

FIELD EVALUATION OF BIOPOLYMER SEALANTS TO CONTROL SEEPAGE FROM EARTHEN IRRIGATION CANALS

Intern

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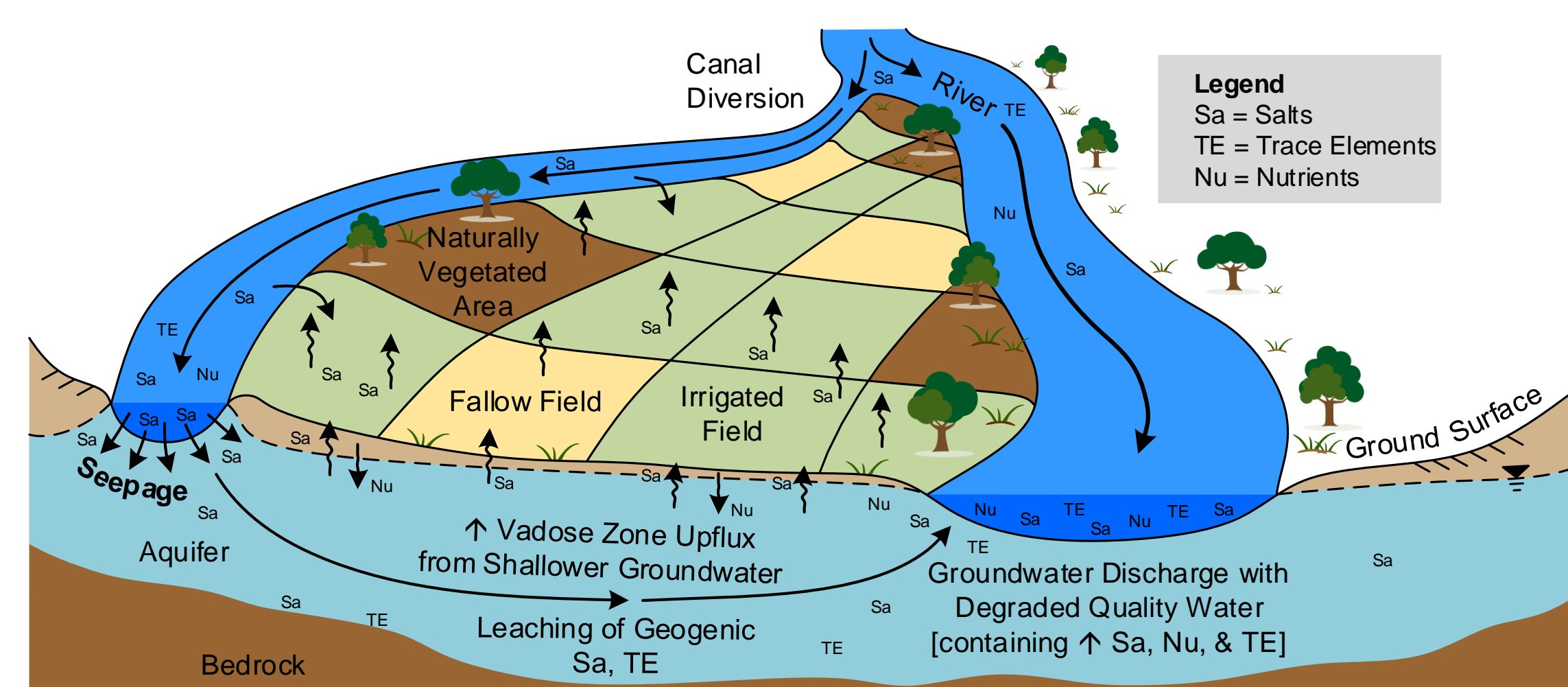
Faculty and Field mentors

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PROJECT INTRODUCTION

A large amount of water diverted for irrigated agriculture in the Cache la Poudre River Basin seeps from earthen canals during conveyance to irrigated fields and results in a variety of environmental and economic damages. Canal seepage not only leads to water loss, but also contributes to mobilization and transport of subsurface pollutants and to shallow saline water tables which reduce crop yields. This project evaluates the promise of biopolymers to reduce seepage from unlined irrigation canals in Northern Colorado and elsewhere.



The picture above shows a conceptual schematic of water loss and negative environmental impacts from canal seepage

INTERNSHIP GOALS

The internship was focused on the extension component of the canal sealing project: to cooperate with agricultural stakeholders in finding best practices of canal seepage control using polymer sealants for improved irrigation water management.

HOW DOES THIS APPLY TO YOUR EDUCATION

This is the topic of my PhD dissertation. My research has a large component centered around fieldwork to quantify canal seepage before and after biopolymer application. The internship helped me to establish networks with the canal company staff and the farmers, and these work-relationships will help me in my future research.

WHAT YOU DID

- Interacted with the canal company [Larimer & Weld Irrigation (LWI)] and informed them about the importance of conducting this research. This task was performed through a few group meetings with the company staff to share our canal seepage control data we published recently (Lund et al. 2021).
- Worked with the canal company to identify canal reaches with a seepage rate that exceeds the expected measurement error.
- Interacted with some local farmers about our research, informing them about the benefits of controlling canal seepage and the damages it can cause if not controlled.
- Took the staff of the canal company onboard in our pre and post biopolymer application seepage quantification. A company intern helped us while collecting the field seepage data and accompanied during the biopolymer application.
- Identified a candidate biopolymer, Xanthan Gum, through our applied lab research and treated a 1.8-mile reach of the Larimer and Weld Canal with the identified biopolymer. Field seepage tests were performed before and after the polymer application. These tasks were completed under a research project funded by Colorado Agriculture Experiment Station.
- At the end of the irrigation season and our field research campaign, we shared our findings and learnings with LWI in a technical report. We have scheduled a follow-up meeting with the company to answer their questions and devise a strategy of continuing this work in the future.

FIGURES AND PICTURES FROM THE INTERNSHIP



- (a) Schematic of the lab experimental setup to identify promising biopolymer
 (b) A field seepage measurement test in progress
 (c) Biopolymer application in progress

WHAT YOU LEARNED

- The most important outcome was building collaborative work-relationships with the agricultural community. Under this collaboration and under my advisers' supervision, I will be assisting the canal company in submitting a research proposal to the Colorado Water Plan program.
- The research conducted along with the internship revealed that treating the canals with Xanthan Gum can reduce seepage by 60-80%. The results are summarized in the section below.

RESULTS

Location	Round	ADCP Sr no.	Q, cfs	COV (%)	Start time	End time	Storage change ΔS/ΔT, cfs	Avg Q, cfs	Avg Storage change ΔS/ΔT, cfs	Seepage rate, cfs	Reach length, mi	seepage per mile	Seepage as a percent of upstream flow	
Thursday, July 29, 2021														
Test 1	Upstream	1	861	138	2.51	10:30:52 AM	10:55:35 AM	-0.27	141.50	-0.10	4.85	1.8	2.69	3.43
		2	567	145	2.61	12:06:38 PM	12:55:17 PM	0.07						
Test 1	Downstream	1	567	135	3.84	9:50:08 AM	10:51:55 AM	-0.27	136.75	0.07				
		2	861	138.5	3.81	12:17:37 AM	12:39:59 AM	0.07						
Wednesday, August 18, 2021														
Test 2	Upstream	1	567	117.88	1.16	10:44:18 AM	11:03:00 AM	0.09	117.13	-0.22	6.53	1.8	3.63	5.58
		2	861	116.39	1.16	12:53:03 PM	1:13:54 PM	-0.53						
Test 2	Downstream	1	861	109.00	1.84	10:38:58 AM	10:57:05 AM	0.09	110.82	-0.53				
		2	567	112.65	1.25	12:53:54 PM	1:10:57 PM	-1.23						
Test 3	Upstream	1	567	116.91	4.39	3:21:58 PM	3:50:18 PM	2.25	119.32	0.51	10.11	1.8	5.62	8.48
		2	861	121.73	1.95	4:31:44 PM	4:52:42 PM	-1.23						
Test 3	Downstream	1	861	106.21	1.46	3:19:55 PM	3:37:51 PM	2.25	108.70	-1.23				
		2	567	111.19	1.75	4:38:52 PM	4:56:36 PM	-1.23						
Tuesday, August 31, 2021														
Test 4	Upstream	1	567	128.98	2.35	9:37:23 AM	10:01:15 AM	0.60	129.67	0.58	6.78	1.8	3.76	5.23
		2	861	130.35	2.89	12:15:04 PM	12:36:34 PM	0.57						
Test 4	Downstream	1	2285	121.17	1.68	9:44:52 AM	10:07:25 AM	0.60	122.31	0.57				
		2	567	123.44	0.7	9:44:52 AM	10:07:25 AM	0.57						
Test 5	Upstream	1	567	132.814	2.62	2:05:37 PM	2:39:38 PM	-0.17	133.40	-0.40	5.14	1.8	2.86	3.85
		2	2285	133.991	2.76	3:24:19 PM	3:48:26 PM	-0.63						
Test 5	Downstream	1	2285	129.089	1.5	2:04:39 PM	2:32:11 PM	-0.17	128.66	-0.63				
		2	567	128.238	2.99	3:24:55 PM	3:47:35 PM	-0.63						
Xanthan Gum Application (Wednesday, Sep 01, 2021)														
Test 6	Upstream	1	567	118.349	3.77	3:41:18 PM	4:00:59 PM	-0.53	114.40	-0.31	1.34	1.8	0.74	1.17
		2	2285	110.448	3.09	5:05:13 PM	5:28:38 PM	-0.09						
Test 6	Downstream	1	2285	112.068	1.02	3:40:53 PM	4:04:47 PM	-0.53	113.37	-0.09				
		2	567	114.673	2.1	5:06:45 PM	5:25:16 PM	-0.09						
Test 7	Upstream	1	567	118.88	3.97	6:58:10 PM	7:14:36 PM	0.87	117.91	0.51	2.56	1.8	1.42	2.17
		2	2285	116.94	5.36	8:10:46 PM	8:38:13 PM	0.15						
Test 7	Downstream	1	2285	111.152	2.9	6:59:08 PM	7:22:05 PM	0.87	114.84	0.15				
		2	567	118.529	1.91	8:17:53 PM	8:42:26 PM	0.15						

NEXT STEPS

- Figuring out the easiest and most effective method of broadcasting the polymers on the canal water surface.
- Performing field experiments on longer canal reaches.

REFERENCES

Lund, A. R., Martin, C. A., Gates, T. K., Scalia IV, J., & Babar, M. M. (2021). Field evaluation of a polymer sealant for canal seepage reduction. *Agricultural Water Management*, 252, 106898.