QUICK SCAN UGANDA

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INTRODUCTION

Within the framework of food security policy, the Ministry of Foreign Affairs of The Netherlands is implementing the programme 'Geodata for Agriculture and Water (G4AW) Facility'. The G4AW Facility aims to increase the agricultural sector output in G4AW partner countries. This is achieved by providing food producers with relevant information, advice and/or (financial) products through operational information chains using satellite data.

In the summer of 2014, a new call for tenders will be opened. In this call, the Ministry of Foreign Affairs of The Netherlands calls for good quality project proposals from viable partnerships.

Goal of the Quick Scan

The Quick Scan serves as input for preparing the country visit and the G4AW information and matchmaking workshop in Uganda. In the workshop the local context, constraints and challenges in agriculture will be discussed. Furthermore, the background and details of the G4AW Facility is provided and the development of partnerships is promoted.

This Quick Scan provides an up-to-date information assessment on agricultural and associated activities. It provides information from different perspectives and in a wider context (climate, water management). Additional, stakeholders from different types of organizations are identified and reported. The document is initially supporting the country visits and workshop, but the provided information can also contribute to the development of partnerships that are intending to bring forward a proposal in the second call of the G4AW Facility.

1 ASSESSMENT OF UGANDA WITH A FOCUS ON AGRICULTURAL ISSUES

Pressure on the agro-eco production systems caused by increased (overpopulation), climate changes and extreme weather conditions lead to a lack of natural local resilience. In this section, the most important challenges in the agro-eco systems in Uganda are given as well as an overview of (governmental) efforts to address the food security situation.

1.1 MAIN CHALLENGES IN UGANDA'S AGRO-ECO SYSTEMS

Uganda lies within East Africa (ACTWatch, 2012) and is landlocked covering a total area of 241,055km^2 of which 18% is open inland waters and wetlands (UNDP, 2014). According to UNFPA's State of Uganda Report, 2012, Uganda's population is estimated at 34.5 million people of, 85% of which live in rural areas (UBOS, 2012). Uganda's population growth stands at 3.2% which is one of the highest in the world (UNDP, 2014 and UNFPA, 2012). The extremely high population growth, coupled with economic development activities are placing a heavy burden on the environment and natural resource base, including water resources[1]. Uganda has over 15 ethnic groups and English is the official language.

Political, climate change & climatological zones

The country is currently governed under a multiparty system following a national referendum of July 2005, which opened the door for political parties to contest for leadership. Since then, the country has held two elections under the multiparty system (2006 and 2011) won by the incumbent President Yoweri K. Museveni, who first came to power in 1986.

Uganda has an equatorial climate with small regional variations in annual temperature and humidity. Precipitation varies from 750 mm/yr in the semi-arid areas to 1 500 mm/yr in the high rainfall areas. There are two distinct seasons; the wet and dry. The mean annual temperature over most of the country is in the range of 18 °C to 35 °C, while the corresponding minimum range is 8° C to 23 °C. Relative humidity is high, ranging between 70 percent and 100 percent and the mean monthly evaporation rates are between 125 and 200 mm[2].

Climate change models for Uganda predict a likely increase temperatures and rainfall variability. These changes are predicted to have a high impact on Agricultural production and food security[3]. In the recent years, Uganda's climate has gone through dramatic climate changes ranging from floods and landslides to prolonged droughts and change in the general pattern of the dry and wet seasons[4]. However, climate change has not received as much attention as it should at policy and implementation levels and yet climate change has significant impact especially on rural populations that are ill-prepared to cope with the impacts on their livelihoods[5].

Uganda has four main agro-ecological zones[6] namely;

- High altitude zone in Kigezi, Sebel, parts of Ankole, west Nile, Toro, Mbale; temperate-zone crops are common;
- Pastoral dry to semi-arid range lands in east Ankole, west Masaka, Karamoja; These have pastoral systems;
- Northern and eastern short grasslands zone; short grasslands and cotton-finger millet mixed farming systems;
- Southern and western tall grasslands zone; tall-grass areas, perennial and annual crops in mixed farming systems.

[1] Source: Ministry of Water and Environment, 2009
[2] Source: FAO AQUASTAT, 2006
[3] Source: NDP, 2011
[4] Source: IFAD, 2013
[5] Source: National Agriculture Policy, 2011
[6] Source: FAO AQUASTAT, 2006

Land use, economic activity and its development

At an average above 6.0 percent per year over the past two decades, Uganda's growth rate was impressive by all standards. In parallel, poverty declined significantly (56.4% in 1993 to 24.5 in 2010) not only in urban areas, but also to some extent within the rural areas. Accordingly, Uganda has already met the first Millennium Development Goal (MDG) of halving poverty by 2015 (World Bank report, 2012). Uganda's per capita income was estimated at $490 by 2009 (World Bank Report, 2012).

Despite the impressive economic performance, Uganda is still facing some challenges that have undermined the faster economic growth and social transformation for example the agricultural sector has not achieved significant productivity growth.

Agriculture is the mainstay of the Ugandan economy, employing 65.65 of the population aged 10 year above in 2010, accounted for 22.5% of the total GDP and 46% of the total exports in 2010 (National Agriculture Policy, 2011). The agricultural sector also provides 73% of total employment, and the bulk of the raw materials used by the mainly agricultural-based industrial sector[7].

The country is facing severe environmental degradation including; loss of biodiversity, deforestation, encroachment on wetlands, soil erosion and declining land productivity, pollution of land, water and air resources among others. A recent report released by the United Nations indicated that the sharp rise in the loss of species and ecosystems is perceived by banks and insurance companies to be a greater economic risk than international terrorism. The declines in biodiversity are estimated to cause a severe US$10bn-$50bn impact on business (UNEP, 2010).

Main issues of attention on food and water

In 2009, only 65% of the rural areas had access to safe water in form of; protected water springs, piped water supplies, shallow wells, boreholes and rain water harvesting[8]. Agricultural productivity[9] in Uganda is increasingly facing challenges because agriculture is highly dependent on rainfall. Seasonal variability of rainfall makes it difficult to ensure consistence in supply of agricultural products. Despite the inconsistent water supply for production, only 3.6% of land is under irrigation of the total national potential of 400,000 hectares. Climate change is also thought to impact negatively on the socio-economic resources or water and contributes to over 70% of natural disasters that affect Uganda.

The following are highlighted as some of the constraints to the performance of water for production

- Lack of a framework for operation and maintenance of water for production
- High operation and maintenance costs for irrigation which are not affordable by the majority of the farmers.
- Limited large scale commercial production
- Limited investment financing from both private and public sectors
- Lack of collaborative and coordination mechanisms in planning infrastructure development
- Weak capacity for provision of critical expansion services for crop production, irrigation techniques and practices as well as marketing
- Inadequate planning and coordination between water supply and water usage.
- Lack of a national irrigation strategy

1.2 GOVERNMENTAL EFFORTS AND POLICY ON FOOD SECURITY[10]

[7] Source: World Bank Data, 2010
[8] Source: MWE, 2009
[9] Source: NDP, 2011
[10] Source: National Agriculture Policy, December 2011

The National Agriculture policy, 2011, mandates the state among other things to provide guidance to all actors in the agricultural sector to make investments that will increase agricultural incomes, reduce poverty, improve household food and nutrition security, create employment and stimulate overall economic growth. The range of investments cut across the entire commodity value. Investments to support the private sector aim to improve access to improved agricultural technologies, improved farming practices, appropriate value addition technologies, improved financial products, and linkage to markets by providing better infrastructure, especially in rural areas.

Ministry of Agriculture Animal Industry and Fisheries is responsible for managing and coordinating agricultural policies and interventions. Agriculture in Uganda still faces several challenges along the commodity value chain. These include: low production and productivity, low value addition to agricultural produce, lack of sustainable access to markets, failure to maintain a consistent policy regime and functional institutions in the sector, and insufficient agricultural manpower and skills. High population growth, climate change and oil discovery are seen as emerging challenges to the agriculture sector. Low production and productivity are mainly attributed to weather variations[11].

The food and nutrition of Uganda is not satisfactory, in 2005 the caloric intake per person per day stood at 1971. Although the overall trend is on a positive trend is it still below the recommended caloric intake of 2300.

Water National policy/programmes & sector

Uganda's fresh water sources comprise of rivers, lakes, wetlands, ground water and rainfall. The total renewable fresh water resources are estimated at 66km^3/year. The major uses of water for production in the country include; irrigation, fish rearing, livestock farming, industrial processing and wild life conservation (NDP, 2010).

The Ministry of Water and Environment is responsible for undertaking off- farm water development. The availability of bulk water for production is currently inadequate and the Ministry of water is mandated to increase investment in off farm bulk water development[12].

There is no local infrastructure of water boards implemented, which causes migration of agricultural activity to land in the vicinity of rivers and related aquifer systems. Agriculture activity is less when moving further from the river due to a lack of surface and ground water. Most agriculture is rain fed but in these areas more irrigation is applied. Efficient and optimum use of aquifer systems in the country is often not well-managed and used for agriculture as it requires high cost pumping materials and maintenance.

[11] Source: NAP, 2011
[12] Source: NAP, 2011

2 ASSESSMENT OF STATUS AND PROBLEMS OF INFORMATION SUPPLY IN THE AGRICULTURAL SECTOR

For food (and water) security programs, actual and accurate (spatial) information is crucial for land and crop production systems to provide quick indicators on the context (e.g. water availability), status (e.g. biomass, crop type, acreage, etc.) and trends (within and in between seasons, years) of local farming practices/performance. In this section, the main challenges in information supply in Uganda are summarized as well as the institutional capacity to support viable information services.

2.1 MAIN CHALLENGES IN INFORMATION SUPPLY ENCOUNTERED IN AGRICULTURAL ACTIVITIES

Uganda Communication Commission is the regulating body of the communications sector in Uganda. It is further mandated to regulate interconnection and access systems between operators and users of telecommunication services[13].

The ICT sector has been liberalized and many private players are now active in the sector. The ICT sector is comprised of the following subsectors; telecommunications, postal services, broadcasting infrastructure, information technology and library and information services.

Meteorology sector

While meteorology services are important in providing real time, short term, seasonal and long term forecasts, for planning and management of agricultural production, these are in short supply in the country[14]. It is confirmed that there are no reliable predictions or early warning systems of the likely impacts of climate change in Uganda[15]. Currently, the short term prediction accuracy ranges between 40% and 50% while the long term is in the range of 70- 80%. Real time prediction is only limited to Entebbe for aviation purposes only. The accuracy is limited due to the poor condition of the instrumentation used for observation and these are not automated. In the country, only ground observations are being made through insufficiently. Apart from satellite observations, atmospheric observations are not being carried out. In addition, only 17% of the required instrumentation is available to capture weather and climate data and information. Of the 9 total types of meteorological stations required, only 6 are in place. Those missing include; upper air, radar and pilot balloon stations. This has limited the quality and quantity of meteorological information captured which has in turn affected the meteorological products available for socio-economic planning and management.

Mobile services

Mobile service voices are reported to have grown substantially over the past decade and mobile subscribers have also grown for example from 8.5 million subscribers by December 2008 compared to 276,000 in 2001. This implies that in one in every four people owns a mobile phone[16].

Mobile applications have been developed however, these are subscription based which poses a challenge to farmers due to related costs involved. Where the applications have been developed, content and information is still limited because these have to be updated regularly. The applications include the following services; SMS, web to phone[17].

Internet

[13] Source: Mulira, N et al. 2010
[14] Source: NDP, 2011
[15] Source: National Agriculture Policy, 2011.

[17] Source: Agri-ProFocus Market Information Symposium 2010.

Internet usage is still an emerging sector and access is limited by high access costs[18]. Despite Uganda being landlocked, it is linked to the rest of the world via the submarine cables. Satellite capacity is reported as being relatively expensive limiting access by the internet service providers[19]

2.2 Institutional capacity to support viable information services

As reported in the NDP, 2011, there are gaps in the collection of reliable and regular information due the use of instruments that are not adequate both in number and quantity. Despite the low capacity to collect and disseminate the right information, there is need for this information especially by due to climate change and changing weather patterns.

2.2.1 General information suppliers active in agriculture domain

Organisation	**Service**
FIT Uganda	Market Information
AgriNet Uganda Ltd	Market Information
Grameen Foundation	Applab
Ric-Net	
East African Grain Council	
Ensibuuko	Mobile & web technologies for farmers
KRC	
UNICEF- ICT	
IICD	
MTN	Telecomunication
AIRTEL	Telecomunication
orange	Telecomunication
UWASNET	
Simba Telecom	Telecomunication
Uganda Communication Commission	Comminication

Table 1: Overview of information suppliers in the agriculture domain

2.2.2 Specific agri-sector information supply and current mechanisms

Market information is the commonest form of information collected and disseminated in Uganda. This information is offered by private Non-Governmental Organisations (NGOs). These services generally involve the regular collection of commodity prices, verification, analysis and disseminated back to a range of clients. The dissemination of prices, market news, weathers alerts, pests and diseases outbreak is achieved through various media options such as radio, newspapers (new vision harvest money), internet (weekly reports on email), mobile phone voice and text and notice boards to farmers, traders within the central markets and farmer meetings. Some of the suppliers of market information include Fit Uganda ltd, Fit Uganda, Agrinet, Grameen foundation, Ric-Net and KRC[20]. Farmers also receive information through the extension services.

[18] Source: Telecommunications Policy, 2012
[19] Source: Mulira, N. 2010
[20] Source: FIT Uganda, 2013

The figure below shows the type of information that is disseminated to actors across the agricultural value chain.

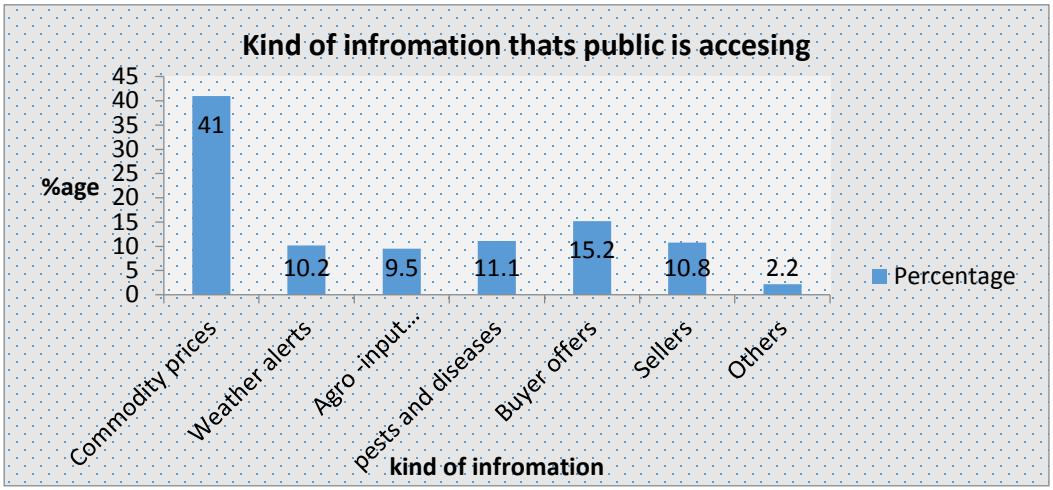

FIGURE 1: KIND OF INFORMATION RECEIVED FROM VARIOUS SOURCES OF DISSEMINATION[21]

Topography

Ministry of land, housing and Urban development, Department of surveys and mapping is responsible for establishment of survey and geodetic controls.

2.2.3 OTHER SECTORS (AND ROLE OF INFORMATION) IMPORTANT FOR THE AGRICULTURAL SECTOR

The telecommunications sector is dominated by UTL, MTN Uganda, Zain Uganda, Warid, Orange Uganda, i-Tel and Smile communications Uganda [22]. Services provided by these and several other companies include; fixed telephony, VoIP telephony, mobile telephony and internet access service. A full list of communication operators can be seen below.

Type of Licence	Provider Name
NTO	MTN (U) Limited Uganda Telecom Limited
PIP	Uganda Electricity Transmission Company Africa Fibrenet (U) Ltd
PIP, PSP (Voice & Data)	Smartel (U) Ltd Comium Data (U) Ltd i-Burst (u) Ltd
PSP (Capacity Resale)	Talk Telecom Solutions Limited Roke Investment International Limited Mo Telecom International Ltd Bandwidth and Cloud Services Group
PSP (Capacity Resale);PSP(Voice and Data)	Satellite Communications Networks Ltd

[21] Source: Source FIT Uganda Report, 2013

[22] Source: Mulira, 2010.

PSP (Voice and Data)	Fastcom Limited Maisha Networks Ltd Dam Solutions Ltd Mara Telecoms Ltd Kanodiko Systems Ltd Kampala Siti cable Limited Radio Communications Services Ltd Tangerine (Nomad Communications Ltd) International Telecom Ltd Fast Path Networks Maisha Networks (U) Ltd Janu Communiations Ltd Kit Tech (U) Ltd Bukasa Telecom International Ltd
PSP (Voice and Data);PIP	Kanyan Telecommunications (U) Ltd Augere (U) Ltd Smile Communications (U) Ltd One ... Solutions Ltd(NR Cyber Business Systems) Wimax (U) Ltd Datanet LLC Anupam Global Soft (U) Ltd TMP Uganda Ltd Afsat Communications (U) Limited Warid Telecom Uganda Infocom Orange Uganda Ltd
PSP and PIP	Latest Technology International Limited Foris Telecom Ltd Excellentcom (U) Ltd
PSP and PIP (Voice and Data)	Airtel (Celtel, Zain) Uganda
PSP(Voice and Data)	Multichoice Uganda Limited Link Wireless (U) Ltd
PSP(Voice and Data); PIP	Africa Online Sure Telecom i-Tel Limited

TABLE 2: LIST OF COMMUNICATION OPERATORS

Key

- PIP ==> Public Infrastructure Provider
- PSP ==> Public Service Provider
- NTO ==> National Telecommunications Operator

3 NEEDS ASSESSMENT OF IMPROVED ICT & INFORMATION SUPPLY IN THE AGRI SECTOR

In this section, an inventory of specific needs and problems in the information supply (and demand) in Uganda's Agri sector is provided. The most important local stakeholders represented in the identified problem domains are selected (short list). Furthermore, additional stakeholders in related domains need to be selected (e.g. water domain, nature, industry, etc.).

3.1 NEEDS ASSESSMENT WITH A FOCUS ON POTENTIAL USE OF SPATIALLY BASED INFORMATION SERVICES

Farmers indicate that there is a need for weather information as it is crucial for the timing of field management. Since weather patterns have been changing, it has become more difficult to determine the correct timing of management. The impact on food production in Uganda is evident as most agriculture is rain fed.

Constraint	***Potential user***	***Potential use of spatially based information services***
Absence of data and information; there is lack of regular and reliable agricultural statistics and information (weather, prices, buyers, quality speficifications and type of product. This is coupled with costly and infrequent data collection services and poor data analysis mechanisms	*Farmers*	*Provision of reliable and timely information;* *Weather predictions* *Reliable data on products Specifications eg.* *Locations of farms and farmers, quantities*
Inadequate meteorology services: Inadequacy in providing early warning information related to changes in rainfall patterns to farmers	*Farmers* *Agri- Firms* *Insurance companies*	*Availing reliable instruments for weather predictions.* *Increasing number of stations for weather data collection*
High risks and high costs of investment; There is limited lending to the agricultural sector due to high administration and management costs involved and perceived difficulty in managing the risks	*Finance institutes* *Insurance farms* *Farmers*	*Service to predict of weather patterns to predict level risk* *Create agricultural products based on reliable weather information*
Limited extension support services to farmers related to improving agricultural productivity Inadequate physical infrastructures such as transport (roads and railway), energy, water, and storage facilities	*Farmers*	*Availing infrastructure especially irrigation technologies to supply water* *Use of spatially based information for Precision use of resources such as water for efficient use.*

TABLE 3: POTENTIAL OPPORTUNITIES FOR INFORMATION SERVICES

3.2 PUBLIC AND PRIVATE PROBLEM STAKEHOLDERS AND INTERNATIONAL ORGANIZATIONS IN THE DOMAIN OF G4AW

Local NGO's and other relevant institutions such as local FAO, World Bank, IFAD offices.

Exemplary for the problems in Uganda are the issues discussed in regional workshops of the UNFFE (Uganda National Farmers Federation) in Uganda. For example the regional workshops in Nakasongola and Sironko[23].

- Empowering UNFFE to understand the link between agricultural development and climate change.
- Analyse the potential impacts of climate variability and climate change on the livelihoods of farmers in the pilot-districts Nakasongola and Sironko
- Identifying adaptation measures- difference between short term and middle long/long term taken into account.
- Empowering UNFFE to optimise their communication to members/farmers, taking into account that still a large part of the smallholders is illiterate. Optimise spin-off of demonstration farms / extension link farmers (farmer to farmer). Use network of District Farmers Organisations and UNFFE national, by presenting experiences in the framework of this project.

The workshops held on 20th and 22nd June 2012 in Nakasongola and Sironko respectively, were attended by the District Farmer Associations board members, Farmers, Extension Link Farmers and Local government representatives (NAADS district coordinator, Production officer, Forestry officers, Environment officers and district secretary for production).

Output (advise from the workshop (related to Nagasongola) to UNFFE and government):

- Have a component of weather insurance- climate risk insurance
- Should have a component of irrigation
- Agro forestry; should ensure accessibility to good agro forestry trees to farmers in the pilot districts
- Should have a water harvesting and soil conservation component at farm and house hold level
- On farm research should be part of the project
- Intensive information dissemination systems on adaptation and mitigation to farmer members.
- Demonstration farms should be emphasized
- Awareness and exchange programs
- Integrate indigenous knowledge in the project

3.3 ONGOING G4AW RELEVANT ACTIVITIES AND/OR PROJECTS IN UGANDA

REDD+ is setting up a project east of Lake Albert and remote sensing is an important aspect of this project. So far have used landsat imagery to calculate deforestation between 1995, 2005 and 2010. They have also mapped the land of some of the farmers they are working with, put in place a ground level forest monitoring system at tree level and developed forest cover maps at parish level in Hoima. The REDD+ project is also a national pilot to inform the government of Uganda on how to reduce their greenhouse gasses emissions. Ideally, the system and approaches implemented and tested by the project will be scaled up to national level[24].

MTN Uganda in partnership with Grameen Foundation and Google search, launched a suite of mobile phone applications which will provide instantly information previously unavailable to Uganda's poor and remote

[23] Contact person Peter Prins (NWP) p.prins@nwp.nl

[24] Contact person: Miguel - mleal@wcs.org

communities. The service combines text messaging, search technologies and databases of locally relevant information. It also provides weather forecasts, agricultural advice and health tips.
Ensibuuko; mobile and web technologies that has an innovative mobile solution for farmers to access information, finance. The focus is on group/cooperative saving. It includes; Mobile saving, dispersing loans, loan collection, and tracking[25].

Fit Uganda Ltd: AGMIS is an on-line platform that incorporates market information collected from different information providers. This platform is also used by field officers to carry out on spot data entry from wherever they are allowing you to access real time data the moment it is added[26].
AgriNet Uganda Ltd: Real time, customized agricultural market information on mobile phone, Information boards and e-mails[27].

Climate adaptive approaches to Food Security
The LTO North initiated project "Climate adaptive approaches to Food Security" aims to strengthen the role of the farmer organisation UNFFE in the national climate debate and at the same time reinforce agricultural practices by linking farmers and local knowledge networks.

Uganda with its economy rooted in agriculture acknowledged the importance of climate change and ratified the Climate Change Convention in 1993. The first national communication was finished 10 year ago, and the National Adaptation Programme for Action (NAPA) was submitted to the UNFCCC 5 years ago. Currently projects addressing the urgent and immediate needs identified in the NAPA are in the implementation phase.

Climate change has too long been seen as an environmental issue ignoring the implications for development. Through increasing temperatures, changing rainfall patterns, extreme events climate change is expected to exacerbate immediate development stresses. Clearly climate change has to be seen in the context of development and cannot be seen or addressed in isolation. Not only will the impacts depend on local condition also the adaptation options will vary per region or household.

Development initiatives and programs are most likely to be less effective when climate change is not taken into account. Effective strategies will need to look for potential synergies and identify trade-offs between development and climate change. These strategies will need to reduce vulnerability and increase resilience.

For agriculture adapting to environmental, social and market changes comes naturally, it is an intrinsic part of risk management at farm level. For effective and efficient management research can help inform farmers, agro-business, and policy makers about risks and implications of management (including adaptation measures) over different time scales, moving away from a reactive to a more pro-active approach.

Adaptation to climate change as part of the development agenda is advocated by the UNFCCC and is framed via the integration or mainstreaming of climate concerns in existing and new plans and policies.

Although implementation of adaptation activities is local and agriculture, a climate sensitive sector, is given a high priority for both development and climate change in Uganda the farmers organisation UNFFE has not been linked to the national discussions on climate change. This is perhaps partly related to the invisibility of UNFFE at the national

[25] Source: www.ensibuuko.com
[26] Source: www.fituganda.com
[27] Source: www.agrinetug.net

level and partly to the level at which the climate change discussions in Uganda take place and the difficulty to formulate and implement on the ground activities in relation to agriculture and climate change.

The underlying idea of the project is to strengthen the role of the Farmers Organisation UNFFE in the national climate change debates and connect UNFFE to adaptation activities. This will be done via two complimentary lines: 1. linking UNFFE to national policies and networks and 2. Use the extensive network of UNFFE to disseminate and implement adaptation measures at farm level.

3.4 REFERENCES TO PUBLIC DOMAIN PUBLICATIONS

- AQUASTAT FAO, 2006: http://www.fao.org/nr/water/aquastat/countries_regions/uganda/index.stm

- Ministry of Water and Environment. 2013. Sector performance Report: http://www.mwe.go.ug/index.php?option=com_docman&task=doc_download&gid=623&Itemid=223

- National Development Plan 2010/2011- 2014/2015: http://www.usaid.gov/sites/default/files/documents/1860/National_Development_Plan_2010_11-2014_15.pdf

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- IFAD. 2013. Republic of Uganda country strategic opportunities programme: http://operations.ifad.org/documents/654016/ccf9e82a-d73e-45c6-ad73-942d0fff9898

4 INVENTORY OF POTENTIAL (CHAIN) SOLUTIONS DIRECTIONS USING GEO-ICT IN LOCAL AGRICULTURE ISSUES

G4AW General: Due to the enormous population pressure, water and land resources require proper management in order to provide a sustainable provision of local food and autonomy. IN general remote sensing derived information can help observing pressure on the land by monitoring and mapping land use and production and with that support land evaluation and related management and measures.

G4AW Climate Change: Due to the increase of population. Mismanagement of the land and the climate change in the past decades, additional negative impacts can be noticed, like increase of erosion, droughts, floods, and the change in patterns of these disastrous effects on agriculture. Remote sensing methods can give more insight in risks by multi-temporal studies of these phenomena. In this sense tools can be provides to local and central governments to identify areas with high and low vulnerability to disasters aforementioned.

G4AW: Institutional capacity: There is a need in increase of actual information in general, which is caused by a lack of local data collection mechanisms. Hybrid combinations of local measurement stations measuring agri/water- and weather conditions with large scale and multi-temporal remote sensing techniques at well selected representative locations (agro-climate-ecological zones) result in a relative low-cost structural information system

Addressing the main problems/constraints encountered in Agricultural activities and also in its value chains on national, regional and local level

- **Absence of data and information**; there is lack of regular and reliable agricultural statistics and information (weather, prices, buyers, quality specifications and type of product. This is coupled with costly and infrequent data collection services and poor data analysis mechanisms

- G4AW: Beside afore-mentioned data acquisition strategies with remote sensing and local measurement, capacity for spatial data management, analysis and information based decision making (governance), needs to be developed. Only in this sense newly developed monitoring systems can be embedded in the appropriate setting for use and operational application in agriculture and fill the gaps in current data gathering.

- **Inadequate meteorology services**: Inadequacy in providing early warning information related to changes in rainfall patterns to farmers

- G4AW: on different spatial scales remote sensing based data-collection on agro-meteorogical parameters (rainfall, evapotranspiration, moisture, etc.) help in identification of recurring hotspots or areas with frequent problems of drought or excess of water. Using a smart combination of ground data collection and remote sensing based measurements on (sub) basin level one can get hold of the local water balance mechanisms. This integrated manner of management in the region, or so-called water-accounting, helps in abridging dry periods by storing and managing water in groundwater of aquifer systems. The water-accounting mechanism and management of water in the region needs to be updated with frequent and recent measurements (either from remote sensing or ground data collection stations)

- High risks and high costs of investment; There is limited lending to the agricultural sector due to high administration and management costs involved and perceived difficulty in managing the risks

- G4AW: See earlier remarks on capacity and improvement of governance and analysis. Besides that new spatial information strategies can help insurance industry in assessing (remote sensing based indicator) risk maps and with that premium differentiation

- Limited extension support services to farmers related to improving agricultural productivity

- G4AW: See earlier remarks om hybrid data collection and remote sensing (Area Frame sampling[28] mechanism is a well-known hybrid way of cost-effective data collection in agriculture)
    - Inadequate physical infrastructures such as transport (roads and railway), energy, water, and storage facilities
- G4AW: spatial information of agricrops-statistics and routing is the base for optimisation of transport, storage and logistics. It could help also in redesigning the road infrastructure and determine priorities of restoring existing road and storage infrastructure.

4.1 Base solution directions in target Uganda tailored to local agricultural practices

4.1.1 Actual agri-spatial information services

See table at section 3.1

4.1.2 Farm insurance and risk prevention strategies

Special to mention is the need for solution in the Girungo Area at Rift valley for flood predictions and early warning for flooding in general. Another important crop is the coffee culture in the highlands, which are capital intensive and also in need for risk based strategies to prevent crop damage due to poor/irregular distribution/availability of water

4.2 Differentiation of spatial solutions tailored to agricultural practices/sector in Uganda

G4AW agro-ecological zones:

- High altitude zone in Kigezi, Sebel, parts of Ankole, west Nile, Toro, Mbale; temperate-zone crops are common; Remote sensing applications as crop mapping, crop production monitoring support in optimization of crop measures and farm manegement
- Pastoral dry to semi-arid range lands in east Ankole, west Masaka, Karamoja; These have pastoral systems; Remote sensing can help in identification of timing and presence of green and fertile grazing areas, which help local nomads in their decisions to travel with their cattle to the right places on the tight time in the season (this is very climate related and difficult to predict)
- Northern and eastern short grasslands zone; short grasslands and cotton-finger millet mixed farming systems; Multi annual and seasonal Remote sensing based - and weather monitoring can help in decision making in crop and farm management in those regions which are mostly rain fed dominated. However this is more on region scale and relevant for groups of farmers or community level as these areas consist mostly of small-scaled farms.
- Southern and western tall grasslands zone; tall-grass areas, perennial and annual crops in mixed farming systems. Like Northern and eastern zones but here the scale of farming systems is larger and in this sense remote sensing based information can probably be better applied on farming system level.

[28] Source: Carrie Davies , 2009, Area Frame Design for Agricultural Surveys, USDA RDD Research Report, Number RDD-09-xx, june 2009

5 RECOMMENDATIONS FOR MATCHMAKING

Addressing the issues earlier mentioned and related to UNFFE and national discussion on (climate) related problems in Ugandese agri-sector, below statements[29] are entry to future (national and international) partnerships between agricultural organisations, knowledge entities and information services

Farmers indicate that there is a need for weather information as it is crucial for the timing of field management, because weather patterns have been changing it has become more difficult to determine the correct timing of management. The impact on food production in Uganda is evident as most agriculture is rainfed. UNFFE is signaling a growing awareness of changing weather patterns among the farmers. Nevertheless the connection between science and the farmer level is poor. Networks of Farmers offer a great opportunity to disseminate knowledge.

UNFFE is a valuable partner for many partners at the national level, due to their extended network down to the parish level. The current president and the new chief executive secretary can make difference and deserve respect, referring to their pro-active approach and smart approach. Since the president had become a member of the Executive Board of the World Farmers Organisation, the interests of the East African Farmers are represented at the highest level.

Although there are comprehensive programs on Food security and Rural Development in Uganda, the farmers are still insufficiently linked to these initiatives. By participating in this project UNFFE has an opportunity to link with the grass root level, working in close cooperation with District Farmers Associations.

[29] Climate adaptive approaches to Food Security, Agriterra project: 11ltn-5741. UNFFE, Uganda, Peter Prins and Jan Verhagen, Arnhem, June 26th 2012