

**Citizen Science Initiative**  
**PIRE: Water Taming in Ethiopia**

**Mid-term Report**

**By**

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### **Executive summary**

This midterm report of the PIRE project component of citizen science approach was based on the agreement between the University of Connecticut and Bahir Dar University in Ethiopia. The report contains the activities from the very beginning of May 31/2018. The activities of the project included the kick off meeting with stakeholders, training of MSc student about the hydrometeorological data collection, site selection for 4 communities, selection of highschool and students who are part of the citizen science. The communities selected are from Kudmi Kebele in Koga, Dangishta Kebele in Branti area, Reem Kebele in Markudi area, and Gaita Kebele in Kuashini areas. Four MSc graduate students were selected and have trained nine highschool students from Merawi, Reem and Mengesha Jembere high schools. The hydrometeorological data collected by citizens of high school students include water level in rivers, soil moisture and shallow ground water level. The river water level or the stage has been measured daily and the remaining once on the weekly basis. The supervision of high school students by MSc graduate students is once per week. The technical team in BDU have been checking the quality of data and sending the data since September/2018. In May 2018, Flat thin mm-sized soil moisture sensor (MSMS) have been installed in the four communities to monitor the soil moisture in 12 locations and two depths (20 cm and 40 cm) for each.

## **1. Introduction**

As part of the NSF-PIRE project in the Blue Nile Ethiopia, the citizen science approach is undergoing in Ethiopia in collaboration between Connecticut University and Bahir Dar University. The project is planned to be carried out for two years from July 2017-2019. The aim of the citizen science approach is to participate the high school students participates in the data collection of hydrometeorological information that will be an input to initialize models and to validate the outputs of hydroclimate forecast in the NSF-PIRE research project. This is helpful to make a link of high school students with professors in university through graduate students in developing advanced forecasting hydroclimate systems. The main task in the proposed time frame is mainly training high school kids, selecting watershed sites or communities and collecting hydrological data in the selected watersheds. The data collected includes the river stage on the daily basis, the soil moisture and shallow ground water level once a week.

The team in Bahir Dar University within the faculty of civil and water resource includes one coordinator, two technical advisors and 4 MSc graduate students which are selected from the Engineering Hydrology masters program. The project has started the work in July 2017 with kick off meeting. Since then the work has been based on the project objective and time line. Kick off meeting was done to officially start the work and announced for the stakeholders, selected communities and faculties from the community. The four sites selected were the Markudi, Koga, Branti and Kuashini has been selected. Awramba watershed was part of the project and later replaced by Markudi watershed after Jan 2018. Hence this report presents the main activities carried out since the commencement of this project in July 2017.

## **2. PIRE project team in BDU**

The team member of citizen science initiative project includes 8 members. One is assigned as coordinator. Two are technical advisors (one hydrological data collection and another for community mobilization). The remaining four are the MSc students training and supervising high school kids during data collection in the field work with advisor. Details of team members and responsibility are presented table 1 with responsibilities they have in the project.

Table 1 List of the team members PIRE project in Bahir Dar University.

No.	Name	Responsibilities in the team	Remark
1	Dr. Seifu Admassu	Project coordinator and manger	<i>Coordinator</i>
2	Dr. Mamaru Ayalew	Hydro-climatological data collection advisor	<i>Hydrological coordinator</i>
3	Dr. Muluken Agaze	Community mobilization advisor	<i>Community coordinator</i>
4	Daniel Geletaw	Engineering hydrology graduate student at BDU for training the selected high school students and supervise the field data collection	<i>Branti watershed</i>
5	Birhanu Geremew	Engineering hydrology graduate student at BDU for training the selected high school students and supervise the field data collection	<i>Was in Awramba watershed currently in Markudi Watershed Reem kebele</i>
6	Wondale Amara	Engineering hydrology graduate student at BDU for training the selected high school students and supervise the field data collection	<i>Koga irrigation area (Chehona Comand area)</i>
7	Muludil Asres	Engineering hydrology graduate student at BDU for training the selected high school students and supervise the field data collection	<i>Kuashini Irrigation area (Gaita Kebele)</i>

### 3. General description of selected sites

The watershed selection was based on the recommendation from the social scientist and students. Discussions were made with the team of the citizen science initiative at BDU and UConn. The team traveled to the proposed sites to observe the sites. Graduate students from Engineering Hydrology in The faculty of civil and water resource engineering master program selected for the project were part of the team (table 1). Even though the team were not directly involved in selection of the high school students, the high school officials have been briefed on the criteria's needed (eg., student should live inside the watershed, student with good academic performance, etc) to choose appropriate students for the project. The selection criteria were similar for all watersheds (Koga, Awramba and Branti). The selected watersheds for PIRE project implementation in the Blue Nile basin was indicated Figure 1.

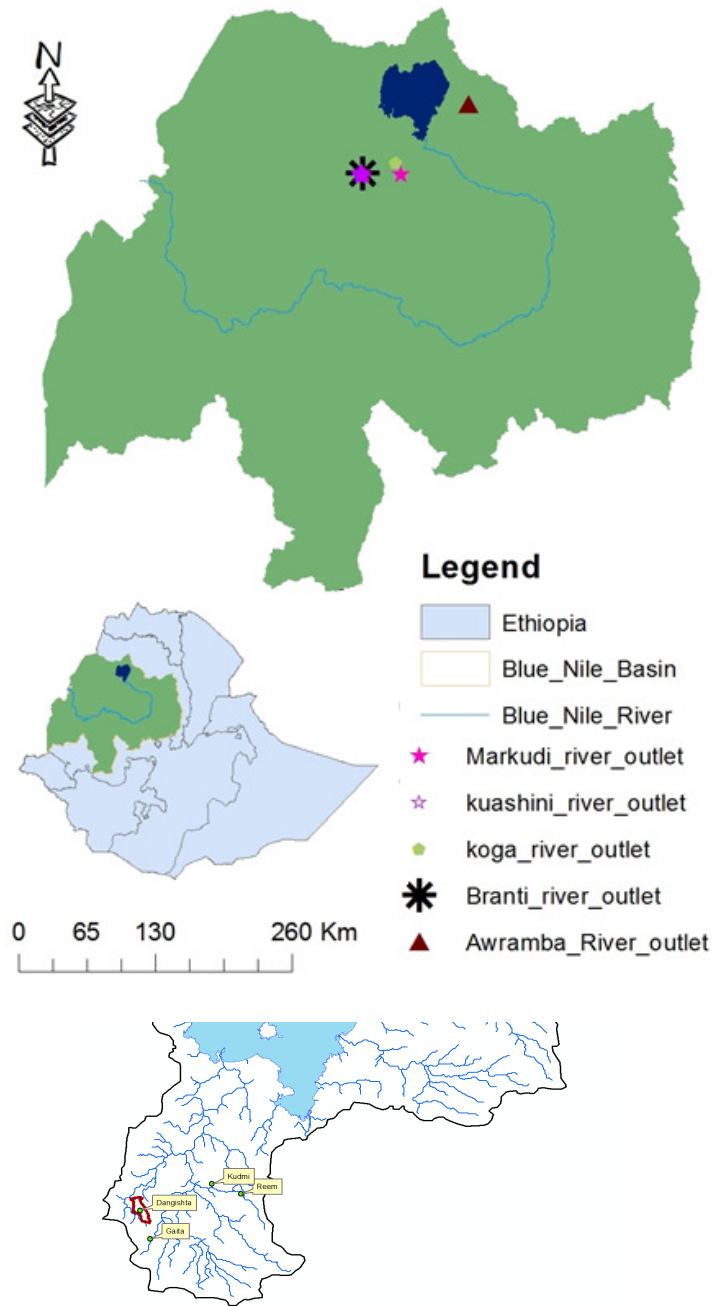


Figure 1 Geographical location of the selected areas over the Blue Nile basin

#### 4. Site locations and high school selection

The selected site in the Blue Nile basin for PIRE, citizen science initiative project includes the Brant, Koga, Kuashini, Markudi and Awramba watershed. Each of the selected watersheds under monitoring are described as follows.

Branti watershed is located Dangishita Kebele of Dangila Woreda which is about 85 km from Bahir Dar town. The watershed (Figure 2a) has an area of 30 km<sup>2</sup> has been monitored for 3 years through Innovation Lab for Small Scale Irrigation (ILSSI) by BDU and IWMI. The watershed has a potential of irrigation from shallow groundwater and this was well introduced by ILSSI. The three high school kids whom are collecting the data till now were from Mengesha Jemberie (MJ) high school at the border of the watershed in Dangila Town.

Kuashini Irrigation scheme is found in the Dangila woreda, Gaita kebele. It is about 12 km from Dangila town and some 97 km from Bahir Dar city. The irrigation command is based on the structure constructed upstream, which was the diversion weir with lined primary canal. The upstream part of the command area till the head of the weir has been chosen for monitoring (Figure 2c) and to collect the hydrological data in the site. It was selected in March 2018 as the fourth monitoring site. The Mengesh Jemberi (MJ) was the high school where the data collectors were selected. Till April/2018 the soil moisture, staff gage and shallow ground water well measurement readings have been started.

The Markudi watershed was located about 80 km from Bahir Dar city. This watershed (Figure 2c) was newly selected as replacement of the Awramba watershed based on the recommendations from report the social scientists (PhD students in UCONN) that visited for proposing the sited for monitoring. It is located in Reem Kebele where the Reem high school was two high school students have been selected to collect the hydrometeorological data data collection. It was set up in early April/2018 and data collection has also been started.

Koga irrigation scheme is located 40 km from Bahir Dar city. The scheme was earthen dam which was designed to supplement irrigation for 7000 ha for around 14, 000 household. The Koga irrigation scheme was selected according to the recommendations by the social scientists. The area was considered as open society due to benefit from the irrigation. Out of the total command areas the Chehona command area was selected as the project irrigation site for data collection. The total area of the command was estimated around 600 ha. The two high school kids whom are currently collecting the hydrometeorological data selected from the Merawi high school around 6 km from the command area.

The Awramba watershed which is 65 km from Bahir Dar was visited on Monday June 26/2017. It is a nested watershed of Mizewa watershed that was established by Nile Basin Development Challenge program on water and food of CGIAR. The watershed was selected as the rain fed system for the project. The two students whom were collecting the data till January i.e the time where we were stopped data collection were selected from Addis Raye high school which is found in the center of the 7 km<sup>2</sup> Awramba watershed. In this watershed the data collection has been stopped since January 2018 based on the PIRE project coordinating center recommendations. It was replaced by the newly selected Markudi watershed.



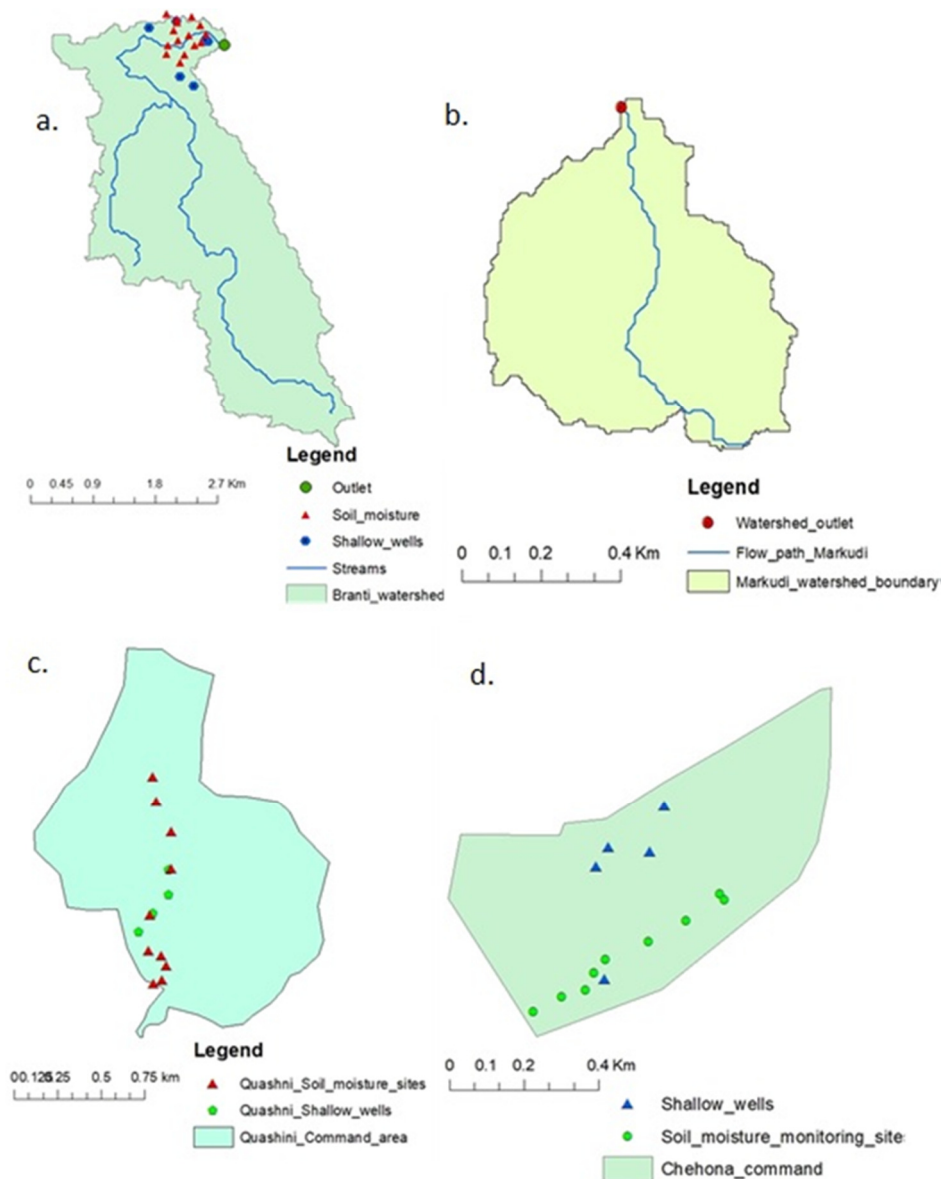


Figure 2 Watershed under monitoring by the PIRE project team in Bahir Dar University

## 5. Kick of meeting

Kickoff meeting was organized for a half day (July 12<sup>th</sup> 2018) participants from the Faculty, Blue Nile Water Institute (BNWI), Abbay Basin Authority (ABA), Tana sub-basin organization (TaSBO), high school teachers and student were attended. The main objective of the kickoff meeting was to implement Citizen Science Initiative (CSI) for the collection of hydrological

data and promote public participation in science in the selected watersheds. The high school kids, teachers and directors were from Mengesha Jemberi general high school (for Brani watershed), Merawi high school (for Koga watershed) and Addis Raye high school (for Mizwa watershed). The half day meeting started at 9:00 with welcoming ( Dr. Mamaru), Opening (Dr. Micheal) and presentations about PIRE (Dr. Semu), Plans to implement the project (Dr. Seifu) and about citizen science (Dr. Muluken) and Ended with the Question and answers from the participants and presenters. At the end of the meeting, the highlight about the instruments has been given outside the hall (Figure 3). During that time the kickoff was s lively, raised awareness of many participants and carried out successfully.

## Kick of Workshop





Figure 3 Kick of meeting pictures, group photos and banners in July/2017

## **6. Training for MSc students and high school kids**

Soon after the kick of workshop, the data collection instruments provided from UCONN (i.e TDR, deep meter and levels) were introduced to high school and graduate students by Dr. Mamaru and other faculty member-Mr. Bishaw. Then, the instruments were distributed to each community and site group (i.e., teachers and high school kids). Then the MSc students travelled to the selected sites and trained the high school kids on site (Figures 4-6).



Figure 4 Masters Student training about soil moisture data collection using TDR for the high school kids in Kuashini irrigation scheme site



Figure 5 Masters Student (Wondale A.) training about soil moisture data collection using TDR for the high school kids in Koga irrigation site in Chehona command



Figure 6 Masters Student (Wondale A.) training about soil moisture data collection using TDR for the high school kids in Koga irrigation site in Chehona command

## **7. Data collection**

Since July 2017 the data collection has been started in Awramba and Branti watersheds and then to Koga (Figure 7-10). After five months based on the recommendation and field visit of social scientist report from UCONN, there was additional new watershed namely Kuashini irrigation site. Based on the recommendation from the social scientists report and PIRE project coordination office at UCONN, Awramba site was changed to Markudi watershed in Reem Keble.



Figure 7 Staff gaging at the outlet of Branti watershed (left) and well water level monitoring sites (right)



Figure 8 Shallow well level measuring sites (left) and soil moisture measuring site (right) in Koga watershed



Figure 9 Staff gaging at the outlet of Markudi watershed (left) in Reem Kebele and Soil moisture measuring site (right)







Figure 10 Staff gaging at the out let of Awramba watershed (left) and Soil moisture measurement sites (right)

## 8. Students research

The selected MSc graduate students have been developing proposals for their MSc thesis research. The research idea upon discussion was made to be in the selected sites and specifically to use the collected data as an input for their research. Currently these students have presented their proposal and approved by the graduate program of Faculty of Civil and Water Resources Engineering. The research title during proposal writing was carried out upon consultation with the coordinators of the project at BDU. The research titles of the students were presented in table 2.

Table 2 Undergoing MSc student research titles

No.	Students Name	Research title	Project site	Student photo
1	Daniel Geletaw	Estimation of Ground Water Recharge Using Water Balance And Water Table Fluctuation Method in Brante Watershed, Ethiopia	Branti	
2	Birhanu Geremew	Simulation of Soil Moisture By Using Satellite Image and SWAT Model in Awramba Watershed, Upper Blue Nile basin	Awramba	
3	Wondale Amera	Comparing actual evapotranspiration from RS with the water balance approach. at Koga Irrigation Scheme, Ethiopia	Koga	
4	Muludil Asres	Estimation of Soil Moisture Content Using Ground Based Data and Remote Sensing In case of Kushini watershed, Ethiopia	Kuashini	

## 9. Monitoring and supervision of data collection

Monitoring of the data collection by the high school students has been done since August 2017. It was carried out every 2-3 weeks by the masters students. During the supervision, the high school students collect the data in the presence of graduate students. They discuss with the high school kids regarding the data collection, and challenges with the instruments if any. The team



at Bahir Dar also travelled to the site once per month and observes the data collection approach and strategy. The data from each site have been collected at the end of every month (Table 2) and shared by e-mail to PIRE project coordinator at UConn.

Table 2 Data type and record length each sites selected by the project

No	Watersheds	Measured variable	Number of locations in each site	Starting period	Temporal resolution	Number of record till May 31/2018
1	Branti	Soil Moisture	8	7/21/2017	weekly	52
		Stage	1	7/21/2017	daily	317
		Well level	10	7/27/2017	weekly	48
2	Kuashini	Soil Moisture			weekly	
		Stage			daily	
		Well level			weekly	
3	Koga	Soil Moisture	9	10/15/2017	weekly	34
		Stage	-	-	-	-
		Well level	5	10/15/2017	weekly	33
4	Markudi	Soil Moisture	8		weekly	8
		Stage	1		daily	
		Well level	9		weekly	9
5	Awramba (January 30/2018 )	Soil Moisture	6	7/18/2018	weekly	30
		Stage	1	7/18/2018	daily	173
		Well level	-	-	weekly	-

#### 10. App development for data collection

In order to facilitate the data management and collection from the site directly to the central data base at UCONN, *Zac Flaming* had made a visit sent from Oklahoma University in February 2018 and developed an app with local Amharic language. The app data collection include the river stages,,well water level and soil moisture from each watershed by using an

iPads that were provided by UCONN PIRE project for this purpose. The app has been developed and tested. Zac trained the graduate students with the high school students (Figure 11). The App needs an internet connection to directly record on site and transfers to data center to UCONN. But because of the limitation with access of the internet, the app is developed in a way that data is collected and stored in the app at site but automatically sending it whenever internet access is possible.



Figure 11 Training and testing the App developed for data collection in Branti watershed

### **11. Soil moisture sensor installation**

For the objective of better spatial distribution of soil moisture in the four watersheds, Twelve Flat thin mm-sized soil moisture sensor (MSMS) soil moisture sensors have been installed within May 2018. The sensors were installed below the ground at 20 cm and 40 cm for each soil moisture measuring site in each watershed. It has been installed with the help of the Phd student from UCONN (Wangichi) and 4 Msc students from BDU. The MS students trained selected farmers in the watershed to monitor soil moisture on a weekly basis. This has also been observed and checked by the team from UCONN.



Figure 12 The team from BDU and UCONN was installing the soil moisture sensors and Wangchi was training the students (left) and the students training the farmers (right)

## 12. Summary

The proposed plan for the time from July 2018-June 2018 has been accomplished except the late site selection of of Kuashini and the change of of Awramba by Markudi watershed. The training of 9 high school students, 4 site selection, daily and weekly data collection of stream gages, soil moisture and groundwater level and supervision of graduate students have been done according to the citizen science initiative objective of PIRE project. The data collection and management will continue in better way such as using flat thin -sized soil moisture sensor (MSMS). In addition the students will check the collected data for their Msc thesis research and will come up with some sort of output from the collected data.