map
Land suitability modelling	• AEZ using ArcGIS	DALaM (2 modellers and 4 staff members for one year)	FAO consultant	Multiple training over the project
Assessment of areas sensitive to landslide risk	• Geomorphology studies plus flooding impact	DALaM	To be discussed Natural Disaster Research Center – Indonesia	To be discussed
Assessment of flooding and drought vulnerability	• Hydrology studies for early warning systems and risk management	DALaM	To be defined	To be discussed
Assessment of the impacts of climate change on agricultural productivity	• AEZ using ArcGIS	DALaM	FAO consultant	Over the project

Courses	Topics	Trainees	Training entity (teachers or professors)	When
Land-cover mapping	• Image classification interpretation accuracy assessment	DALaM (4 staff members for one year)	FAO consultant	Theory and practice in 2018 Finalization in 2019
Geo-informatics technology for estimating forestry carbon stocks	• To be discussed	DALaM	DOF/MAF	2019/2020
Downloading free satellite images from web sites	• To be discussed	DALaM	National or international consultant or firm	2019/2020
Creating and managing the metadata	• Metadata theory • Use in ArcGIS	DALaM	FAO consultant National or international consultant or firm	2019/2020
Use of servers and the LRIMS	• Application structure and components • Use of the server or data clouds • Inserting data in LRMIS (tables, photos, videos, images or GRID with legend) • How to insert metadata in the LRMIS • LRMIS maintenance	DALaM	PHOENIX company	2018/2019

Courses	Topics	Trainees	Training entity (teachers or professors)	When
Integrated agricultural landscape-level planning and management	• Land management at multiple scales, multiple functions and multiple stakeholder management		To be defined	2020/2021
Policy, data management and data-sharing capacity	• Data management for policy-makers, data communication, data representation, information-sharing theory, open source data access	DALaM	To be defined	2020
Socioagricultural assessments		DALaM + other entities officially responsible	International entity	2019/2020
Long-term hands-on training by an international expert in AEZ	The presence of an international expert would ensure continued use of English and working at an advanced level		To be defined	2018–2020

3.3.3 Advanced overseas training for enhancing GIS units

Ideally, members of the GIS unit could study within teams and in other countries with different technical focus. The selection of training participants will be made over the time. However, there needs to be a clear focus on English-speaking countries or in countries where English as a second language is well developed.

Table 5 *Overseas training*

Targets	Number of trainees	Location/trainers
AEZ specialized entity	2	To be defined
Group field visit	6	In a country where land-use planning employs AEZ
Short training in advanced GIS crop modelling	"-"	To be defined
Master programmes	"-"	The project can interact with other donors willing to support specific training abroad

4 CONCLUSION

This project comprises a multiple training needs assessment for enhancing the capacity of DALaM staff and other partners relevant to the SAMIS project. This task is a necessary and important undertaking for capacity development. In order to achieve our goals, the capacity development exercise is an essential task that we need to combine with the capacity development of technical staff simultaneously to ensure that this strategy will support DALaM planned targets.

GIS is an important tool to organize, manage and distribute geographic information in many fields. The identification of topics for capacity development is the first step towards achieving our ultimate goals. However, there are multiple dynamics to consider as well as the implementation of Component 2 (LRIMS, NAEZ, SAVA) and other tasks. As such, DALaM staff members have to study industriously at training courses and with international experts; the trainings could be held at DALaM or overseas and will also have the benefits of boosting staff confidence and generating good results. Therefore, the preparation of tools for capacity development is an important process that should take into account the potential of the human resources who will apply them. Essentially, staff lack technical skills in remote sensing and GIS technologies and this is compounded by low capacity to communicate in English. Thus, DALaM is taking this opportunity to address the issues mentioned in order to become a national leader in GIS technology use after the end of the SAMIS project. The main capacity development tools are:

1. Continuing English language training for staff to boost their confidence in speaking, reading, report writing and interacting with international experts.
2. Training on LRIMS, AEZ, SAVA and GIS.
3. Providing guidance through general and specific manuals, handouts, leaflets and posters on technical aspects related to the SAMIS project.
4. Developing programming, modelling and management of geographic database capacity.

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