Citizen Science at the Source of the Blue Nile: Promoting Public Participation in Science for Ensuring Food and Water Security in Ethiopia

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The main source of water for Ethiopia is the Blue Nile Basin where inter-annual variability of precipitation has caused droughts and floods leading to economic and food insecurity. Our NSF-PIRE project focuses on the Blue Nile Basin as the study domain, and aims to develop novel forecast technologies to mitigate the stresses to local communities.

To overcome data scarcity challenges in the region, a Citizen Science Initiative (PIRE CSI) was established, a project that trains high school students and local farmers in hydrologic data collection in four watersheds of interest, located south of Lake Tana, Ethiopia.

1. MOTIVATION

The kick-off meeting of the Citizen Science Initiative in Bahir Dar was held on 12/1/2017, where high school students and teachers gathered to participate in the initiative.

2. QUICK FACTS

When was the PIRE CSI established? June 2017

Who is involved from Ethiopia? 4 high schools, 10 high school students, 4 high school teachers, 4 graduate students and 3 faculty from Bahir Dar University, Farmers from 4 local communities, south of Lake Tana.

What are they doing? Collecting hydrological data on: river stage, soil moisture and groundwater levels.

Participating in college-ready activities.

3. LOCAL COMMUNITIES

Four local communities (Koga, Markudi, Yang, and Semu villages) are involved from Ethiopia.

4. DATA COLLECTION

New Soil Moisture Sensor Development (MSMS)

Advantages
➢ Low cost (<$1 per sensor)
➢ High resolution profiling at low cost
➢ Long-term stability (over a year)
➢ Multiple depth measurements

Challenges
➢ Salinity values may be affected by other soil parameters (e.g. nutrients, pH)
➢ Soil sensor contact could be further improved

5. DATA TRANSMISSION

BWING app – Blue Nile Weather Identification Near the Ground

➢ IOS app
➢ Loaded onto iPads for use in the field
➢ Queues reports until wifi is available and then sends
➢ Translated into Amharic for easier use in the field
➢ Graphs last 10 reports for easy comparison of current observation vs historic
➢ Will integrate model predictions with in-situ data in a single graph

6. DATA INTEGRATION

PIRE Researchers (Engineers) are integrating the data into their modeling for:
➢ Validation of model predictions (soil moisture, streamflows and groundwater levels) made each wet season 2016 through 2022

PIRE Project Modeling Framework

7. IMPACT

➢ Citizen participation in science can:
   ➢ Promote empowerment of local communities
   ➢ Establish long-lasting partnerships between scientists and local communities
   ➢ Build local capacity in science and scientific literacy
   ➢ Co-generate and disseminate knowledge with farmers and students
   ➢ Contribute to higher rates of forecast adoption by the local farmers
   ➢ Trigger student’s interest in STEM

Following the high school students in a longitudinal study to see the impact of their participation in the citizen science initiative and STEM activities on their future careers

Focus on gender studies and self-efficacy, specifically studying how high school female students perceive their participation in citizen science data collection and how they are perceived by their social network.

Once training is completed, the usage of the app is being monitored to guide water management decisions in the field.

8. FUTURE STEPS

➢ A prototype nitrogen sensor is currently being developed to monitor nitrogen in the fields.

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