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INNOVATION LAB FOR SMALL SCALE IRRIGATION

Innovation Lab For Small Scale Irrigation

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Getting Ahead of the Game: Raising Awareness of Groundwater Depletion in Ethiopia

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Hypothesized impact pathway

Intervention package:

- Game-facilitated experiential learning
- Platform for community-wide discussion about shared vision and ways to improve governance

Outcomes:

- Awareness about system, connections, and social dilemma
- Behavioral change at the individual level
- Rules established, implemented and enforced

Impact:

- Sustainable and equitable NRM

Introduction

- Objective: To improve our understanding of the potential of behavioral experiments (games) as an experiential learning tool to improve common-pool resource management in Ethiopia
- Research questions:
  1) To what extent the intervention can change individual mental model, raising awareness about the biophysical/system characteristics of groundwater resources, social dilemma in common-pool resource management, and the need for shared solutions (institutions and collective action) to address sustainable governance challenges?
  2) To what extent the intervention stimulates or catalyzes conversations among community members about the need and ways to improve governance?
  3) To what extent awareness raising and community discussions lead to actions at both individual resource user level (e.g., crop choice, water saving technology adoption) and community level (e.g., change in rules, establishing procedures for developing rules)?
  4) What are the factors and conditions that are important for the learning effect at both individual/group and community levels?

Methods

- Selected study area and constructed sampling frame based on hydrological assessment, two rounds of field visits, and information collected from woreda officials on kebeles
- Study area: Butajira in central Ethiopia, SE of Addis Ababa
- Target Population: Farm households that use GW for crop irrigation
- Research design: Mixed methods
- Sampling:
  - 39 kebeles in 4 woredas using GW for irrigation - Sampling frame
  - Stratified random selection of 15 treatment kebeles and 15 control kebeles
  - Pick one village, with the help of extension agents, in each selected kebele
  - Randomly (when practical) select 5 male and 5 female participants to play the game separately but simultaneously

Men playing game March 2021. Photo credit: Fekadu Gelaw

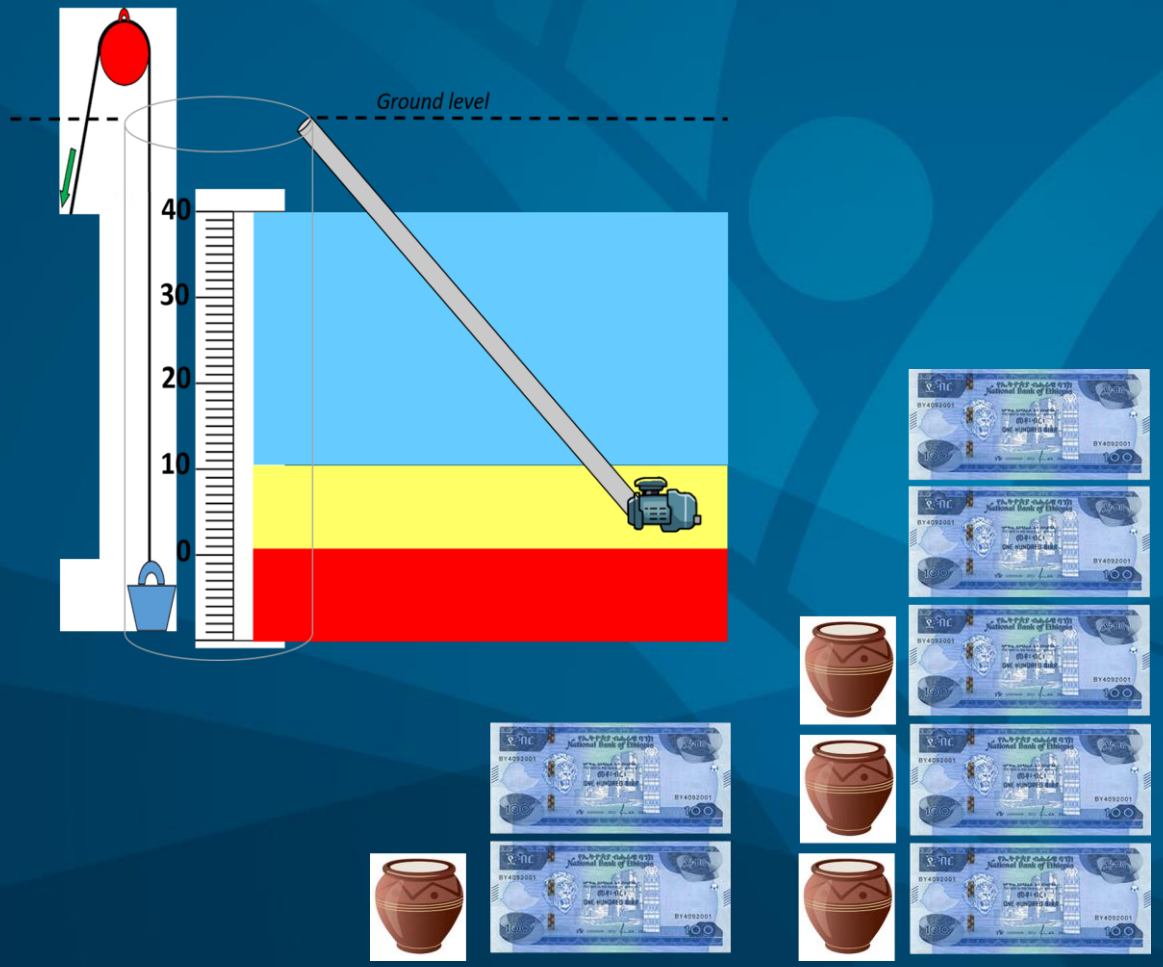
Activities and data collection

Timing	Activity	Treatment	Control
Before intervention (beginning of field work)	Baseline community survey/FGD		✓ Yes
Visit to treatment village to implement intervention - Part 1	• Baseline community survey/FGD	✓ Yes	
	• Pre-game player survey	✓ Yes	
	• Games	✓ Yes	
	• Post-game player survey	✓ Yes	
Visit to treatment village to implement intervention - Part 2	Community debriefing meeting	✓ Yes	
Approx. 6 months after intervention implementation	Endline community survey/FGD	✓ Yes	✓ Yes
	Endline player survey (TBD)	Maybe	

Groundwater game adapted from a game developed/piloted in India (Meinzen-Dick et al. 2018)

- Games:
  - Groups of 5 men or women
  - Choose crop A or B with different water use & returns → Locally relevant crop types
  - See effect on water table
  - Multiple years, with and without communication, and optional group election of rules

- Community debriefing
  - How this relates to own experiences and challenges farming
  - Lessons and insights the participants gained from the experience
  - Possible solutions



- Meinzen Dick, R., M. Janssen, S. Kandikuppa , R. Chaturvedi, K. Rao and S. Theis. 2018. Playing Games to Save Water: Collective Action Games for Groundwater Management in Andhra Pradesh, India. World Development 107(July):40 53.

Women playing game, March 2021. Photo credit: Fekadu Gelaw

Early results

- Qualitative:
  - Baseline community FGD
  - Initial evidence of social learning effect
    - Mental model: pre- and post-game comparison
    - Community debriefing
- Quantitative: Game results

Existing water rules in communities (FGD)

- Surface water rules are more common in communities compared to groundwater rules
  - Most common: *redirecting river canals/ building a dam is prohibited*
- Few communities had a rule related to groundwater
  - Most common: *digging more than one well on one's land not allowed*
- Few communities believed that there should be rules governing water, particularly groundwater

Total amount of water consumed for irrigation by all players in each round

Game, women, March 2021. Photo credit: Fekadu Gelaw

Group election of rules (Game 3)

- All groups enforced crop choice rules in game 3
  - Only 2 groups chose to just monitor water levels while freely choosing crops
- Most elected leaders to monitor player choices and water levels, and sometimes to change the rule
  - More women groups tended to elect a leader
- Most imposed sanctions
  - Mostly monetary sanctions (variable; 10 – 1500 birr)
  - Social isolation; cultivation / water bans
  - Progressive sanctions

	Leader	No leader	Total
Female	12	3	15
Male	8	7	15
Total	20	10	30

"We need sincerity and openness... When we cultivate these crops by rotation we will have two benefits; one save our water, and for the market the product may not be over-supplied."

Game with rules discussion
Male player, Geoogeti 2

Group election of rules (Game 3)

- Groups were more likely to alter their rule according to how the groundwater changes between rounds; some groups had constant rather than reactive rules
- Female groups recorded more violations to group elected rules, but imposed less fines on violators
- All groups clearly played the game / assessed the situation as if in real life

	Reactive	Constant	Total	Violations
Female	10	5	15	21
Male	8	7	15	10
Total	18	12	30	31

Game, women, March 2021. Photo credit: Fekadu Gelaw

Preliminary regression results: Total amount of water consumed for irrigation by all players in the round

	Male_ols	Male_glm	Female_ols	Female_glm
Rounds 2-7	**mostly significant**			
Game type (within game treatment): With communication				
Game type (within game treatment): Group election of rules			-	-
Interactions of rounds and game types	**mostly insignificant**			
Group average_Age of respondent				
Group average_Education level of household Head			--	---
Group average_Respondent is household head			---	---
Group average_ Farming is the primary livelihood option during dry season				
Ground average_Cultivated land in ha			-	-
Group average_Household owns water pump			-	--
Group average_Use groundwater for irrigation			+++	+++
Group average_How long the Household Head lived in the village				
Group average_How many out of ten would show up for help?	+	++		
Constant			+++	+++
Observations	**287**	**287**	**279**	**279**
r2	**0.346**		**0.378**	
r2_a	**0.272**		**0.305**	

Mental model: Before and after game

Our current groundwater use will affect the sustainability of the resource	After		Before	
	Freq.	%	Freq.	%
Strongly agree	22	14.7	8	5.3
Agree	90	60.0	64	42.7
Disagree	37	24.7	66	44.0
Strongly disagree	1	0.7	9	6.0
Not applicable			3	2.0

No need for rules restricting type of crops to be irrigated	After		Before	
	Freq.	%	Freq.	%
Strongly agree	16	10.7	41	27.3
Agree	31	20.7	55	36.7
Disagree	65	43.3	44	29.3
Strongly disagree	38	25.3	8	5.3
Not applicable			2	1.3

Need collective actions to establish and maintain community water structures	After		Before	
	Freq.	%	Freq.	%
Strongly agree	65	43.3	68	45.3
Agree	79	52.7	79	52.7
Disagree	1	0.7	3	2
Strongly disagree	5	3.3		

Mental model: Before and after game

No need for rules to regulate surface water use	After		Before	
	Freq.	%	Freq.	%
Strongly agree	15	10.0	21	14.0
Agree	12	8.0	37	24.7
Disagree	70	46.7	52	34.7
Strongly disagree	41	27.3	26	17.3
Not applicable	12	8	14	9.3

No need for rule to limit wells or ground water use	After		Before	
	Freq.	%	Freq.	%
Strongly agree	18	12.0	36	24.0
Agree	34	22.7	47	31.3
Disagree	65	43.3	53	35.3
Strongly disagree	32	21.3	12	8.0
Not applicable	1	0.7	2	1.3

Community members should act collectively to manage groundwater	After		Before	
	Freq.	%	Freq.	%
Strongly agree	40	26.7	32	21.3
Agree	106	70.7	96	64.0
Disagree	3	2.0	21	14.0
Strongly disagree	1	0.7	1	0.7

Post-game player reflections

Game fun?	relatable?	Educational?
99%	97%	100%

"I learned that we have to the groundwater equitably and fairly There should be rules that govern the use of groundwater"

Male, Mekicho
-Village community has no water rules; people don't think they should have rules

"I learned that groundwater has limits and thus, to use water for generations we have to start to use water wisely . Otherwise it can be exhausted"

Female, East Meskan
-Village community already has some rules

"Before the game I didn't think that groundwater can get lower and lower by our crop choices in the irrigation. But after the game I have a lot of information about how to save and use our groundwater."

Female, Googeiti 1
-Village community has no water rules; people don't think they should have rules

"I suggest that this game shall be exercised by many farmers to let them have a good knowledge like us. So I recommend the game to include as many farmers as possible"

Female, East Meskan
-Village community has surface water rules

Conclusions

- Understanding behavior:
  - Work in progress
  - None of the current group characteristics are useful explaining men's choices, except for "trust". Next round will explore:
    - Community characteristics
    - Relationship among players
    - Perceptions
    - Production, asset, and market participation
- Social learning:
  - Qualitative indication of immediate learning effect at both individual and community levels
- Next steps:
  - Follow-up visits to the communities will assess to which extent the insights brought about by the games influence groundwater governance over the long term.

Game, men and women, March 2021. Photo credit: Fekadu Gelaw

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Community debriefing meeting, March 2021. Photo credit: Fekadu Gelaw

Extra slides

በመስኖ የሚለሙ የጓሮ አትክልቶች

○ውሃ ቆጣቢ አትክልቶች (water saving)

- ○ጎመን
- ○ካሮት
- ○በቆሎ



•ውሃ ጨራሽ አትክልቶች (water intensive)

- ቲማቲም
- ቀይ ሽንኩርት


Crop choices: Water intensive (WI) and Water saving (WS)