

A woman wearing a red headband and a red and black striped shirt is carrying a large bundle of firewood on her back. She is walking on a dirt path in a forested area with a steep, eroded hillside in the background. The text is overlaid on the image.

NSF PIRE Food & Water Security 2022 Celebration

Innovation Partnership Building – University of Connecticut

May 16 – 17, 2022

We would like to acknowledge that the land on which we gather is the territory of the Mohegan, Mashantucket Pequot, Eastern Pequot, Schaghticoke, Golden Hill Paugussett, Nipmuc, and Lenape Peoples, who have stewarded this land throughout the generations. We thank them for their strength and resilience in protecting this land, and aspire to uphold our responsibilities according to their example.



THE UNIVERSITY
of
WISCONSIN
MADISON



Overview



PROJECT GOALS



MILESTONES



PROFESSIONAL
DEVELOPMENT FOR
STUDENTS



INTERDISCIPLINARY
RESEARCH
COLLABORATION



IMPACT



REMAINING WORK

Project Goals

This project establishes an international research and education partnership to promote a political-institutional model of science that links **sociological and engineering methods** in a people-centered approach to the human-climate-water-agriculture-energy nexus in the Blue Nile basin (BNB), Ethiopia. Our objectives are to:

(i) improve seasonal hydrologic and crop yield forecasts at scales relevant to farmers and water managers;

(ii) identify and reduce barriers to effective forecast communication and uptake;

(iii) train a new generation of global experts who recognize the political-institutional and climate-ecological dimensions of complex food-energy-water problems

Engineering Milestones

Statistical
forecasts and
resevoir operation

Dynamic seasonal
forecasts

Watershed model
implementation

Groundwater
model
Implementation

Crop yield model

Economic
modeling

Social Science Milestones

Forecast
communication

Qualitative
Data

Household
surveys

Agent based
model (ABM)

Data sharing
application (E-
Ping App)

Citizen Science
Initiative



Professional Development for Students

- Undergraduate research and cross disciplinary training for students
- Conference and workshop presentations
- Brownbag series between undergraduate and graduates & sociology and engineering students
- 3 Internships at IFPRI for UW - Madison & UConn students



Interdisciplinary Research Collaborations

- Probabilistic information games (UConn, University of Wisconsin & Addis Ababa University: BAMS)
- Household surveys & model simulated irrigation and soil moisture estimates
- Combining agent-based and crop productivity models to study farmer's management decisions
- Evaluating the citizen science process and output as contributing to the Sustainable Development Goals
- New partnership with Ethiopian research at IFPRI

Project Goals Revisited

(i) improve seasonal hydrologic and crop yield forecasts at scales relevant to farmers and water managers;

Five forecasts produced (two wet & three dry season)

Onset of rains prediction

2019 KIREMT SEASON RAINFALL PREDICTION - KUDMI

Due to conditions favorable for rain, Kiremt season 2019 is predicted to have normal or slightly above normal (wet) total rainfall. The onset is expected in end of May.

KIREMT SEASON PREDICTION

chance of kiremt start
Onset is expected in the end of May.

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			1	2	3						
4	5	6	7	8	9	10					
11	12	13	14	15	16	17					
18	19	20	21	22	23	24					
25	26	27	28	29	30						

onset probability:

- very low probability of kiremt onset
- low probability of kiremt onset
- moderate probability of kiremt onset
- high probability of kiremt onset

PREDICTED IMPACT TO CROPS

anticipated crop yields

last year (2018) this year (2019)

teff normal teff normal
maize normal maize normal

Teff yields are expected to be slightly lower than last year. Maize yields are expected to be slightly higher than last year.

RECOMMENDATION

You can use this information to make decisions that will benefit crop management on your farm this season.

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			1	2	3
4	5	6	7	8	9
10	11	12	13	14	15
16	17	18	19	20	21
22	23	24	25	26	27
28	29	30			

Kiremt onset is likely to be later this year, in end of May

Expect slightly lower teff yields and slightly higher maize yields, compared to last year.

total kiremt rainfall prediction

The most probable scenario is that Kiremt 2019 will have a similar total amount of rainfall as last Kiremt season.

Normal: 50% chance total rainfall amount will be similar to last year.

Wet: 30% chance total rainfall amount will be higher than last year.

Below: 20% chance total rainfall amount will be lower than last year.

soil moisture

last year (2018): above normal 2018

this year (2019): normal 2019

For additional information, please ask your local agricultural extension.

*Although predictions & adaptations are assumed to be reasonable, individual farm outcomes may vary. Developers assume no legal responsibility.

This information is from the Water and Food Security PIRE project, with support from the U.S. National Science Foundation.

Project Goals Revisited

“We have specifically talked about this when you were here.” –Chair, Water Users Association, Gayta, June 17 2021



(ii) identify and reduce barriers to effective forecast communication and uptake;

The case of the Kiremt 2020 and the November dry spell

- **Gayta prepared**, November dry spell did not disrupt irrigation
- **Koga/Kudmi did not prepare**, water released not adequate; farmers stole water, and several were detained and arrested

Project Goals Revisited



(iii) train a new generation of global experts who recognize the political-institutional and climate-ecological dimensions of complex food-energy-water problems

- US institutions
 - 11 PhD degrees awarded/to-be awarded
 - 1 master degree awarded
 - 2 undergraduate research studies
 - 9 graduate students and 8 undergraduate students at Field Visit
 - Developed an interdisciplinary water-energy-food graduate course
- Ethiopia
 - 6 Ethiopian Graduate Students
 - 9 Ethiopian citizen science high school students

27 publications, 6 *in review*, 9 in preparation

Remaining Work

Conduct policy workshop
(Ethiopia(?)/Washington D.C.) in Fall 2022

Citizen science E-PING training

Continue citizen science data collection
through the end of the project

Explore ways to sustain forecast and data
collection system going forward

Impact *Science*

Developed new ways to understand human security and complex decision-making under uncertainty through the combination of hydro-climatic and social scientific research

Improved aspects of forecast communication with innovative and hyper-local methods of delivery.

Improved the ways that hydrologists/scientists have engaged in developing forecasts, and the ways water managers and farmers have received the information, with a special emphasis on probabilistic thinking.

Provided seasonal prediction on water levels and soil moisture at local scales through a combination of high-resolution sectoral models (seasonal atmospheric forecast, hydrologic model, lake water balance model, groundwater model, and crop yield model); demonstrated how these models can be used to support irrigation management.

Impact *Stakeholders*

Developed new soil moisture sensors & established in situ observation network in BNB

Building capacity for US institutions to conduct interdisciplinary-international research

Developed interdisciplinary course on water-food nexus that can be offered in future years

Impact
*Ethiopian
Institutions*

Increased technical capacity,
namely, receiving training &
equipment for hydrological data
monitoring

At the end of project they will
receive tech transfer on how to
sustain forecasting system in
Ethiopia

Congrats!

Kudos to the team for truly being able to come together from different disciplines, backgrounds and countries to innovate approaches towards food and water security issues in climatic vulnerable remote regions in Sub-Saharan Africa.