2nd JOINT STAKEHOLDER WORKSHOP

31 JULY 2019

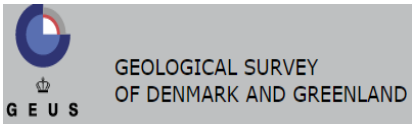
Makhado Agricultural Office, Louis Trichardt

South Africa

Submitted by :

Implemented by:

Project Partners:



Authors:

Resego Mokomela (IWMI)

Manuel Magombeyi (IWMI)

Jaqui Goldin (University of the Western Cape)

Karen Villholth (IWMI)

Acknowledgement

The author would like to thank the participants of the 2nd Stakeholder Workshop on the Establishment of Citizen Science and Water Monitoring volunteer group at Makhado office, Louis Trichardt for their presentations, contribution and discussions before, during and post workshop.

Acronyms and Abbreviations

APP	Application
AFASA	African Farmers Association South Africa
CS	Citizen Science
DWS	Department of Water and Sanitation
ESGUSA	Enhancing Sustainable Groundwater Use in South Africa
GEUS	Geological Survey of Denmark and Greenland
IWMI	International Water Management Institute
RSA	Republic of South Africa
UWC	University of the Western Cape
MAO	Makhado Agricultural Office

Contents

1. Introduction

This report documents the 2nd ESGUSA Stakeholder workshop between stakeholders from African Farmers Association South Africa (AFASA) and local farmers within and around Makhado District. The International Water Management Institute-Southern Africa (IWMI-SA) together with the Univeristy of the Western Cape (UWC) convened this workshop which was held in Makhado Agricultural office, Louis Trichardt, South Africa on the 31st of July 2019. The workshop included a two hour groundwater monitoring instrumental demonstration.

1.1 Workshop Objectives and Participants

The objective of the 2nd Stakeholder workshop was to present the objectives, key progress of the ESGUSA and introduce the idea of Citizen Science (CS) in the Hout catchment to the participants as well as to gain an understanding of the current water resource monitoring processes undertaken by farmers in the Makhado District.

A total of 24 participants attended the ESGUSA stakeholder workshop. A complete list of the participants can be found in ANNEX 1. The stakeholder participants included representatives from the Department of Water and Sanitation (DWS), African Farmers Association South Africa (AFASA), University of the Western Cape (UWC), International Water Management Institute (IWMI) and Department of Agriculture (DOA).

This meeting highlighted the importance of collaboration and joint water resource monitoring for enhanced groundwater management in the area.

1.2 Target Audience

The target audience of the 2nd Stakeholder workshop were the smallholder and commercial farmers in Makhado District, Limpopo Province, who fall within the Hout catchment boundaries, the Department of Water and Sanitation and the Department of Agriculture.

1.3 Workshop schedule

The Enhancing Sustainable Groundwater Use (ESGUSA) 2nd stakeholder session lasted for half a day, a complete agenda can be found in ANNEX 2. The workshop began with welcome remarks from the Department of Water Sanitation and a representative from the Makhado Agricultural Office, followed by a self-introduction by participants of the workshop. The workshop then kick-started with an introduction presentation on the project ESGUSA. The introduction covered the project objectives, partners, approaches and activities that have been on-going since the initial project kick-off. The second presentation focused on the introduction to Citizen Science (CS), its implementation and the progress to date in the Hout catchment. The third presentation focused on introduction to monitoring tools and volunteer tasks in applied CS. This was then followed by an open panel discussion which encouraged the stakeholders to present their experience, challenges on groundwater use, monitoring and management. The final presentation focused on the roles and engagement of Citizen Science volunteers in the Hout, this was then followed by an identification of volunteers interested in participating in CS activities. The workshop concluded with a hands-on-demonstration of the monitoring instruments and concluding remarks from the ESGUSA research team.

The presentations and pictures from the workshop can be found on the project SharePoint website https://cgiar-my.sharepoint.com/:f:/g/personal/iwmisa-helpdesk_cgiar_org/EtWi-80JanNDitKEJqha8jkBY1YhleNEv-f0LRZBmcTYMg?e=3i4Fo3

2. Presentations and discussions in the ESGUSA workshop

2.1 Welcome Remarks and Introduction

Welcome remarks were made by a representative from Department of Water and Sanitation (DWS), Mr. Tshiololi Mashudu from the Inter-governmental relations board, who expressed the importance of the DWS participating in such meetings because they are the National Water Authority (NWA) and manage all the water resources within the country. Mr Mashudu emphasized that the workshop is key to farmers, who are faced with limited water resources in the Limpopo Province. An additional welcome speech was made by Mr. Justice Ludere from the African Farmers Association South Africa (AFASA) on behalf of the Chairperson of the Union (in absentia). Mr Ludere was thankful to the ESGUSA team for inviting farmers within the region to share their experience and challenges about the groundwater management. After the welcome speech, all the participants introduced themselves.

2.2 ESGUSA Project: Objectives, Partners, Approaches and Activities – Dr Karen Villholth

The ESGUSA project objectives are to 1) Support sustainable groundwater management in South Africa through effective research partnership with Denmark; 2) Improve understanding of hydrogeological processes in typical geological settings in South Africa; 3) Develop and calibrate integrated hydrological model(s) for the Hout/Sand catchment, Limpopo Province; 4) Promote the CS approach which involves local stakeholders in the research; 5) Define sustainable groundwater management schemes based on resource indicators; 6) Increase the research and human capacity for groundwater resource assessment and management in South Africa.

The Project partners include the University of Copenhagen, University of the Western Cape (UWC), International Water Management Institute-Southern Africa (IWMI-SA), Geological Institute of Denmark and Greenland (GEUS), EKOSOURCE, Capricorn District Municipality and the Department of Water and Sanitation (DWS).

The ESGUSA project focuses on the study area, Hout River catchment within the Limpopo River Basin. The catchment area is about 2,478 km^2 with a semi-arid climate and precipitation averaging at 407 mm/year. The catchment is mostly underlain by crystalline basement rocks. The riverbeds in the catchment tell us a story about the geology of the area and give us a general understanding of the rock formation underground.

The workshop had four focus areas: 1) to introduce the idea of CS by bringing together stakeholders in Hout catchment; 2) to share and discuss scientific and stakeholder knowledge and concerns around water in the catchment; 3) to bring a common understanding current monitoring of water resources in the catchment and gaps; 4) to identify the scope for CS and a practical approach for involving volunteers in water monitoring and data sharing, with a focus on groundwater.

The ESGUSA research team has made several visits across the catchment since the beginning of the project in ? (put date). During these visits the project team noted the following: 1) most of the catchment is dry with little to no surface water flow 2) the surface water flow relies on flood events or heavy rainfall in the catchment 3) even in such instances surface flow is ephemeral 4) in instances were river flow is visible in dry season, it comes from wastewater discharge 5) other geological features such as dykes are important as they form barriers that can control or facilitate groundwater 6) drilling and logging of boreholes in the catchment provide information about the soil and rock types in the catchment.

The main source of water in the Limpopo is groundwater and it is mostly used for irrigation, livestock and domestic water supply. Issues of water resources include intermittent river flow, contamination, poor water supply infrastructure, large variability in rainfall amounts and groundwater levels, inadequate data on water resources.

Collectively we can manage our groundwater by being involved in CS activities such as data collection and sharing for improved management of the water resources. The data collected can be shared and viewed through a Citizen Science App which will be implemented by IWMI.

The catchment was divided into three sections for easy and well distributed monitoring sites; section 1: Community members around Polokwane, section 2: Commercial farmers and section 3: Smallholder/ commercial farmers.

2.3 Introduction to Citizen Science, implementation in Hout, and progress to-date – Prof Jaqui Goldin, University of the Western Cape

Citizen Science is not science about citizens and it is not a science that takes place in a laboratory. It is real science done by everyday people who observe, question, plan, analyze and communicate on field data collected. CS is about creating, planning, connecting and collaborating with experts for a common objective. A CS is anybody who voluntarily contributes his or her time and resources toward scientific research in partnership with professional scientists.

Creating a Science-Society partnership allows us to have a potential for developing new ways to collectively solve big problems, fundamentally change the relationships between scientists and the society. It is an approach whereby non-scientists are actively involved – to differing degrees in the generation of new scientific knowledge. Non-scientist also actively stand to benefit from CS. It is thought to be the future of genuine interaction and inclusive science engagement.

CS programs work to incorporate observations taken from the everyday lives and experiences of citizens. This is achieved as CS provides important real site-specific context andobservations that contribute to meaningfully to research programs. CS can inform conservation action, management decision, environmental policy, etc.

2.4 Introduction to Monitoring Tools and Volunteers Tasks in Applied Citizen Science - Dr Manuel Magombeyi

Globally and nationally, water resources are increasingly under pressure mainly from human activities, namely urbanisation, population growth, increased living standards, growing competition for water, and pollution. The impact of these human activities are aggravated by climate change. The challenge for water managers is how to manage water resources sustainably while meeting an ever increasing demand.

There has been a drastic decline of the groundwater table over the years in the Hout Catchment. This groundwater table decline is mainly caused by climate change and heavily influenced by agriculture as farmers over pump on a daily basis. There is need for the farmers to start monitoring their water usage and groundwater levels using hydrological instruments. Some of these instruments include the "dip meter" often called a groundwater level meter that is used to measure the distance from the ground surface or from top of casing to the water table. These measurements can be taken weekly or monthly because groundwater levels do not change drastically in a short period of time, unless groundwater levels from a pumping well are being measured. From farmers' practical point, the groundwater level meter is important because it can be used to provide general groundwater levels in the different sections of the catchment. These levels can guide the farmers or enhance their knowledge on the general borehole drilling depth required to reach the groundwater table.

Rainwater (also called precipitation) is a natural feature of the earth's weather system. A rain gauge is an instrument which is used to measure rainfall daily (i.e., from 8am current day -8am the next day). This helps us analyze how much rainfall has fallen in a specific area over a specific period. Rainwater provides us with water for drinking and growing of crops. Part of the rainwater seeps into the ground and some of it becomes groundwater when it reaches the water table in the form of recharge.

Monitoring rainwater and groundwater table allows us to see how the rainfall and groundwater table are related in the different sections of the catchment. To date, we have observed that flood events (e.g., in year 2000) are the main cause of significant groundwater recharge in the catchment. A staff gauge, takes the form of a meter ruler with graduations and is used to measure depth of water levels in a flowing river. The depth of flow is measured from the riverbed to the water surface. River flow can be linked to recharge or rise in groundwater table in boreholes near or along the river.

The tasks to be done by the volunteers include:

1) Monitoring groundwater levels
2) Monitoring rainfall
3) Monitoring presence of flow or no flow in the river
4) Monitoring depth of water levels in flowing river

The frequency of monitoring for the different monitored variables are:

1) Every two weeks for groundwater level
2) Whenever there is a rainfall event, and preferably to take reading daily at 8am
3) Whenever there is flow in the river

Hydrological monitoring is important for effective water resources management. However, datasets collected for a specific purpose and over a wide area often result in unexpected patterns emerging, which can trigger more focused studies over time which will improve water resources management.

2.5 Open Panel: Current Monitoring Practices and Gaps – Dr Karen Villholth, IWMI

This session was for feedback from the local stakeholders after the presentations on project components and on CS. The stakeholders engaged in a discussion on how CS can be incorporated in to their daily activities as farmers, and whether and in what ways it would be helpful in giving them informed decisions for their farming activities in the Hout catchment, with its unique climate and hydrological processes.

Dr Karen Villholth and Prof Jaqui Goldin opened the panel discussion by asking the farmers the following questions:

1) Did the farmers monitor groundwater or rainfall as part of their farming activities?
2) Did the farmers notice any changes in groundwater levels and water quality over the years?
3) Is there a need for CS in the Hout-River Catchment?
4) Did any of the farmers know of any hydrological monitoring instruments in the catchment?

Various farmers in the workshop indicated that they monitor their boreholes, but it's mainly pumping boreholes and they monitor them there is a problem such as when the power reduces over time or the pump is pumping less volumes of water. Farmers do not have access to monitoring instruments as they are costly. Most of the farmers use groundwater for irrigation, and only a few farmers outside of the Hout catchment use surface water for their farming. The farmers in the Hout River use groundwater from the same borehole (well) for irrigation and domestic use. No information is being supplied to farmers from DWS in-terms of water resource quantity and quality or water levels in the area. Hence, farmers often employ professionals to drill boreholes to depths determined by the drilling company. The farmers expressed the need for CS in the catchment because they use water daily hence taking measurements would not put additional burden on their daily activities, but would, instead, help them to make informed day-to-day decisions, to save costs and to promote effective water resource planning.

Farmers need training on hydrological monitoring, especially those in the Hout River catchment, relying only on groundwater for a variety of activities. Farmers are drilling boreholes without making informed decisions and this means that their boreholes run dry unexpectedly in a short period of time. The presentations assisted farmers to understand the importance of monitoring and that collaborating in data collection can help pre-empt situations such as boreholes running dry. Furthermore, having groundwater table level knowledge prior to construction can provide an indication of how deep they should drill to reach the groundwater table level.

Farmers in the Hout Catchment are mainly concerned with finding groundwater using reliable methods. Some farmers use sticks and others use geophysics to identify sites with groundwater, but the overall concern is that not all these methods guarantee them groundwater. Geophysics is a more advanced and better technique to use and it allows for the detection of dyke formations. Dykes have different geological properties from the rest of the geology in the area, and with experience boreholes can be drilled adjacent to the dyke or inside the dyke to maximize water availability, depending on whether the dyke is impermeable or permeable.

2.6 Role and Engagement of Citizen Science Volunteers in Hout – Resego Mokomela

A Volunteer/Citizen Scientist is an individual who voluntarily contributes his or her time, effort, and resources toward some scientific research in collaboration with professional scientists or alone which will benefit the community and him/her in the long-term. These individuals do not necessarily need to have a formal science background.

Within the context of the ESGUSA project, volunteers are trained in operating mobile apps to capture, store and share observed data weekly/ monthly/yearly depending on the project data demand. This creates a relationship between scientists, farmers and local citizens. In doing so, data sharing boundaries are broken through the sharing of data from privately and communally owned land. All stakeholders and locals within the catchment can have an overall observation of the catchment and have a better understanding, which will help them make informed decisions about their farms and community management in relation to water resources. CS provides a tool for scientific education and capacity building. Data collection skills are taught to achieve accurate data collection, critical thinking and scientifically informed decision-making thus providing many scientific eyes for research and decision making. Locals are empowered to respond to local level challenges such as water contamination and in the process they develop a sense of ownership of their resources. This increases environmental democracy (sharing of information) whilst at the same time providing an early warning/detection system. The involvement of citizens at the grassroots makes it more possible to check for failure in water supply infrastructure. Other advantages include reduced theft and vandalism to monitoring instruments. In the long run proactive changes to policy and legislation are supported because new data is made available.

The following requirements should be satisfied for local farmer or member to be a volunteer:

1. Reside within the Hout River Catchment or within a 5km radius outside of the catchment
2. Have access to one or several monitoring boreholes
3. Have a smart phone
4. Be willing to co-operate with the project team
5. Be willing to learn and engage with other stakeholders

The following are the roles of a volunteer:

1) Collect field data weekly or daily depending on the variable being monitored
2) Ensure that all instruments are in good condition at all times
3) Ensure that the volunteer can be reached by the project team when and if needed
4) Ensure that correct measurements are taken at all times
5) Be willing to assist others and guide new volunteers
6) Participate in data collection process training and ensure that the monitoring process is understood
7) Contact the project team if there is need for clarification or when faced with a data collection challenge
8) Report back to the project team weekly with field observations

Citizen Scientists are expected to communicate their field observation with the project team through a “My Citizen” App (see Figure 1). This App allows the citizens to upload their observed data of rainfall, groundwater level or surface flow along with images to the project team. The Citizen Scientists report

directly to Mr Resego Mokomela and Dr Manuel Magombeyi from the International Water Management Institute (IWMI-SA).

Figure 1. Citizen Science App landing page(https://www.citizenscientists.biz/)

The volunters are required to sign an agreement with the ESGUSA project team. Volunteers are expected to sign a contract with the handover of hydrological instruments such as rain gauges, staff gauges, tape measure and groundwater level meter etc. The volunteer agreement specifies the voluntary work expected from the volunteer, person to report to, re-imbursement for any additional costs incurred by volunteer in the project on a monthly basis and describes volunteer roles and responsiblities.

2.7 Discussion and Enrolment of Volunteers – Prof Jaqui, University of the Western Cape

In this session the activities that will be done by the volunteers were discussed and the volunteers residing within the Hout catchment were identified. Six stakeholders opted to volunteer in groundwater monitoring, rainfall and river flow. See list in ANNEX 3. The Volunteer contact details were taken by the project team to enable mapping of their loaction in the catchment. Distribution of instruments to the volunteers by the project team will be done in September 2019.

3. Hands-on demonstration of Instruments and Monitoring practice, and monitoring Manual for Volunteers – Dr Magombeyi and Resego Mokomela, IWMI

The project team demonstrated how measurements are taken in the field. The following instruments were presented to the volunteers (Figure 2, 3 and 4). The volunteers were shown how to include decimal readings from the instruments. This exercise will be repeated at the handing out of the instruments to volunteers in Spetmber 2019.

Figure 2. Groundwater level meter for groundwater level measurement

Figure 3. Rain gauge for rainfall measurement

ANNEX2: Workshop Agenda

2nd Stakeholder Workshop

Establishing Citizen Science and Water Monitoring

Enhancing Sustainable Groundwater Use in South Africa - ESGUSA

Makhado Agricultural Office

Louis Trichardt, South Africa

31st July 2019

BACKGROUND

The Stakeholder Workshop serves to enhance stakeholder collaboration around groundwater and surface water management within and around the Hout River Catchment in Limpopo province (Figure 1). The ESGUSA project is a Danish-funded research project led by the University of Copenhagen in Denmark together with the University of the Western Cape in South Africa, and IWMI-SA (International Water Management Institute - South Africa). The project will run for two and a half years (starting April, 2018) and addresses the knowledge gaps of aquifer systems, their replenishment and interactions with rivers, wetlands, terrestrial systems, and the management of water resources in Hout Catchment, with the involvement of the local community through Citizen Science. The project seeks to support several sustainable development goals, and particularly "Clean Water and Sanitation", and contribute to integrated participatory water management in the Hout Catchment.

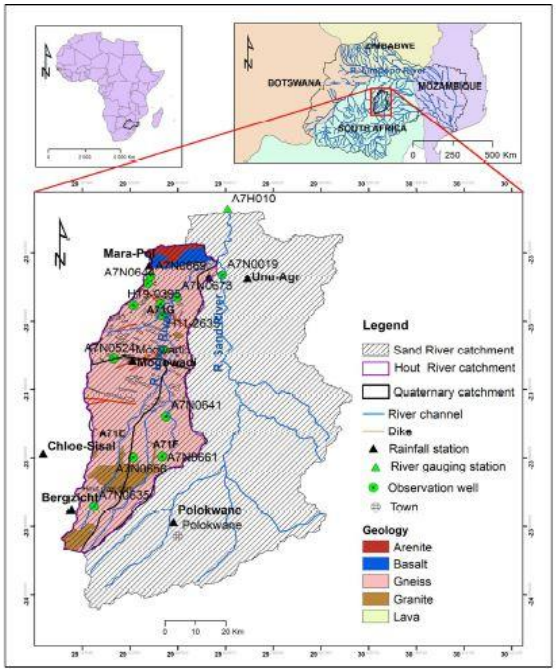


Figure 1: Map of the Hout-River Catchment in the larger Sand River Basin

OBJECTIVES

The objectives of the project are to:

1. Support sustainable groundwater management in South Africa through effective research partnership with Denmark
2. Improve understanding of hydrogeological processes in typical geological settings in South Africa
3. Develop and calibrate integrated hydrological model(s) for the Hout/Sand catchment, Limpopo Province
4. Involve local stakeholders in the research (Citizen Science)
5. Define sustainable groundwater management schemes based on resource indicators
6. Increase the research and human capacity for groundwater resource assessment and management in South Africa

The objectives of the Stakeholder Workshop are to:

1. Present the ESGUSA project and its objectives
2. Introduce the idea of Citizen Science by bringing together stakeholders in Hout catchment
3. Share and discuss scientific and stakeholder knowledge and concerns around water in the catchment
4. Understand current monitoring of water resources in the catchment and gaps
5. Identify scope for Citizen Science and a practical approach for involving volunteers in water monitoring, with focus on groundwater

PROGRAM

Wednesday 31 July 2019

09:15 – 09:30	**Registration**
09:30 – 10:00	**Opening of the meeting and self-introductions by attendants** - Moderator: Prof Jaqui Goldin, Univ. of the Western Cape
10:00 – 10:20	Introduction and Welcome Remarks - Chairman of African Farmers Association South Africa (AFASA-Limpopo) - Mr M.E Tshiololi, Department of Water and Sanitation
10:20 – 10:40	ESGUSA Project: Objectives, Partners, Approaches, and Activities - Dr Karen Villholth, IWMI
10:40 – 11: 00	Introduction to Citizen Science, Implementation in Hout, and progress till Date - Prof Jaqui Goldin, Univ. of Western Cape
11:00 – 11:20	Introduction to Monitoring Tools and Volunteer Tasks in Applied Citizen Science - Dr Manuel Magombeyi, IWMI
11:20 – 11:40	Open Panel: Current Monitoring Practices and Gaps - facilitated by Dr Karen Villholth, IWMI
11:40 – 12:00	Role and Engagement of Citizen Science Volunteers in Hout - Mr Resego Mokomela, IWMI
12:00 – 12:20	Discussion and Enrolment of Volunteers - facilitated by prof Jaqui Goldin, Univ. of the Western Cape
12:20 – 13:00	**TEA and packed lunch**
13:00 – 14:00	Hands-on Demonstration of instruments and Monitoring Practice, and Monitoring Manual for Volunteers - Dr Manuel Magombeyi and Resego Mokomela, IWMI
14:00	**Departure**