KU LEUVEN

ARENBERG DOCTORAL SCHOOL
FACULTY OF SCIENCE & ENGINEERING SCIENCE

A socio-material approach to water access struggles of smallholder farmers

Co-shaping actors, institutions, and infrastructures in Ağlasun, Turkey



Adnan MİRHANOĞLU

Supervisors:
Prof. dr. Maarten Loopmans
Prof. dr. Pieter Van den Broeck
Co-Supervisor:
Assoc. Prof. Dr. Gül Özerol
(University of Twente)

Dissertation presented in partial fulfilment of the requirements for the degree of Doctor of Science: Geography and Engineering Science: Architecture

September 2023

A socio-material approach to water access struggles of smallholder farmers

Co-shaping actors, institutions, and infrastructures in Ağlasun, Turkey

Adnan MİRHANOĞLU

Supervisors:

Prof. dr. Maarten Loopmans

Prof.dr. Pieter Van den Broeck

Co-Supervisor:

Assoc. Prof. dr. Gül Özerol

(University of Twente)

Members of the Examination Committee:

Prof. dr. Chris Kesteloot

Prof. dr. Jeroen Poblome

Dr. Xenia Katsigianni

Dr. Sinem Kavak (Lund University)

Dr. Jean-Philippe Venot

(French National Research Institute (IRD))

Prof. dr. Gert Verstraeten (chair)

Dissertation presented in partial fulfilment of the requirements for the degree of Doctor of Science: Geography and Engineering Science: Architecture

September 2023

© 2023 Adnan Mirhanoğlu

Uitgegeven in eigen beheer, Adnan Mirhanoğlu, Division of Geography and Tourism, Celestijnenlaan 200E box 2409 B-3001 Heverlee, Belgium.

Alle rechten voorbehouden. Niets uit deze uitgave mag worden vermenigvuldigd en/of openbaar gemaakt worden door middel van druk, fotokopie, microfilm, elektronisch of op welke andere wijze ook zonder voorafgaandelijke schriftelijke toestemming van de uitgever.

All rights reserved. No part of the publication may be reproduced in any form by print, photoprint, microfilm, electronic or any other means without written permission from the publisher.

To the loving memory of my father, Hemedê Hesenê Eyşanê and my admirable mother, Edla mala Xano

ACKNOWLEDGEMENT

Coming from a smallholder farming family, I would never imagine myself having a PhD degree. I was born into many injustices, and I had to make a lot of effort to change my destiny. It would not be possible to have a PhD without the very meaningful solidarity of the people I met. Although my name is written as the author of this PhD, it is the outcome of these actions of lovely solidarity. Therefore, this PhD not only belongs to me but also to the lovely people who have been in solidarity with me.

Maarten, I am deeply grateful for your continuous and meaningful support. I feel very lucky to work with you. I admire how you take care of people around you. Our communication was beyond the typical relationship between a PhD researcher and a supervisor. In the last five years, I have sometimes seen you as a friend, comrade, and family member. I really enjoy our discussions, and I am very impressed by your intellectual capital. If you were born in the 19th or 20th century, you could have become a very influential philosopher, and I believe this is still possible in this century. So, I am very curious about your book project. I look forward to continuing our academic and non-academic sharing.

Gül, I still remember very well our first email exchange in 2019. We didn't know each other before, and I was looking for a research collaboration. I sent you a very long email, and you replied to my email cordially. We started our collaboration quickly, which made me very excited and happy. I really admired your patience, care, and constructive feedback. I felt very relieved to know that there was somebody ready to support me if I faced any obstacles in my research. Thank you for your valuable support, and I hope to continue our communication and collaboration.

Pieter, I am very grateful for your help, especially at the beginning and end of my PhD. Our discussions helped me find my way and engage with different theoretical frameworks. You helped me discover theory of access that affected my entire PhD trajectory in a very positive way.

I also want to thank to each jury member, Jean-Philippe Venot, Chris Kesteloot, Sinem Kavak, Xenia Katsigianni, and Jeroen Poblome, and the chair, Gert Verstraeten. Your detailed comments have helped me improve the quality of my PhD and many thanks for taking your time for this research.

I met lovely people in Belgium. Although being an immigrant is not easy and has many difficulties, these lovely people made me feel home. We touched each other's lives, and I am very grateful for meeting these lovely people. Special thanks go to Valia, Alba, Hélène, Anastasia, Maria, Nick, Margot, Seyhan, Ufuk, Clara, Janne, Inte, Dılşad, Dominique & Olivier, Damla, Catalina, Loïca, Karin, Marjan, Atahan, Sercan, Boshra, Amin and Caro.

People living in different parts of the world were also in solidarity with me. I wish to thank Deniz Alan Held, Ethemcan Turhan, Irmak Ertör, Ali Kerem Saysel, Duygu Kaşdoğan, Ekin Kurtiç, Zeynep Kadirbeyoğlu, Kiraz Özdoğan, and Koray Sakarya.

I would like to thank my colleagues and administrative staff in the Division of Geography and Tourism, and the Sagalassos Archeological Research Project. Alex, Max, Bianca, Monica, Ate, Anton, Jan, Arie, Nicole, Vanessa, Veronica, Coşku, Jinat, Nathalie, Kato, Kamal, Anirudh, Olena, Jingyu, Svongwa, Intan, Renhao, Mona, Korneel, Felix, Renske, Lisa, Lieasa, Karst, Lee, Ran, Wesley, Qianwen, Pieter, Danyang and Getaneh, thank you for the jokes and interesting discussions during coffee and lunch breaks. Saga people, Ralf, Danai, Özge, Johan, Vera, Veerle, Dries, Bas, Stef, Sam, Dorien, Frans and Patrick, thanks for sharing your time, especially during the summer campaigns in Sagalassos/Ağlasun. I am especially grateful for the continuous support of Ebru Torun. She helped me a lot find contacts in the field. I also wish to thank the bachelor's and master's students that I mentored and collaborated with; Nele Tops, Wouter Van den Broeck, Enrico Roets, Ebru Akgün and Ruben Joos.

I wish to thank the farmers in Ağlasun for sharing their life stories and struggles, and other participants for sharing their time for this research. Without their contributions, it would not have been possible to write this thesis. I owe special thanks to Özkan Taştekin, who introduced me to the farmers in Ağlasun.

Last but not least, many thanks to my family members. My father, *Hemedê Hesenê Eyşanê*, spent his entire life on his children. He couldn't continue his education after primary school. Therefore, he did his best to ensure that each of us could attend schools. His loving memories always live with me. My mother, *Edla mala Xano,* is the most precious person in my life. I admire her patience and care a lot. My sister, Fidan Mirhanoğlu, showed me the importance of not giving up. My brother, Şahin, helped me make courageous decisions in my life. My sister, Türkan, was always there to listen to me. My brother, Şeyhmus, helped me discover the different aspects of life. My sister, Sultan, was always supportive and caring for me. Finally, my uncle, Tahir, always inspired me. I grew up with his success stories, which motivated me and helped me find my own way.

Brussels, 27 August 2023

SUMMARY

Smallholder farmers are key users of irrigation water, and equitable access to water is vital for sustaining agriculture. Without smallholder farmers, global food production will drastically decrease, as more than one-third of global food production comes from small farms of two hectares or less in size. However, most smallholder farmers face serious issues in accessing sufficient water. Given the urgency and significance of the global challenge of equitable access to water for smallholder farmers, it is crucial to understand and explain how farmers obtain access to water, the conditions for equitable access, and the reasons for the (structural) inequalities in access to water.

Water governance dynamics and the inequalities they produce have been addressed by various scholars in critical water research. I broadly categorized how critical water research engages with different theoretical frameworks into two approaches. The first approach involves engaging with a school of thought that focuses on one perspective in detail. The second is to engage with an 'overarching' theory that fits in almost all situations and offers analytical insights embedded in water governance. However, these types of 'overarching' theories tend to insufficiently explain the overdetermined contingencies of local and temporally specific situations. In this thesis, I conceptualize 'socio-material approach', intertwining 'the social' with 'the material' perspectives, as a third approach to understanding how water is managed, distributed, and used by whom, when, and under what conditions, and why there are inequalities in access to water. In this thesis, I explain how critical institutional, political ecology, and socio-technical approaches can help to reveal the agency of different actors and explain how they become winners or losers in terms of water access. Building on these approaches, I synthesize insights from the common pool resource (CPR) theory, theory of access, institutional bricolage, science and technology studies, infrastructural violence, accumulation by dispossession, and water grabbing. I aim to show how these different theories that prioritize mostly either the 'social' or the 'material' perspective in critical water studies can interact with each other to shape a 'socio-material approach', which stresses the interactions between actors, institutions and infrastructures. By introducing and applying this 'socio-material approach', I aim to demonstrate how to tinker the 'bricolage' of various theoretical frameworks to explain the specific reasons of inequalities in access to water.

Through three ethnographic case studies conducted in Ağlasun, a rural town in the southwest of Turkey, I answer the research question: "how and why actors, institutions, and infrastructures form a water governance system and why some actors can easily access water while others cannot". I conceptualize irrigation systems as institutional, technical, natural,

individual, and collective processes, ‘all at once’. In each case study, I explored the water governance system from distinct conceptual and empirical perspectives.

In the first case study, I examined how institutions (rules and social relations) co-shape access to water. My findings show that social distance to authorities, like spatial distance to a water source, influences inequalities in access to water. I conceptualize the farmers that invest in building relations with authorities as “social head-enders”, and I investigate how those social head-ender farmers manage to ‘bend the rules’ and access water illicitly, although they are far away from the water source.

In the second case study, I investigated how various infrastructures co-shape access to water. I examined how the switch from surface irrigation to drip irrigation entailed an interaction of institutional re-arrangements, a bricolage of material infrastructures and strategizing actors. By introducing and applying the concept of ‘socio-material bricolage’, I show how actors, institutions, and material infrastructures are interdependent and mutually shaped by individual and collective agency. In the studied case, the drip irrigation technology introduced by the local municipal government significantly affected the institutional arrangements. I focus on how new infrastructure affects and co-shapes institutions of water distribution, the operation and maintenance of irrigation canals, and water fee rules.

In the third case study, I explored how actors co-shape access to water. I examined how the arrival of the new bottled-water company, together with the existing bottled-water company, co-shaped access to water and the struggles among farmers and bottled-water companies to access water. This case study provided two main insights. First, water was grabbed through bending the rules, institutions of clientelism, and ambiguities in the legislation exploited by the bottled-water companies. Second, various infrastructures, such as fencing water sources and water-saving agricultural technologies, were used to grab water and conceal the scale of grabbing. The strategies of bottled-water companies to commodify and control water have caused the dispossession of local farmers from the water sources they have used for centuries.

The results of the three case studies underline the importance of institutional, material, and social changes as well as the interactions of these changes in irrigation systems. These changes increased the conflicts in access to water by creating privileges for some actors to access water while simultaneously causing the exclusion of other actors.

The findings of my research could help smallholder farmers fight the injustices they face on a daily basis. I demonstrate the crucial role of locally embedded institutions and collective action. Such institutions strengthen collective rulemaking, which increases the potential of smallholder farmers to oppose and counteract external institutions that are introduced by powerful actors. Therefore, my solidarity recommendations for smallholder farmers are to find ways to defend and strengthen local collective action and solidarity-based institutions, such as collective canal cleaning and the örüm system, related to specific infrastructures and institutions. Although giving up these institutions may look beneficial for farmers in the short term, preserving them can enhance the capacity of farmers to fight injustices to access water in the long term.

SAMENVATTING

Kleine boeren zijn de belangrijkste gebruikers van irrigatiewater en eerlijke toegang tot water is van vitaal belang voor de instandhouding van de landbouw. Zonder kleine boeren zal de wereldwijde voedselproductie drastisch afnemen, aangezien meer dan een derde van de globale voedselproductie afkomstig is van kleine boerderijen van twee hectare of minder. De meeste kleine boeren hebben echter ernstige problemen om toegang te krijgen tot voldoende water. Gezien de mondiale urgentie en het belang van eerlijke toegang tot water voor kleine boeren, is het cruciaal om te begrijpen en verklaren hoe boeren toegang krijgen tot water, wat de voorwaarden zijn voor eerlijke toegang en wat de redenen zijn voor de (structurele) ongelijkheid in toegang tot water.

De dynamieken van waterbeheer en de ongelijkheden die daaruit voortkomen zijn door verschillende wetenschappers in kritisch wateronderzoek aan de orde gesteld. Ik heb de manier waarop kritisch wateronderzoek zich bezighoudt met verschillende theoretische kaders in twee benaderingen onderverdeeld. De eerste benadering betreft een denkschool die zich in detail richt op één perspectief. De tweede benadering houdt zich bezig met een 'overkoepelende' theorie die in bijna alle situaties past en analytische inzichten biedt die zijn ingebed in het waterbeheer. Dit soort 'overkoepelende' theorieën hebben echter de neiging om de ‘overgedetermineerde’ contingenties van lokale en tijdspecifieke situaties onvoldoende te verklaren. In dit proefschrift stel ik een derde 'socio-materiële benadering' voor, waarbij 'het sociale' conceptueel met 'het materiële' wordt verweven, om te begrijpen hoe water wordt beheerd, gedistribueerd en door wie, wanneer en onder welke omstandigheden het wordt gebruikt en waarom er ongelijkheden bestaan in de toegang tot water. Ik leg uit hoe kritische institutionele, politiek ecologische en socio-technische benaderingen kunnen helpen om de agency van verschillende actoren bloot te leggen en te verklaren hoe zij winnaars of verliezers worden in termen van toegang tot water. Voortbouwend op deze benaderingen synthetiseer ik inzichten uit de *common pool resource* (CPR) theorie, toegangstheorie, institutionele bricolage, wetenschaps- en technologiestudies, infrastructureel geweld, accumulatie door onteigening en watergrabbing om aan te tonen hoe deze verschillende theorieën, die in kritische waterstudies meestal de voorkeur geven aan ofwel het 'sociale' ofwel het 'materiële' perspectief, met elkaar kunnen interageren om een 'socio-materiële benadering' te vormen, die de nadruk legt op de interacties tussen actoren, instellingen en infrastructuren. Op basis van deze socio-materiële benadering kunnen de specifieke redenen van ongelijkheden in de toegang tot water beter verklaard worden.

Aan de hand van drie etnografische casestudies, uitgevoerd in Ağlasun, een plattelandsstad in het zuidwesten van Turkije, beantwoord ik de onderzoeksvraag: "hoe en waarom vormen actoren, instellingen en infrastructuren een waterbestuursysteem en waarom hebben sommige actoren gemakkelijk toegang tot water dan andere"? Irrigatiesystemen worden

geconceptualiseerd als tegelijkertijd institutionele, technische, natuurlijke, individuele en collectieve processen. In elke casestudy onderzocht ik het waterbeheersysteem vanuit verschillende conceptuele en empirische perspectieven.

In de eerste casestudy wordt geanalyseerd hoe instituties (regels en sociale relaties) samen de toegang tot water vormgeven. Mijn bevindingen toonden aan dat zowel de sociale afstand tot autoriteiten, als de ruimtelijke afstand tot een waterbron, beide de ongelijke toegang tot water beïnvloeden. Ik beschouw de boeren die inzetten op het opbouwen van relaties met autoriteiten als "sociale koplopers", en onderzocht hoe deze erin slagen om "de regels te omzeilen" en illegaal toegang te krijgen tot water, hoewel ze ver verwijderd zijn van de waterbron.

In de tweede casestudy werd onderzocht hoe verschillende infrastructuren samen de toegang tot water vormgeven door te analyseren hoe de overstap van oppervlakte-irrigatie naar druppelirrigatie een interactie van institutionele herschikkingen en een bricolage van materiële infrastructuren en strategische actoren met zich meebracht. Door het concept 'socio-materiële bricolage' te introduceren en toe te passen werd duidelijk hoe actoren, instituties en materiële infrastructuren onderling afhankelijk zijn en wederzijds gevormd worden door individueel en collectief handelen. De bestudeerde casus toonde aan dat de druppelirrigatietechnologie die door de lokale gemeentelijke overheid werd geïntroduceerd een aanzienlijke invloed heeft op de institutionele arrangementen. De nieuwe infrastructuur gaf de instellingen voor waterdistributie, de exploitatie en het onderhoud van irrigatiekanalen en de regels voor watertarieven mede vorm.

In de derde casestudy analyseerde ik hoe actoren samen de toegang tot water vormgeven door te onderzoeken hoe de komst van het nieuwe flessenwaterbedrijf, samen met het bestaande flessenwaterbedrijf, de toegang tot water en de strijd tussen boeren en flessenwaterbedrijven om toegang tot water mede constitueerden. Deze casestudy leverde twee belangrijke inzichten op. Ten eerste werd water verkregen door het omzeilen van de regels, door cliëntelisme en door dubbelzinnigheden in de wetgeving die door de flessenwaterbedrijven werden uitgebuit. Ten tweede werden verschillende infrastructuren, zoals het omheinen van waterbronnen en waterbesparende landbouwtechnologieën, gebruikt om water te grijpen en de omvang van het graaien te verbergen. De strategieën van de flessenwaterbedrijven om water te commercialiseren en te controleren hebben ervoor gezorgd dat lokale boeren werden beroofd van de waterbronnen die ze eeuwenlang gebruikten.

De resultaten van de drie casestudies onderstrepen het belang van institutionele, materiële en sociale veranderingen en de wisselwerking tussen deze veranderingen in irrigatiesystemen. Deze veranderingen verhoogden de conflicten in de toegang tot water door privileges te creëren voor sommige actoren ten koste van anderen.

De bevindingen van mijn onderzoek kunnen kleine boeren helpen in hun strijd tegen het onrecht waar ze dagelijks mee te maken hebben. De rol van lokaal verankerde instituties en collectieve actie blijkt hierin cruciaal. Dergelijke instellingen versterken de collectieve besluitvorming, waardoor kleine boeren meer mogelijkheden hebben om zich te verzetten tegen externe instellingen die door hegemonische actoren worden geïntroduceerd. Daarom adviseer ik kleine boeren om manieren te vinden om lokale collectieve actie en op solidariteit gebaseerde instituties te verdedigen en te versterken, zoals bijvoorbeeld het collectief dat kanalen schoonmaakt en het örüm systeem, gerelateerd aan specifieke infrastructuren en instituties. Hoewel het opgeven van deze instellingen op de korte termijn gunstig kan lijken voor boeren, kan het behoud ervan de capaciteit van boeren om te vechten tegen onrechtvaardigheden in de toegang tot water op de lange termijn vergroten.

Table of Contents

1. INTRODUCTION 1

1.1. Research problem: struggles to access water in the changing countryside 1

1.2. Socio-material approach: the social in the material and the material in the social 3

1.3. Studying access to equitable water 5

1.4. Research objective and research questions 8

1.5. Scientific output and communication 11

1.6. Structure of the thesis 12

1.7. References 15

2. METHODOLOGY 19

2.1. Case selection 19

2.2. Water governance in Ağlasun 23

2.3. Data collection 24

2.3. Data analysis 27

2.4. Fieldwork experience in Ağlasun, Turkey 29

2.5. Reflections on positionality 33

2.6. References 37

3. SOCIAL HEAD-ENDERS: ACCESS AND AUTHORITY IN IRRIGATION GOVERNANCE 39

3.1. Introduction 40

3.2. Theoretical framework: access and authority in irrigation governance 41

3.3. Research materials and methods 44

3.4. Results 48

3.5. Discussion and conclusion 55

3.6. References 58

4. SOCIO-MATERIAL BRICOLAGE: (CO) SHAPING OF IRRIGATION INSTITUTIONS AND INFRASTRUCTURES 63

4.1. Introduction 64

4.2. Socio-material bricolage in irrigation systems 65

4.3. Irrigation in Ağlasun, southwest Turkey 70

4.4. The introduction of drip irrigation as socio-material bricolage 74

4.5. Discussion and conclusion: aggregation, alteration and articulation in socio-material bricolage 84

4.6. References 86

5. WATER GRABBING THROUGH INFRASTRUCTURES AND INSTITUTIONS IN RURAL TURKEY 91

5.1. Introduction 92

5.2. Water grabbing through institutional arrangements and infrastructures 93
5.3. Case study 97
5.4. The mechanisms and processes of water grabbing in Ağlasun 99
5.5. Discussion and conclusion 111
5.6. References 113
6. CONCLUSION 117
6.1. Revisiting the research questions 117
6.2. Theoretical contributions of the thesis 119
6.3. Solidarity recommendations for smallholder farmers 122
6.4. Directions for future research 123
6.5. References 125
7. ANNEXES 127
8. ABOUT THE AUTHOR 138

1. INTRODUCTION

In this chapter, I first explain the problem of water access issues for smallholder farmers. Then, I describe the socio-material approach, the analytical framework of the whole PhD thesis. After that, I elaborate on the iterative process of the thesis and how I engaged with different bodies of literature after each fieldwork. Then, I explain the research objective and research questions, which are followed by a scientific output and communication section. Finally, I provide an overview of the thesis outline.

1.1. Research problem: struggles to access water in the changing countryside

The central focus of this thesis is to understand how access to irrigation water is organized and contested in Ağlasun, and to examine the conditions that make some farmers the 'winners' and others the 'losers' in the water struggles they are waging. The reasons why I chose to focus on this topic are both personal and societal.

The catchphrase 'geography is destiny' is one of my favourite phrases to reflect on. Although I am not sure it holds true in every situation, there is definitely an intimate relationship between the reasons to conduct this research focusing on water and my personal experiences. I was born in Stililê[1], a small rural village in the south-east of Turkey. Located in the area between Tigris and Euphrates rivers, known as ancient Mesopotamia, almost all local people had land to cultivate. I was born into a smallholder farming family highly dependent on irrigation water. There were many fights among farmers over unfair water sharing. Starting from the age of six, I was a part of the irrigation network. I used to help my family with irrigation, and I was in the middle of these conflicts on a daily basis. Sometimes, I was angry and disappointed since there was enough water for all of us, but some 'powerful' farmers were asking for more water, which caused daily conflicts and fights. After my first-hand experience in agriculture and irrigation, I pursued my studies in chemical engineering. I convinced myself that the majority of problems in the world are "technical" problems and as an engineer, I would help to solve some problems in the world. However, my life was not that linear, and I became an environmental activist and highly politicized while studying chemical engineering. In the last year of my bachelor studies, I followed a course named 'sustainable living and green chemistry' where I read many papers about Elinor Ostrom, common pool resource theory (CPR), Vandana Shiva, food sovereignty and the Brazilian Landless Workers Movement (Portuguese: Movimento dos Trabalhadores Rurais Sem Terra). This course was a

[1] The name of my hometown was first changed to "Istilil", then to "Akarsu" in 1980s with the aim of Turkifying non-Turkish villages. Tunçel, (2000) argues that the names of around 35% of villages in Turkey have been changed between 1940 and 2000. Most of the villages were located in north-east, south-east and east of Turkey.

turning point in my life. I decided not to work as an engineer, as the CPR theory has told me that not all solutions to collective problems are of a technical nature. I started a master's in environmental sciences and worked on a socio-ecological model for sustainable groundwater use in northern Mesopotamia, the place where I was born. I did my first fieldwork during my master's studies, which I enjoyed a lot. During this fieldwork, I also realized that the 'social part' of water governance is strongly related to struggles for equal access to water. Access to energy resources was a crucial condition for extracting and accessing groundwater in the studied area. The farmers supporting the leading party managed to access electricity to pump groundwater while the other farmers not voting for the leading party were facing power cuts for very long periods, which caused an immense decrease in their crop yield. It was not easy to show the effects of this 'social part' in water governance clearly in the model I was building. Then, I decided to continue working on water governance for my PhD research, focusing on the 'social' part of water governance, with a particular interest in inequalities in water access. With this thesis, I integrate the social and the material dimensions of water governance, as I aim to understand how power relations, institutions and infrastructures intersect to affect access to water in Ağlasun, a rural town in the southwest of Turkey. Such analysis intends to enhance our comprehension of the reasons causing injustice in access to water, on the one hand, and to illustrate the conditions for equitable and just water governance among smallholder farmers, on the other hand.

The timeliness and relevance of such a question do not require much explanation in the current era of global environmental crisis, manifested by droughts and water scarcity problems in many rural regions. Smallholder farms are both essential contributors to global food production and key users of irrigation water. Roughly 35% of all food produced around the world comes from small farms that are two hectares or less in size (Lowder et al., 2021). Therefore, equitable access to water by smallholder farmers is crucial for sustainable food production. The United Nations World Water Development Report (Unesco, 2019), under the slogan 'leaving no one behind', also calls for better access to water for smallholder farmers by stating that: "Across the world, millions of smallholder family farmers find ways of accessing, storing and conducting water to their crops to make up for water deficits during periods of dry spells or to secure food supplies during the dry season. Yet, despite their often high level of water (and land) productivity (Molden et al., 2007) and their crucial role in contributing to national food security, smallholders tend not to be the ones receiving attention as part of ongoing efforts to formalize the allocation of water use rights nor through the allocation of public subsidies for the establishment and operation of irrigation infrastructure" (pp. 108-109).

Considering the urgency and significance of the global problem of equitable access to water for smallholder farmers, in combination with my personal farming experience, I conducted research on water access struggles for my PhD thesis. In the next section, I explain the existing literature on water access and how I engaged my research with the literature to understand

and explain the dynamics of water access struggles. Also, there was an iterative process between data collection, data analysis and theory development and I followed this iterative process intending to reach theoretical saturation (Glaser & Strauss, 2017).

1.2. Socio-material approach: the social in the material and the material in the social

Equitable access to water is a subject that fascinates researchers. Studies on access try to understand how water is managed, distributed, and used by whom, when, and under what conditions, and why there are inequalities in access to water. These questions have been addressed from various theoretical frameworks.

I broadly categorize how critical water research engages with different theoretical frameworks into two approaches. The first approach focuses on one perspective in detail. For example, scholars working with the critical institutionalist approach have attempted to explain the reasons of inequalities in access to water from an institutionalist perspective. The second approach engages with an 'overarching' theory (for example, hydrosocial territories (Boelens et al., 2016)) that fits in almost all situations and offers analytical insights embedded in water governance. However, these 'overarching' theories tend to explain the overdetermined contingencies of local and temporally specific situations insufficiently.

In this thesis, I conceptualize the 'socio-material approach', intertwining the 'social' with the 'material' perspectives, as a third approach to understanding the overdetermined contingencies of local and temporally specific situations. By introducing and applying the 'socio-material approach', I argue for combining multiple theoretical frameworks to strengthen their potential in explaining how water is managed, distributed, and used by whom, when, and under what conditions, and why there are inequalities in access to water.

Critical institutional, political ecology, and socio-technical approaches can help to reveal the agency of different actors and explain how they become winners or losers in terms of water access. Building on these approaches, my analysis synthesizes insights from the common pool resource (CPR) theory, theory of access, institutional bricolage, science and technology studies, infrastructural violence, accumulation by dispossession, and water grabbing. Many of these frameworks, if not most, prioritize either 'social' or 'material' dimensions. Theoretical frameworks with a social perspective focus on institutional, economic, political, and cultural dimensions, while frameworks with a material perspective emphasize water materiality and technological and infrastructural change. For example, critical institutionalist approaches incorporate power and politics into their analysis to reveal how individuals shape institutions and are themselves shaped by institutions (Cleaver & de Koning, 2015; Mollinga, 2019). However, the 'material' dimension is under-researched, although it has high potential to contribute to institutional analysis. Cleaver (2012) argues that "an understanding of the ways

in which social arrangements also manifest physically (through labour, infrastructure and resource use practices) would significantly strengthen institutional analysis" (p. 20). Similarly, theoretical frameworks focusing on the 'material' perspective prioritize the 'material' dimensions and insufficiently engage with the 'social' perspective. For example, the concept of infrastructural violence focuses on the capability of infrastructure to constitute and shape inequalities. Rodgers and O'Neill (2012, p. 402) propose the concept of infrastructural violence "to understand when it is that infrastructure becomes violent, for whom, under what conditions, and why". Since the departure point of infrastructural violence is the 'material', less attention is paid to the 'social' dimension.

Considerable efforts have been made to develop frameworks in critical water studies that connect water, infrastructure, and power (Mollinga, 2019; Obertreis et al., 2016), such as the hydrosocial cycle (Linton & Budds, 2014), hydrosocial territories (Boelens et al., 2016), and urban metabolism (Heynen et al., 2006). Although these frameworks discuss the 'social' and the 'material' perspectives together, their concepts can be put into dialogue with other available frameworks to improve our understanding of socio-material interactions. Indeed, in critical water studies, the conversation between the different theoretical frameworks mentioned above and their potential to interact with each other remains underexplored. In this thesis, I seek to establish such a conversation to explain the complex relationships among actors, institutions, and infrastructures, the mechanisms through which these elements influence each other, and the social inequalities in water access that emerge from those relationships and mechanisms.

Furthermore, by introducing and applying the 'socio-material approach', I aim to broaden the scope of the socio-technical approach in critical water studies. Socio-technical scholars, engaging with insights from Science and Technology Studies (STS), unveil the interactions among actors, institutions, and infrastructures. Since its beginning, STS has concentrated on the dynamic relationship between individuals and technology and how they shape each other. One of the pioneers in the 1980s was Norman Uphoff, stating that "the socio-technical nature of irrigation management is manifested in the interaction of these physical and social sets of activity" (Uphoff, 1986, p.45). However, although STS scholars engaging in critical infrastructure research consider infrastructures to be volatile and adaptable (Anand, 2011; Furlong 2011), there are few scholars who disaggregate the water infrastructure into different elements such as pipes, pumps, and valves and unveil the role of those elements in creating distinct inequalities in access to water (Furlong 2011, 2014; Tiwale, 2019). In this thesis, I unpack not only the water infrastructure network but also the infrastructures around the water network to explain the agency of each material infrastructure and how each of them affects access to water. Regarding irrigation, the material infrastructures I focus on, include irrigation canals (earthen, concrete, plastic pipe), pressurized pipes for drip irrigation, valves used for the ponds in front of the springs, valves of the drip irrigation pipes, and fences and concrete huts around the springs.

In this thesis, I conceptualize irrigation systems as institutional, technical, natural, individual and collective processes, 'all at once' (Boelens, 2014; Reyes Escate et al., 2022). I analyze how and why actors, institutions, and infrastructures co-shape a water governance system and why some actors can easily access water while others cannot. Therefore, I examined how water is managed, distributed, and used by whom, when, and under what conditions to unveil the interactions among actors, institutions, and infrastructures in access to water. By doing so, I aim to unveil the conditions of being winners and losers in access to equitable water through institutions, infrastructures, and actors as the three components of water governance systems. First, I delved into institutional arrangements, specifically rules and social relations. Second, I focused on infrastructures, particularly drip irrigation technology. Third, I examined actors with a focus on private bottled-water companies.

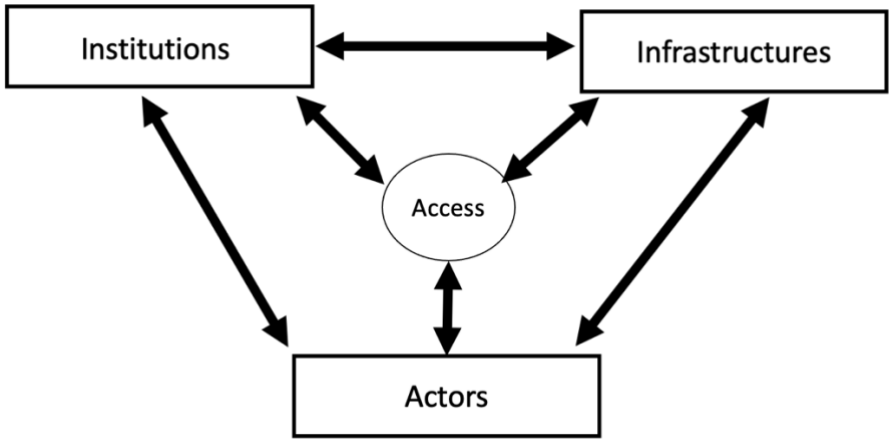


Figure 1. The interactions between actors, institutions, infrastructures, and access. Institutions, actors and infrastructures determine access; but also influence and shape each other.

As shown in Figure 1, I analyze how a change in any of the three components of the governance system (institutions, actors, and infrastructures) affects the other two, and is affected by them, to show their interactions and interdependencies.

1.3. Studying access to equitable water

In this section, I briefly explain the iterative process I experienced while writing this thesis and how I have engaged with various theoretical frameworks.

The first theoretical framework I examined was CPR theory, one of the most influential theories in water governance research. The primary focus of CPR scholars has been to investigate how common pool resources, such as fisheries, forests, and water, can be

managed responsibly and how to organise their collective governance (Janssen et al., 2011; Johnson, 2004; Ostrom, 2009; Ostrom et al., 1994). However, equitability and access to resources are not the primary concern of CPR scholars. Quintana & Campbell, (2019) have reviewed the critiques of CPR, which focus on institutions and property rights (Ostrom, 1998), and have found that the literature on CPR governance absorbed many critiques it received since the 1980s. However, they argue that a lack of attention to structural inequalities in resource access continues to persist, although equitable access has long been recognized as a crucial dimension of sustainable resource governance (Agrawal, 2014; Robbins, 2011). Departing from these critiques, I started to look for theories that could help understand and explain how people get access to water, what are the conditions for equitable access, and what are the reasons for the (structural) inequalities in access to resources that are less explored in CPR literature.

Since my primary focus was 'access', I started to read the theory of access (Ribot & Peluso, 2009) which analyses how access to resources is organized and how these resources are used to create an imbalance of access between different groups. Throughout reading the literature on the theory of access, I explored how this literature ascribes a critical position to the role of authorities and institutions in access to resources (Milgroom & Ribot, 2020). Then, I focused on the role of institutions, actors, and power in access to water.

The term **actor** used in this research refers to the individuals, groups, or organizations that participate in a particular social system. In irrigation systems, actors, institutions, and material infrastructures are interdependent and mutually co-shaping each other.

After conducting the first fieldwork in 2018, it became clear to me that institutions play a significant role in the dynamics of access to water in Ağlasun. Therefore, I started to read and analyse the various institutionalist theories which have been applied in the field of natural resources management. My departure point on institutions was Hardin's seminal article (Hardin, 1968), 'The Tragedy of the Commons', which argues that there is little incentive for collective action given individual rationality and holds local users responsible for their inability to create institutions to conserve resources. The mainstream institutional approach, which includes common pool resources (CPR) scholarship and ideas from new institutional economics (Cleaver, 2012), criticized Hardin and argues that users do create formal and informal institutions to regulate resource use and management (North, 1990; Ostrom, 1990). Although CPR approaches also gave attention to the importance of informal institutions, the central focus was on formal institutions, such as water management committees or associations (de Koning, 2011). However, Mehta et al. (1999) show that this approach ignored how institutions are embedded in local history and society. This neglect triggered the development of critical institutionalism, which argues that the assumptions of common pool resources and new institutional economics do not always reflect the local reality (Boelens, 2015; Cleaver, 2002; de Koning, 2011). After reflecting on my fieldwork notes, I agreed with

the critiques raised to the assumptions in CPR and new institutional economics and I engaged my research with critical institutionalism literature which originates from historical and sociological institutionalism (Cleaver & de Koning, 2015; Hall et al., 2014).

The definition of what constitutes an institution depends on the school of thought. However, in most theories, institutions are considered *social* arrangements that structure human behaviour (North, 1990; Ostrom, 1990; de Koning, 2011). In line with critical institutionalism, I assume that institutions are complex, dynamic, and contingent. They are inherently place-bound, as they are shaped by local politics, culture, and history (Cleaver & de Koning, 2015; Hall et al., 2014; Jones, 2015; Whaley, 2018). I largely follow Frances Cleaver's definition of **institutions** as "arrangements between people which are reproduced and regularized across time and space, and which are subject to constant processes of evolution and change"(Cleaver, 2012, p. 8). For example, in irrigation systems, the rules about how water is distributed can be regarded as an institution. The rules on water distribution can include both formal and informal institutions.

I started the second fieldwork in 2019 by paying attention not only to the role of institutions in irrigation systems but also to how the irrigation institutions were being co-shaped. The drip irrigation infrastructure was being introduced to certain irrigation networks by the municipal government during my fieldwork and the new infrastructure highly affected the institutional arrangements, such as water distribution rules, the operation and maintenance of irrigation infrastructures and water pricing. Therefore, I started to dig deeper into the literature on material infrastructures in irrigation systems and how they relate to institutions.

Various disciplines study hydraulic infrastructure, from engineering and agronomy to anthropology and science and technology studies (STS) (Hommes, 2022). For this thesis, I follow the definition of P. Harvey et al. (2017): "**infrastructures** are extended material assemblages that generate effects and structure social relations, either through engineered (i.e., planned and purposefully crafted) or non-engineered (i.e., unplanned and emergent) activities" (p. 5). Hydraulic infrastructures connect institutional actors, legal rules, policies, and knowledge traditions, a network that continually forms across space and time (Anand et al., 2018; Edwards, 2003; Mitchell, 2002). The hydraulic infrastructures that might be regarded as neutral and mundane are recognized as highly political units (Goodwin, 2018), which cause socio-spatial inequalities in access to water.

I engaged with the socio-technical approach to water governance, which enhanced my understanding of the interactions among actors, institutions, and infrastructures. I specifically focused on actor-network theory (ANT) and STS (Latour, 1987, 2005; Law, 1992; Winner, 1986), which highlight how actors deal with the distinction between the social and the technical issues (Bolding, 2004). For example, Van der Kooij et al. (2015) examine the agency of infrastructure and explain how the implementation of gates in irrigation canals in Seguia

Khrichfa in Morocco co-shapes the governance arrangements. Similarly, Kemerink-Seyoum et al. (2019) and Chitata et al. (2021) use the lens of socio-technical tinkering to investigate how irrigation governance is affected by the materiality of water and its infrastructures.

In 2021, I started the final fieldwork to further examine the relationships between actors, institutions, and infrastructures. During the fieldwork in 2018 and 2019, I analysed how access to water was being transformed through changes in institutions and infrastructures in access to water. The remaining part was to analyse how access to water would be affected if there is a change in actors. Since there was a new bottled-water company in the rural town where I was conducting my research, I spent the final year of the fieldwork focusing on the role of bottled-water companies in co-shaping access to water. Also, since I had already analysed the role of institutions and infrastructures in access to water during the two previous fieldworks, I decided to focus on how the arrival of the new bottled-water company and the existing bottled-water company caused changes in institutions and infrastructures.

To unveil how bottled-water companies control and commodify water through institutional arrangements and infrastructures, I engaged my research with three literature streams. First, I reviewed the literature on 'infrastructural violence'. The concept of infrastructural violence is useful "to understand when it is that infrastructure becomes violent, for whom, under what conditions, and why" (Rodgers & O'Neill, 2012, p. 402). Second, I engaged my research with the concept of 'accumulation by dispossession', a process of capital accumulation where assets that are not commonly exchanged or have limited availability are used to make a profit and then integrated into the market exchange for very little or no cost (Jaffee & Newman, 2013). Third, I reviewed the literature on water grabbing, a process in which powerful actors gain access to water resources that were already in use by local communities or were necessary to sustain aquatic ecosystems upon which these communities rely for their livelihoods (Franco et al., 2013; Mehta et al., 2012; Veldwisch et al., 2018). Finally, I combined the concepts of 'infrastructural violence' (Rodgers and O'Neill, 2012) with 'accumulation by dispossession' (D. Harvey, 2003) to investigate the mechanisms employed by bottled-water companies through infrastructures and institutions to grab water and conceal the scale of grabbing.

In summary, I focused on the interactions between actors, institutions, and infrastructures and how they co-shape access to water throughout this thesis.

1.4. Research objective and research questions

The overall objective of this thesis is to understand the water governance dynamics and unveil the inequalities they produce by analyzing the interactions of institutions, actors, and infrastructures in shaping access to water. While achieving this objective, I engaged with the literature from common pool resource theory, theory of access, institutional bricolage,

science and technology studies, infrastructural violence, accumulation by dispossession and water grabbing. My thesis aims to show how these different theoretical frameworks can interact and be in conversation with each other in critical water governance studies.

To achieve the overall objective, I adopted the following main research question:

> *How and why do actors, institutions, and infrastructures co-shape a water governance system and why some actors can easily access water while others cannot?*

I answer this research question by developing three ethnographic case studies in three chapters (chapters 3, 4, and 5) in the same rural town.

In each case study, I focus on different elements of the water governance system and unveil how these elements co-shape each other to form a water governance system.

The first case study (chapter 3) focuses on the role of institutions in access to water. Therefore, my first sub-research question (SRQ1) is: *How and why do institutions influence access to water and who benefits from this influence?* SRQ1 investigates how institutions co-shape access to water. I specifically examine the water distribution rules and explain how they are shaped by and through the social relations between farmers and local authorities (Figure 2).

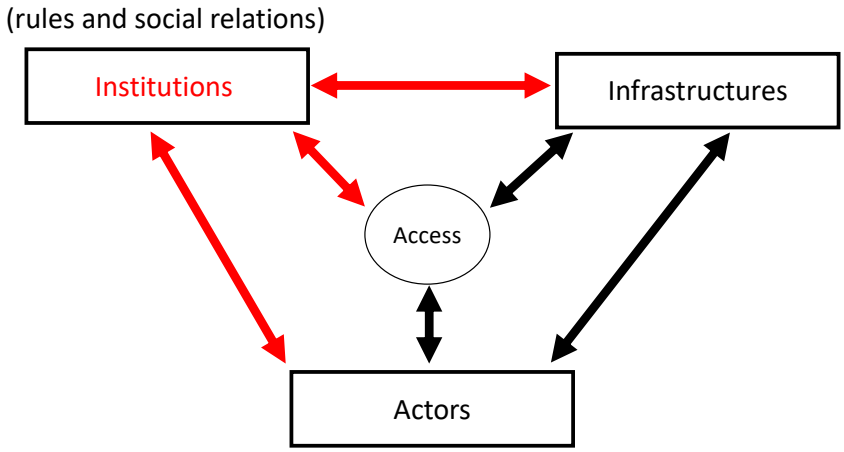


Figure 2. The role of institutions in access to water.

The second case study (chapter 4) focuses on the role of infrastructures in access to water. Therefore, my second sub-research question (SRQ2): *How and why do infrastructures influence access to water and who benefits from this influence?* SRQ2 investigates how various infrastructures co-shape access to water. I examine how the switch from surface irrigation to

drip irrigation entails institutional re-arrangements, a bricolage of material infrastructures and strategizing actors (Figure 3).

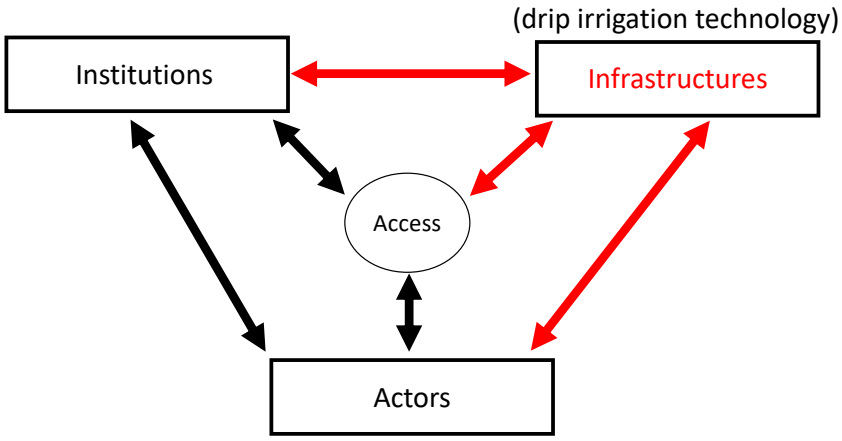


Figure 3. The role of infrastructures in access to water.

The third case study (chapter 5) focuses on the role of actors in access to water. Therefore, my third sub-research question (SRQ3): *How and why do actors influence access to water and who benefits from this influence?* SRQ3 examines how actors co-shape access to water. I unveil how bottled-water companies control and commodify water in this rural town (Figure 4).

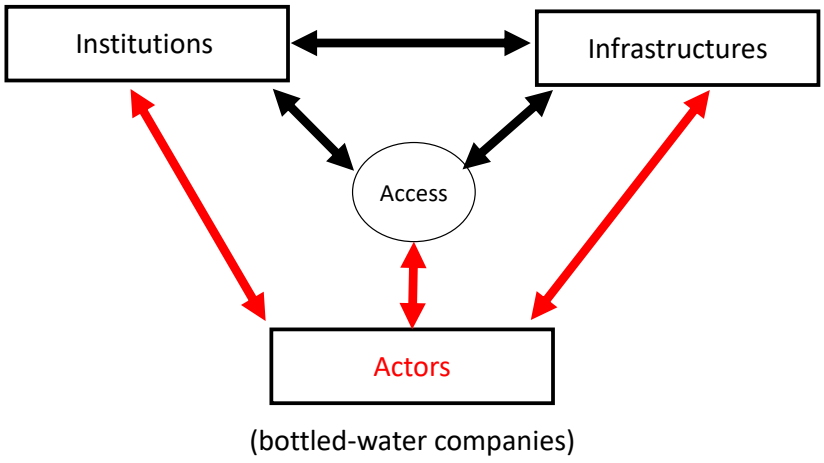


Figure 4. The role of actors in access to water.

Figure 5 shows how the three sub-research questions are interconnected to answer the main research question.

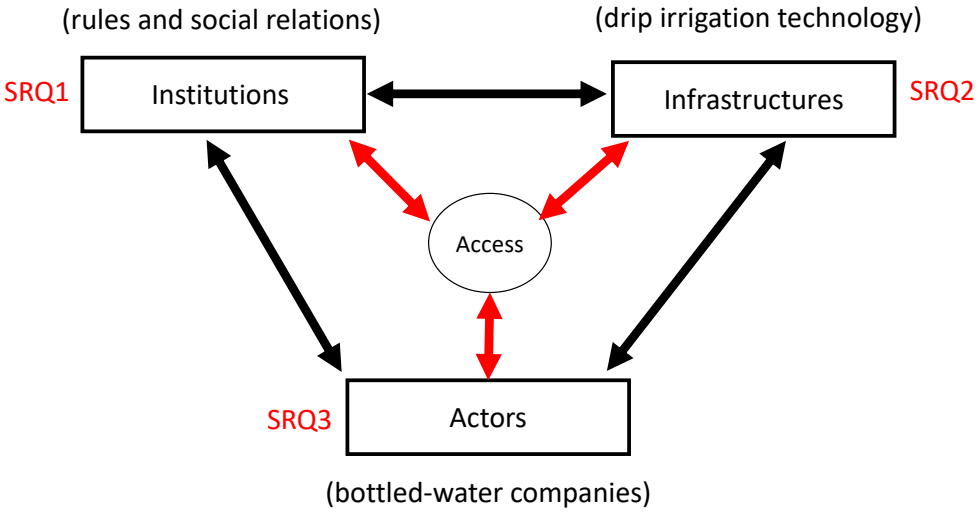


Figure 5. The interactions between actors, institutions, and infrastructures in access to water.

1.5. Scientific output and communication

This thesis is designed as an article-based document. Chapters 3 and 4 have been published in peer-reviewed journals and chapter 5 has been accepted for publication (subject to revision). I indicated the status of each publication at the beginning of each chapter. Chapter 3 was co-authored with my PhD supervisors, chapter 4 was co-authored with my PhD supervisors and one external author, and chapter 5 is a single-authored paper.

The research on how institutions co-shape access to water in Ağlasun was published in the journal of Society & Natural Resources (see chapter 3) with the title "Social Head-Enders: Access and Authority in Irrigation Governance" (Mirhanoğlu et al., 2022). The research on how various infrastructures co-shape access to water was published in the International of Journal of the Commons (see chapter 4) with the title "Socio-material bricolage:(Co)Shaping of Irrigation Institutions and Infrastructures" (Mirhanoğlu et al., 2023). The research on how actors co-shape access to water has been accepted for publication (subject to revision) with the title "Water grabbing through infrastructures and institutions in rural Turkey" (see chapter 5).

In addition to the publications, I am one of the guest editors for two special issue projects that are very close to my research question. The title of the first special issue project in the International Journal of the Commons is 'Contested socio-material transformations in irrigation communities'. It is the outcome of the panel on 'irrigation issues in emerging economies', which I organized together with my PhD supervisor Prof. dr. Maarten Loopmans, at the Third Biennial Conference of the Political Ecology Network in 2020. Its goal is to unveil socio-material transformations and explain how these affect access to water from different

theoretical angles. I am co-editing this special issue with my PhD supervisor, Prof. dr. Maarten Loopmans and Prof. dr. Jaime Hoogesteger. Chapter 4 of this thesis has been published as part of this special issue. The title of the second special issue project is 'Rural futures in peri-urban areas' in the Belgian Journal of Geography. I am co-editing it with my PhD supervisor, Prof. dr. Maarten Loopmans. This special issue project helped me broaden my research scope, as several articles address peri-urban water actors in different countries such as China, Nepal, Spain, and Poland.

All chapters have been presented at different international conferences such as the Second Biennial Conference of the Political Ecology Network (2018, Oslo, Norway), the Third Biennial Conference of the Political Ecology Network (2020, online), the Conference of Unpredictable Environments: Politics, Ecology, Agency (2021, online), the Conference of Spaces of Possibility confex (2021, online), Delft International Conference on Sociohydrology (2021, Delft, the Netherlands), European Society for Rural Sociology (2022, Crete, Greece) and European Rural Geographies Conference (2023, Groningen, the Netherlands).

Finally, I have contributed to one radio program and two exhibitions where I shared my research with a non-academic audience. First, I was invited to Açık Radyo, a collective and community-based radio channel in Turkey, to talk about the Irrigation conflicts and water access issues in Turkey. Second, my research appeared in the two exhibitions. First, I contributed to 'Sandstorm – And Then There Was Dust' (17 Sep 2020-01 Nov 2020, Istanbul, Turkey) which focused on the ecological phenomenon of sandstorms and the related socio-political circumstances. My contribution was an audio recording on water access in Turkey. Second, I contributed to 'Meanwhile in the Mountains: Sagalassos' (27 Nov 2019-28 May 2020, Istanbul, Turkey). My contribution was a video recording which I talked about the significance of the water resources in Sagalassos/ Ağlasun region.

1.6. Structure of the thesis

This thesis includes six chapters, as part of three distinct sections: introductory chapters, empirical chapters, and a conclusion, which is schematically shown in Figure 6. Chapters 3, 4, and 5 are written as individual articles that can be read independently. Chapters 3 and 4 have were published in peer-reviewed journals, and Chapter 5 has been accepted for publication (subject to revision). Therefore, it is possible that there may be some overlap between the introduction, methodology and conclusion and chapters 3,4, and 5.

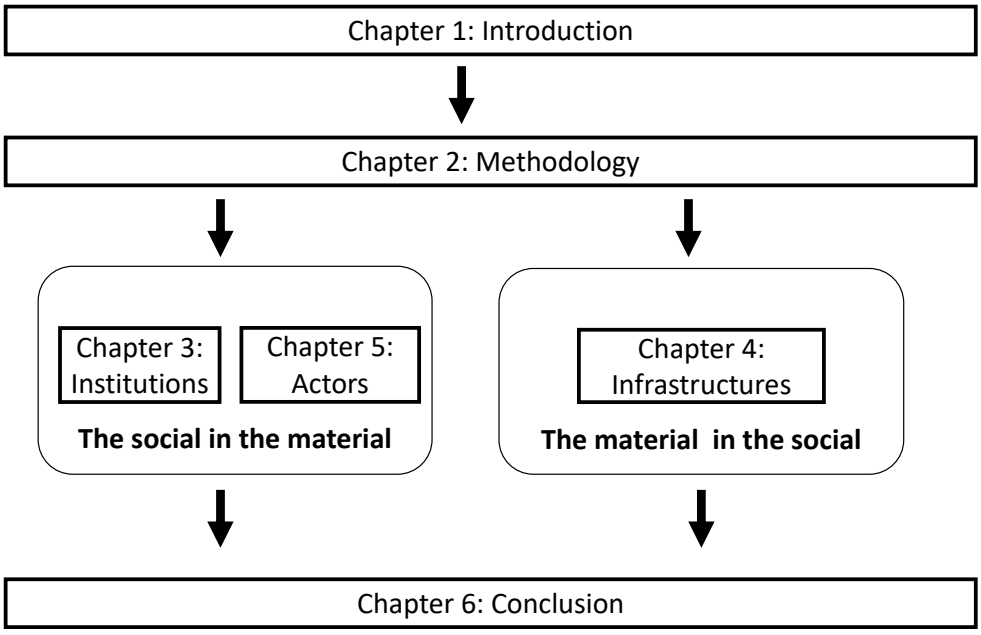


Figure 6. The general outline of the PhD thesis.

Chapters 1 and 2 serve as introductory chapters. In the current chapter 1, I gave a brief rationale for the research, the research objective and research questions and scientific output and communication. In chapter 2, I introduce the methodology and reflect on the fieldwork and my positionality. I also explain the reasons why I chose the case of Ağlasun, how I engaged with the fieldwork, and how I collected the data.

The empirical part of this thesis is composed of three chapters. Chapter 3 is the first empirical chapter. It contributes to the CPR theory by examining how institutions co-shape access to water. Through introducing and applying the concept of "social head-enders", my findings indicate how certain farmers are able to 'bend the rules' and access water illicitly through building relationships with authorities. The main argument of this chapter is that both spatial distance to a water source and social distance to authorities influence access to water. Focusing on socio-spatial inequalities in access to water, I show how the 'social' (rules and social relations) intertwine with the 'material' (spatial distance to a water source).

Chapter 4 contributes to critical institutionalism literature by investigating how various infrastructures co-shape access to water. By introducing and applying the framework of 'socio-material bricolage', I examined how the switch from surface irrigation to drip irrigation entailed an interaction of institutional re-arrangements, a bricolage of material infrastructures and strategizing actors. My findings reveal that the farmers with the financial capability to invest in drip irrigation infrastructure on their farms get priority access to water. The main argument of this chapter is that actors, institutions, and material infrastructures are interdependent, and they are mutually co-shaping each other in irrigation systems. Focusing

on the change in the irrigation method, I show how the 'material' (drip irrigation technology) intertwines with the 'social' (locally embedded and newly introduced institutions).

Chapter 5 contributes to the water grabbing literature by unveiling the role of the water infrastructures' materiality in water grabbing. By combining the concepts of 'infrastructural violence' (Rodgers and O'Neill, 2012) and 'accumulation by dispossession' (D. Harvey, 2003), I analyze how the arrival of the new bottled-water company together with the existing bottled-water company co-shapes access to water. My findings demonstrate that bottled-water companies use both water infrastructures and institutions to grab water and conceal the scale of grabbing. The main argument of this chapter is that the strategies of bottled-water companies to take control of water and make it a commodity result in the dispossession of local farmers from the water sources they have used for centuries. Focusing on water grabbing by bottled-water companies, I show how the 'social' (bending the rules and institutions of clientelism) intertwines with the 'material' (fencing the water sources and the imposition of water-saving agricultural technologies).

The final chapter is the conclusion. In this chapter, I revisit the research questions and provide the answers to the research questions. I also discuss the theoretical contribution of the thesis and identify solidarity recommendations for smallholder farmers. Finally, I offer directions for further research.

1.7. References

Agrawal, A. (2014). Studying the commons, governing common-pool resource outcomes: Some concluding thoughts. *Environmental Science & Policy*, *36*, 86–91. https://doi.org/10.1016/j.envsci.2013.08.012

Anand, N. (2011). PRESSURE: The PoliTechnics of Water Supply in Mumbai. *Cultural Anthropology*, *26*(4), 542–564. https://doi.org/10.1111/j.1548-1360.2011.01111.x

Anand, N., Gupta, A., & Appel, H. (Eds.). (2018). *The promise of infrastructure*. Duke University Press.

Boelens, R. (2014). Cultural politics and the hydrosocial cycle: Water, power and identity in the Andean highlands. *Geoforum*, *57*, 234–247. https://doi.org/10.1016/j.geoforum.2013.02.008

Boelens, R. (2015). *Water, power and identity: The cultural politics of water in the Andes*. Routledge. https://doi.org/10.4324/9781315867557

Boelens, R., Hoogesteger, J., Swyngedouw, E., Vos, J., & Wester, P. (2016). Hydrosocial territories: A political ecology perspective. *Water International*, *41*(1), 1–14. https://doi.org/10.1080/02508060.2016.1134898

Bolding, A. (2004). *In Hot Water. A study on sociotechnical intervention models and practices of water use in smallholder agriculture, Nyanyadzi catchment, Zimbabwe*. 419.

Chitata, T., Kemerink-Seyoum, J. S., & Cleaver, F. (2021). *Engaging and Learning with Water Infrastructure: Rufaro Irrigation Scheme, Zimbabwe*. *14*(3), 27.

Cleaver, F. (2002). Reinventing Institutions: Bricolage and the Social Embeddedness of Natural Resource Management. *The European Journal of Development Research*, *14*(2), 11–30. https://doi.org/10.1080/714000425

Cleaver, F. (2012). *Development through bricolage: Rethinking institutions for natural resource management*. Routledge.

Cleaver, F., & de Koning, J. (2015). Furthering critical institutionalism. *International Journal of the Commons*, *9*(1), Article 1. https://doi.org/10.18352/ijc.605

de Koning, J. (2011). *Reshaping institutions: Bricolage processes in smallholder forestry in the Amazon*. Wageningen University and Research.

Edwards, P. N. (2003). Infrastructure and Modernity: Force, Time, and Social Organization in the History of. *Modernity and Technology*, 185.

Franco, J., Mehta, L., & Veldwisch, G. J. (2013). The Global Politics of Water Grabbing. *Third World Quarterly*, *34*(9), 1651–1675. https://doi.org/10.1080/01436597.2013.843852

Furlong, K. (2011). Small technologies, big change: Rethinking infrastructure through STS and geography. *Progress in Human Geography*, *35*(4), 460–482. https://doi.org/10.1177/0309132510380488

Furlong, K. (2014). STS beyond the "modern infrastructure ideal": Extending theory by engaging with infrastructure challenges in the South. *Technology in Society*, *38*, 139–147. https://doi.org/10.1016/j.techsoc.2014.04.001

Glaser, B. G., & Strauss, A. L. (2017). *Discovery of grounded theory: Strategies for qualitative research*. Routledge.

Goodwin, G. (2018). Water, Infrastructure and Power: Contention and Resistance in Post-colonial Cities of the South: Review Essay: Water, Infrastructure and Power. *Development and Change*, *49*(6), 1616–1630. https://doi.org/10.1111/dech.12458

Hall, K., Cleaver, F., Franks, T., & Maganga, F. (2014). Capturing Critical Institutionalism: A Synthesis of Key Themes and Debates. *The European Journal of Development Research*, *26*(1), 71–86. https://doi.org/10.1057/ejdr.2013.48

Hardin, G. (1968). The Tragedy of the Commons. *Science*, *162*(3859), 1243–1248. https://doi.org/10.1126/science.162.3859.1243

Harvey, D. (2003). *The new imperialism*. Oxford University Press.

Harvey, P., Jensen, C. B., & Morita, A. (2017). Infrastructures and social complexity. *New York: Routledge*, *10*, 9781315622880.

Heynen, N., Kaika, M., & Swyngedouw, E. (2006). *In the Nature of Cities—Urban Political Ecology and The Politics of Urban Metabolism*.

Hommes, L. (2022). *Infrastructure lives: Water, territories and transformations in Turkey, Peru and Spain* [Wageningen University]. https://doi.org/10.18174/569800

Jaffee, D., & Newman, S. (2013). A Bottle Half Empty: Bottled Water, Commodification, and Contestation. *Organization & Environment*, *26*(3), 318–335. https://doi.org/10.1177/1086026612462378

Janssen, M. A., Anderies, J. M., & Cardenas, J.-C. (2011). Head-enders as stationary bandits in asymmetric commons: Comparing irrigation experiments in the laboratory and the field. *Ecological Economics*, *70*(9), 1590–1598. https://doi.org/10.1016/j.ecolecon.2011.01.006

Johnson, C. (2004). Uncommon Ground: The 'Poverty of History' in Common Property Discourse. *Development and Change*, *35*(3), 407–434. https://doi.org/10.1111/j.1467-7660.2004.00359.x

Jones, S. D. (2015). Bridging political economy analysis and critical institutionalism: An approach to help analyse institutional change for rural water services. *International Journal of the Commons, 9(1)*.

Kemerink-Seyoum, J. S., Chitata, T., Domínguez Guzmán, C., Novoa-Sanchez, L. M., & Zwarteveen, M. Z. (2019). Attention to Sociotechnical Tinkering with Irrigation Infrastructure as a Way to Rethink Water Governance. *Water*, *11*(8), Article 8. https://doi.org/10.3390/w11081670

Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through Society*. Harvard University Press.

Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory.* Oxford University Press.

Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy, and heterogeneity. *Systems Practice*, *5*(4), 379–393. https://doi.org/10.1007/BF01059830

Linton, J., & Budds, J. (2014). The hydrosocial cycle: Defining and mobilizing a relational-dialectical approach to water. *Geoforum*, *57*, 170–180. https://doi.org/10.1016/j.geoforum.2013.10.008

Lowder, S. K., Sánchez, M. V., & Bertini, R. (2021). Which farms feed the world and has farmland become more concentrated? *World Development*, *142*, 105455. https://doi.org/10.1016/j.worlddev.2021.105455

Mehta, L., Leach, M., Newell, P., & Scoones, I. (1999). *Exploring Understandings of Institutions and Uncertainty: New Directions in Natural Resource Management*. Institute of Development Studies. https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/13858

Mehta, L., Veldwisch, G. J., & Franco, J. (2012). *Introduction to the Special Issue: Water Grabbing? Focus on the (Re)appropriation of Finite Water Resources*. *5*(2).

Milgroom, J., & Ribot, J. (2020). Children of Another Land: Social Disarticulation, Access to Natural Resources and the Reconfiguration of Authority in Post Resettlement. *Society & Natural Resources*, *33*(2), 184–204. https://doi.org/10.1080/08941920.2019.1590668

Mirhanoğlu, A., Loopmans, M., & Özerol, G. (2022). Social Head-Enders: Access and Authority in Irrigation Governance. *Society & Natural Resources*, *35*(2), 185–203. https://doi.org/10.1080/08941920.2021.2009944

Mirhanoğlu, A., Özerol, G., Hoogesteger, J., Broeck, P. V. den, & Loopmans, M. (2023). Socio-Material Bricolage: (Co)Shaping of Irrigation Institutions and Infrastructures. *International Journal of the Commons*, *17*(1), Article 1. https://doi.org/10.5334/ijc.1188

Mitchell, T. (2002). *Rule of experts: Egypt, techno-politics, modernity* (4th print). University of California Press.

Molden, D. (2007). *A Comprehensive Assessment of Water Management in Agriculture*. Earthscan.

Mollinga, P. P. (2019). *Cultural Political Economy and Critical Water Studies: An Introduction to the Special Themed Section*. *12*(3).

North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press. https://doi.org/10.1017/CBO9780511808678

Obertreis, J., Moss, T., Mollinga, P. P., & Bichsel, C. (2016). *Water, Infrastructure and Political Rule: Introduction to the Special Issue*. *9*(2), 14.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge university press.

Ostrom, E. (1998). A Behavioral Approach to the Rational Choice Theory of Collective Action: Presidential Address, American Political Science Association, 1997. *American Political Science Review*, *92*(1), 1–22. https://doi.org/10.2307/2585925

Ostrom, E. (2009). *Understanding Institutional Diversity*. Princeton University Press.

Ostrom, E., Gardner, R., Walker, J., & Walker, J. (1994). *Rules, Games, and Common-pool Resources*. University of Michigan Press.

Quintana, A., & Campbell, L. M. (2019). Critical Commons Scholarship: A Typology. *International Journal of the Commons*, *13*(2), 1112–1127. https://doi.org/10.5334/ijc.925

Reyes Escate, L., Hoogesteger, J., & Boelens, R. (2022). Water assemblages in hydrosocial territories: Connecting place, space, and time through the cultural-material signification of water in coastal Peru. *Geoforum*, *135*, 61–70. https://doi.org/10.1016/j.geoforum.2022.07.005

Ribot, J. C., & Peluso, N. L. (2009). A Theory of Access*. *Rural Sociology*, *68*(2), 153–181. https://doi.org/10.1111/j.1549-0831.2003.tb00133.x

Robbins, P. (2011). *Political Ecology: A Critical Introduction*. John Wiley & Sons.

Rodgers, D., & O'Neill, B. (2012). Infrastructural violence: Introduction to the special issue. *Ethnography*, *13*(4), 401–412. https://doi.org/10.1177/1466138111435738

Tiwale, S. (2019). Materiality matters: Revealing how inequities are conceived and sustained in the networked water infrastructure - The case of Lilongwe, Malawi. *Geoforum*, *107*, 168–178. https://doi.org/10.1016/j.geoforum.2019.09.005

Tunçel, H. (2000). Türkiye'de ismi değiştirilen köyler. *Fırat Üniversitesi Sosyal Bilimler Dergisi*, *10*(2), 23–34.

Unesco (Ed.). (2019). *Leaving no one behind*. UNESCO.

Uphoff, N. (1986). *Getting the Process Right: Improving Water Management withFarmer Organisation and Participation (Working Paper)*. 151.

Van der Kooij, S., Zwarteveen, M., & Kuper, M. (2015). The material of the social: The mutual shaping of institutions by irrigation technology and society in Seguia Khrichfa, Morocco. *International Journal of the Commons*, *9*(1), Article 1. https://doi.org/10.18352/ijc.539

Veldwisch, G. J., Franco, J., & Mehta, L. (2018). Water Grabbing: Practices of Contestation and Appropriation of Water Resources in the Context of Expanding Global Capital. In R. Boelens, T. Perreault, & J. Vos (Eds.), *Water Justice* (1st ed., pp. 59–70). Cambridge University Press. https://doi.org/10.1017/9781316831847.004

Whaley, L. (2018). The Critical Institutional Analysis and Development (CIAD) Framework. *International Journal of the Commons*, *12*(2), xx–xx. https://doi.org/10.18352/ijc.848

Winner, L. (1986). *The Whale and the Reactor*. The University of Chicago Press.

2. METHODOLOGY

This chapter introduces the methodology used in this thesis. I adopted qualitative in-depth case study research using ethnographic methods. I conducted a single case study with multiple subcases (Diop & Liu, 2020). The research questions of the subcases have theoretical connections, and they aim to answer the main research question. This research design helped me delve into the subject and gain a comprehensive understanding of the subject from different angles (Dyer & Wilkins, 1991). As outlined in the introduction, the results of the research are organized in a journal article format. Chapters 3 and 4 have been published in peer-reviewed journals, and Chapter 5 has been accepted for publication (subject to revision). Since the three chapters also contain information related to the methodology and to limit the overlaps, I provide a brief introduction to the case study and the research methods in this chapter.

2.1. Case selection

I collected data by conducting fieldwork in Ağlasun, a mountainous rural town situated at the foothills of the Taurus Mountains in southwest Turkey (Figure 1).



Figure 1. An Overview of Ağlasun (Source: Adnan Mirhanoğlu)

Ağlasun is one of the 15 districts of the Burdur province. The population of this district is 7,408 (*The Turkish Statistical Institute*, 2023). The main economic activities are agriculture and livestock. Farming is done in a valley that is not very wide, with agricultural plots on the valley bottom and few irrigated terraced farms on the valley sides (see Figure 2).



Figure 2. An Overview of Ağlasun Valley (Source: Adnan Mirhanoğlu).

The average annual precipitation in Ağlasun is 617.8 mm/year (Aksu & Güngör, 2020), and the mean annual temperature is 13.3°C (Bulut et al., 2017). Ağlasun experiences cold and wet winters as well as hot and dry summers. The majority of precipitation occurs during the spring and the winter. Precipitation is generally in the form of rain during the summer and spring and snow during the winter (Ceylan, 2015).

The Ağlasun Valley has been able to irrigate its lands owing to 24 different water sources which originate at the limestone-ophiolite interface (Van Loo, 2018). Seventeen of them are used by farmers, two are used by bottled-water companies, and one is used by both farmers and the bottled-water companies (Figure 3). The remaining water sources were excluded from the studied case because they were used in the villages around Ağlasun. The management of water sources is performed by the headmen (elected neighbourhood representatives, 'muhtar' in Turkish) in these villages. The groundwater flows in the direction of the Ağlasun stream from northwest to southeast. The Ağlasun Stream also provides surface

water discharge to the plain (Çelik, 2013). Farmers in Ağlasun primarily cultivate apples, cherries, walnuts, roses, clovers, beans, corn, and wheat nowadays. The crop choice of farmers is based on multiple factors, such as water availability, land size, irrigation method (surface, sprinkler, and drip irrigation), and population dynamics, including, an aging population (Kocabıyık & Loopmans, 2021).

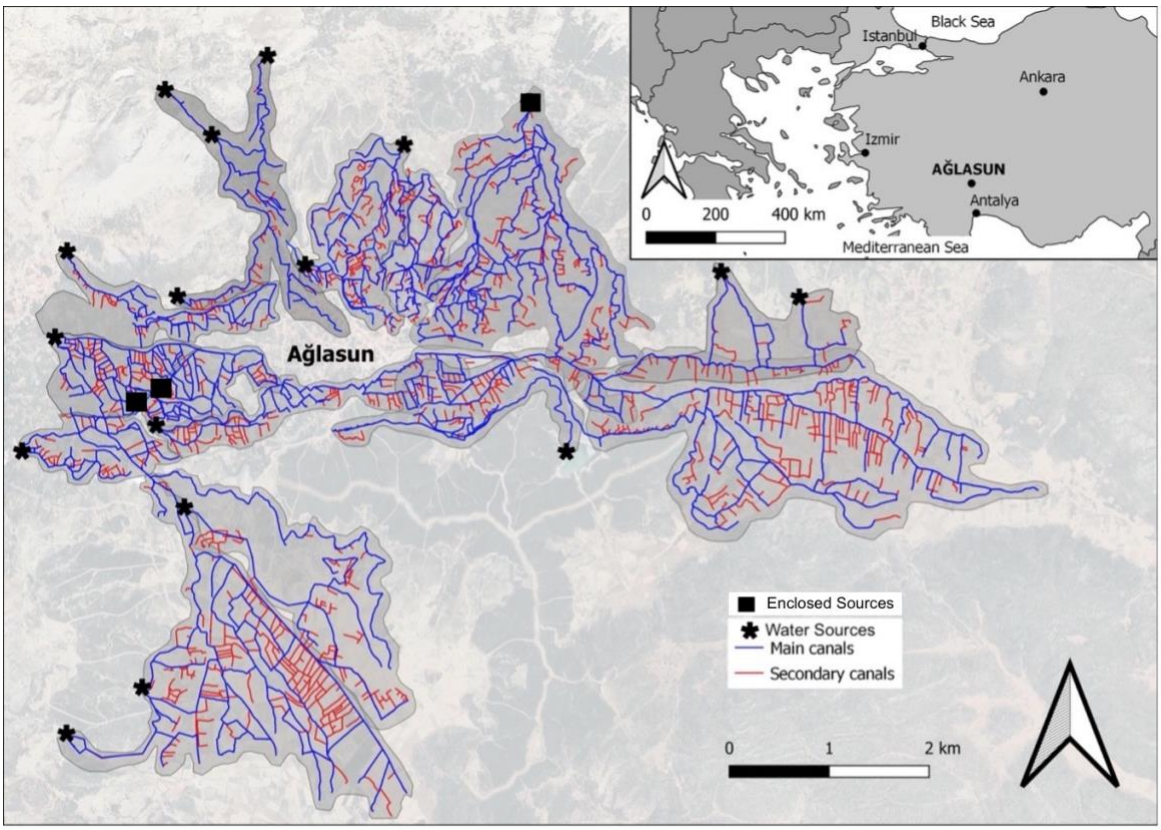


Figure 3. Map of the Ağlasun irrigation network (Source: Adnan Mirhanoğlu and Enrico Roets).

My PhD research was funded by the Sagalassos Archeological Research Project at KU Leuven, which also predefined the case study of Ağlasun. Notwithstanding this, Ağlasun was an appropriate location for this PhD research because changes in state policies, natural resources and infrastructures enable an analysis of "how and why do actors, institutions, and infrastructures co-shape a water governance system and why some actors can easily access water while others cannot?"

First of all, the neo-liberalization of Turkey has led to major changes in the rural areas of Turkey. State policies in industry and agriculture had been applied in the Turkish economy between the 1930s and 1980. The 1980s were a significant turning point for Turkey since there were extensive privatization efforts in various sectors such as water and energy distribution, hydropower infrastructure, telecommunications and health care (Kibaroğlu, 2020). The economic reforms applied during the neo-liberalization of Turkey in the 1980s caused a decrease in the rural population (Aydın, 2010; Kavak, 2016). Additionally, Ağlasun is

one of the rural areas which have been highly affected as a result of neoliberal policies, which resulted in a decreasing and aging population (Kocabıyık & Loopmans, 2021). According to the Turkish State Development Plan for 2014-2018, "the population of rural areas (where the population is less than 20.000) has decreased by 8.8% between 2007-2012 although the population of the country has increased by 7.1% in the same period (2013, p.134)". A similar situation can be seen in Ağlasun as its population has decreased by 9.2 % in the same period (*The Turkish Statistical Institute*, 2023).

Second, the neoliberal policies also affected the use of natural resources in rural areas and the relationship between rural areas and cities. The rural population became impoverished as a result of neoliberal changes to the agricultural sector (Aydın, 2001), leading to the pressure to privatize the natural resources in rural areas. With the neoliberal policies, the rural areas were considered as places where natural resources could be extracted for the people living in the cities, while the well-being of rural people was largely ignored. One of the explicit examples is the changes in the use of water resources in rural areas in Turkey. In the case of Ağlasun, one multinational and one national bottled-water company set up factories to bottle water from the springs of Ağlasun and the multinational company sells water to 36 countries on four continents (Sırma, 2023). They have enclosed some of the springs and managed to grab water in Ağlasun (Figure 3).

The third reason why Ağlasun is a good case study for this research is the institutional and infrastructural changes that occurred. Institutional changes are mainly related to the distribution of the irrigation water. Agriculture and livestock were the dominant economic activities in Ağlasun before the neoliberal reform in Turkey. Land use was organized around these two activities. The system in Ağlasun was called 'örüm' system. In this system, the entire region of Ağlasun was roughly divided into two parts through farmers'collective decisions. The decision was taken generations ago, and the grandchildren of those farmers respected that decision. One part was irrigated agriculture, whereas the other part was used for grazing and rainfed irrigation. There was a rotation between these two parts, and the 'örüm' system was one of the most significant locally embedded institutions in Ağlasun. The crops that were produced on the irrigated land side in the 'örüm' system were mainly sugar beet, cannabis, tobacco, and aniseed, all of which required irrigation. These crops were very profitable, and farmers in Ağlasun could build their livelihoods based on these crops. However, after neoliberal policies were implemented, the Turkish state gradually brought production quotas to these crops. Agriculture became less profitable and farmers were looking for alternative crops. For example, in the 1980s, rose production became more popular. In addition, some farmers started to plant trees, such as cherries, walnuts, pears, and apples in different parts of Ağlasun. Since rose trees and other trees were in need of water and were dispersed over Ağlasun, water was distributed to the whole Ağlasun at the same time, and it was not possible to continue with the 'örüm' system for the whole region. However, a system similar to the 'örüm' system continues in a small part of Ağlasun. A small area in Ağlasun is divided into two

sides for the production of opium poppy (Papaver somniferum), and the farmers who produce it must wait one year to reproduce it. Today, Ağlasun is almost losing the 'örüm' system, which is one of the most substantial locally embedded institutions. According to farmers, one of the main reasons for this loss is that agriculture is no longer profitable. Additionally, farmers are no longer interested in collective decision-making. Rather, each farmer now makes an individual decision regarding what to produce. Currently, the dominant crops grown in Ağlasun are apples, cherries, walnuts, roses, clovers, beans, corn, and wheat. Irrigation water is being controlled and managed by the Ağlasun Municipal Government. Moreover, there have been changes in institutions related to irrigation canal cleaning. Until 2009, the cleaning of canals was the collective responsibility of farmers. During the 2009 election for the mayor, one of the candidates promoted canal cleaning as part of his campaign and guaranteed that the municipal government would take on the full responsibility of canal cleaning. This strategy helped the candidate win the election and the farmers stopped cleaning the main canals. However, municipal workers cleaned the canals superficially, which made the farmers unhappy. In addition, the municipal government took the responsibility only for the main canals, and the farmers were left to clean the sub-canals by themselves. The transfer of cleaning of irrigation canals from farmers to the municipal government caused a loss of collective canal cleaning as another important locally embedded institution.

Infrastructural changes that took place in Ağlasun are mainly related to irrigation canals, their maintenance and the type of irrigation. Since the 1970s, the majority of irrigation canals in Ağlasun have been lined with concrete by the State Hydraulic Works (DSİ), the governmental body in charge of the management of water resources in Turkey. Since 2009, the Ağlasun Municipal Government has made the effort to switch the irrigation infrastructures to drip irrigation technology, which influenced institutions of water distribution, the operation and maintenance of irrigation canals and water fee rules.

Given the abovementioned reasons, Ağlasun is a feasible case to examine the interactions among actors, institutions, and infrastructures.

2.2. Water governance in Ağlasun

Water governance in Ağlasun is organized by both local and national state authorities. The state authorities are the DSİ, the Ministry of Agriculture and Forestry and the special provincial administrations, and they are responsible for water allocation. The only local legal actor is the Ağlasun Municipal Government, which is principally responsible for the daily governance of water for irrigation and domestic purposes.

At the national level, under the Turkish constitution, the Turkish state owns water resources in Turkey, the state authorities can lease water usage rights for a certain period. The Ministry

of Agriculture and Forestry and its provincial administrations handle requests for water allocation and leasing.

At the local level, the mayor and Ağlasun Municipal Council are responsible for decisions regarding water management for domestic and agricultural use. The irrigation fee per hour is determined annually by the municipal government before the start of the irrigation season. The decisions made by the municipal government are executed in the field by water chiefs and guards. Since the 1930s, the water guard system has been operational by the Ağlasun Municipal Government. Water guards are responsible for water management and record the fees that farmers need to pay for each hour. Two water chiefs are permanent employees of the municipal government. Water guards are hired by the mayor seasonally, generally from May to September each year, and there is one water guard for each irrigation network. A water guard can take over the responsibility for two different irrigation networks if the irrigation networks are relatively small and if not enough water guards are available. The main responsibility of the water chiefs is to control the water guards and solve issues between the water guards and farmers. Some of the water chiefs and guards also have land to irrigate, and they are supposed not to have any priorities and respect their irrigation turns.

2.3. Data collection

I mainly collected the data through semi-structured and unstructured interviews and participatory observation. I also used multiple secondary data sources, namely the archives of the Ağlasun municipality, the reports of the DSİ, the ministry of agriculture and forestry, and the special provincial administration. For the mapping of the irrigation canals, I worked with two cartographers. In section 2.4, I explain how I coordinated with them during data collection for mapping.

2.3.1. Interviews

The primary method of data collection I used in this thesis was semi-structured and unstructured ethnographic interviews. The semi-structured interviews were conducted by appointment and I prepared the interview questions before the interviews (Gorden, 1998), while the unstructured interviews took place mainly while I was following the water during the fieldwork. I conducted the scheduled interviews at participants' fields, homes, and public places, such as parks and coffeehouses in Ağlasun.

I conducted the fieldwork during the summers (June-August) of 2018, 2019 and 2021. I conducted interviews with 67 participants. Each interview lasted between 30 minutes and 2 hours. Participants included farmers (n=42), the water chiefs and the water guards (n=11), the current mayor of the municipal government (n=1), the former mayor of the municipal government (n=1), the council members of the municipal government (n=4), headmen

(elected neighbourhood representatives, 'muhtar' in Turkish) (n=2), the manager of one of the bottled-water companies (n=1), an official from the special provincial administration (n=1), an official from the ministry of agriculture and forestry (n=1) and 3 officials from the DSİ (n=3). These participants can be grouped into four categories: (1) farmers who try to access water to irrigate their lands, (2) local officials who are responsible for local management including water management at the local level, (3) nonlocal state officials who deal with policies in water governance, (4) the manager of the bottled-water company who is responsible for the management of the company and decides on the amount of water being taken from the leased water springs of Ağlasun on a daily base. Besides these organized interviews, I also had unstructured interviews with 12 farmers while following the water in Ağlasun during the fieldwork stay. I approached the participants through a combination of purposive and snowball sampling. My main gatekeeper was one of the headmen who was born in Ağlasun and knew both local actors and nonlocal state actors.

The questions asked in the interviews were derived from the research questions, which were informed by the literature. However, the questions were largely inquisitive and open-ended. Also, the questions posed during the interview were tailored to the participant's specific role. The interview guide for farmers included questions about the issues they were facing in irrigation, the solutions they devised, the relationship they maintained with local and nonlocal authorities and other farmers, the issues they faced related to infrastructure and irrigation methods, how they perceived the introduction of drip irrigation technology and their thoughts about the bottled-water companies (see Annex 1). Through the interviews conducted with the water guards and water chiefs, the general operation of irrigation systems in Ağlasun was discussed. The main themes included their daily routines of managing the irrigation canals, the maintenance of infrastructure and their strategies to solve the problems they received from farmers, the social relations between the water chiefs, the water guards and the farmers, and how the water chiefs and the water guards handle any requests from the farmers (see Annex 2). The questions posed to the mayors and the council members revolved around the management of irrigation systems, the introduction of drip irrigation, and the difficulties they encountered during their terms as mayors or council members. Regarding the interview questions with supralocal state actors (the officials from the special provincial administration, from the ministry of agriculture and the General Directorate of State Hydraulic Works (DSİ)), the focus was on how bottled-water companies get permission to bottle water, the policy decisions related to the amount of water to be allocated to the municipal government for domestic use and irrigation, and to the bottled-water companies for bottling water. For the interview with the manager of the bottled-water company, the focus was on how they decide on the amount of water to be bottled, the policy decisions related to the amount of water to be allocated, and their relationship with authorities and farmers.

2.3.2. Participatory observation

Besides the semi-structured interviews, I also used participatory observation as a method to understand the dynamics of water struggles in Ağlasun. There are various kinds of observation, for example, simply observing, taking part in the activity while observing, and totally participating and observing (Yin, 2018). I mainly conducted interviews with farmers on their land while they were irrigating or just after they finished the irrigation. Therefore, I was waiting for the farmers to become available. During the waiting period, I was suggesting to help with the irrigation. Some of the farmers I interviewed in the field were happy with this suggestion and I had the chance to spend more time in the field with the participants. The informal conversations I had with farmers were very helpful, and I was writing down my reflection notes when I was back from the field each day. The below photo was taken by one of the farmers during the fieldwork. We went to the water source together to meet the water guard there. Some irrigation networks have ponds in front of the water source with the aim of adjusting the flow rate of water. Also, there are two large ponds that accumulate rainwater to be used for irrigation. The pond seen in the figure is one of these large ponds.



Figure 4. Visiting water source and water guard with a farmer (Source: Adnan Mirhanoğlu).

I also made observations while I was waiting in the halls of the Ağlasun Municipal Government and the other state actors' buildings. I was also invited to a couple of wedding parties where I could have informal talks with some local actors and had the chance to observe how local actors are interacting with each other during the wedding parties. Moreover, I had various observations during visiting the mayor's office in the municipal government building. During my fieldwork in 2018, 2019, and 2021, I visited the office of the mayor many times and had the opportunity to observe the various changes that had taken place. In 2018, the former mayor would keep locals waiting in the lobby of the entrance hall, individually inviting them to his office and listening to their queries, attempting to provide suitable answers. I engaged in conversation with the people waiting at the entrance of the mayor's office to uncover the reasons why they wished to see the mayor. One of the main issues during the summer periods was irrigation conflicts. Therefore, there were many farmers waiting to talk to the mayor. The mayor was listening to each farmer one by one, and he was closing the door. So, each farmer had some private time with the mayor. Then, he could invite one of the water chiefs to his office and solve the problem of irrigation water requests. However, after the local elections on 31 March 2019, the mayor changed. The current mayor implemented a strategy that was distinctively different from the one that the former mayor had adopted. He was inviting several people to his office and wanted to know what they each wanted. Also, he was keeping the door open so that the people staying in the waiting hall could hear them. The strategy implemented by the new mayor prevented further personal requests on irrigation priority. The mayor had the choice to request a private meeting when a supporter of his visited him, either by inviting the person to the meeting room or by closing the door of his office and instructing the secretary not to let anyone else in. Furthermore, while the former mayor seemed to be more inclusive and made sure to appear welcoming both to the farmers who gave their vote to him in the local elections and to those who did not, the current mayor seemed not to worry about hiding his clientelism.

These observations were helpful for me in understanding the dynamics of water struggles. The observations also helped me to reflect on my interview questions, and I sometimes revised the questions or added more detailed questions after the observations I made.

2.3. Data analysis

Qualitative research data analysis is a complex and challenging process. Ritchie & Lewis, (2003) attempt to explain this complexity: "qualitative explanations attempt to say why patterns and outcomes in the data have occurred. These explanations may use causal logic in a loose, non-universal, nondeterministic sense, but the logic is not based on linear variable analysis. They rarely cite a single cause or reason but set out to clarify the nature and interrelationship of different contributory factors or influences" (p.216).

Software programs can be very useful to manage, analyze, and visualize the complexity and diversity of the data gathered in qualitative research. With the help of computer-assisted qualitative data analysis software (CAQDAS NVIVO), the data can be coded to gain insight into and seek answers from the data being analyzed (Saldaña, 2013). I used the CAQDAS NVIVO to analyze, code, and organize the data. I uploaded the transcripts of the interviews, the daily reflection notes I wrote during the fieldwork, and the photos I took while following the water. During the coding process, I followed the techniques suggested by Saldaña (2013). In the book of Saldaña (2013), data coding consists of various methods and is broadly divided into two main sections: first and second cycle coding methods. I started with the first cycle coding as an initial coding of the data, and I defined the subcategories. Also, I prepared a general code tree to link the codes with the research questions and the literature I have read on water access (see Annex 4). This strategy helped me recognize the extra literature that may be relevant to this research. Saldaña (2013) argues that the second cycle coding methods are more demanding, and they require more advanced analytical skills such as "classifying, prioritizing, integrating, synthesizing, abstracting, conceptualizing, and theory building" (p. 58). Therefore, I spent more time during the second cycle coding to analyze the codes in detail. I classified the codes under different themes, and I connected these themes with the theoretical concepts I was applying. The codes used for this study were access, belief, collective, communication, conflict, control, cost, crop pattern, distrust, drip irrigation, economy, environment, governance, history, inequality, information, infrastructure, politics, power, rule, trust, usefulness and useless. Moreover, I prepared a concept map in NVIVO which shows the relationship between themes, codes, actors and relevant literature sources (see Annex 5). Together with the code tree, the concept map was helpful for me in understanding and analyzing the data. I experimented with multiple coding methods during both the first and second cycle coding processes. I found two of the methods most useful: In vivo coding for the first cycle coding method and axial coding for the second cycle coding. In vivo coding refers to a code that is a concise word or phrase taken directly from the transcription. In other words, they are "the terms used by [interviewees] themselves" (Strauss, 1987, p. 33). During the first cycle coding, in vivo coding was helpful in gaining an in-depth understanding of stories and ideas that were articulated by the actual words of those involved in the interviews (Manning, 2017), and it was very useful since it enabled the codes and the theories I used for this research to emerge from the data. During the second cycle coding, axial coding was useful to reorganize the codes and subcategorize them. Boeije (2009) underlines the aim of axial coding: "to determine which [codes] in the research are the dominant ones and which are the less important ones ... [and to] reorganize the data set: synonyms are crossed out, redundant codes are removed and the best representative codes are selected" (p. 109).

Finally, to ensure that the codes are linked with theoretical concepts and the research questions, I went through the first cycle and second cycle coding processes multiple times until there was theoretical saturation.

2.4. Fieldwork experience in Ağlasun, Turkey

I collected the data during three fieldwork visits between 2018 and 2021. In this section, I illustrate my fieldwork experience and how I engaged with the field.

During the summer of 2018, I visited Ağlasun for the first time in my life. I was very impressed with how green it was. I was checking some photos of the town before I visited the field. Therefore, I was aware that there would be a green area, but I was still very surprised. My first impression started in Antalya, where I took the shared taxi (dolmuş) to Ağlasun. The name of the dolmuş cooperative was written as 'green Ağlasun Sagalassos shared taxis cooperative' in front of the shared taxi. Ağlasun is 7 km away from the famous and well-preserved Sagalassos archaeological site and visitors planning to visit Sagalassos need to pass by this rural town. Therefore, I could understand why the name of Sagalassos was included in the shared taxi cooperative name. However, the word green was a bit unclear to me. After arriving there and spending the first couple of days, I understood better how local people in this town are proud of their 'green Ağlasun'. Since one of the main reasons for this greenery was the rich water sources of Ağlasun, I was very excited to start my research on water.

I went to Ağlasun as a team member of the Sagalassos Archeological Research Project, which is managed and coordinated by the Department of Archeology of KU Leuven. The members of this project have been collaborating with local people and different institutions in Ağlasun since the 1990s and this long-term collaboration helped me to get access to the field. Together with the director of the Sagalassos Archeological Research Project, Prof. dr. Jeroen Poblome, we visited the Ağlasun Municipal Government in June 2018, and Prof. Poblome introduced me to the mayor as a 'waterman'. The mayor seemed very interested in my research topic since water governance was a hot issue in Ağlasun. After conducting the first fieldwork for a couple of days, I understood much better why the mayor was so keen to learn more about my research topic. Apparently, the mayor of Ağlasun is considered 'the mayor of water'. Since almost all local people have land to irrigate, the politics of Ağlasun is heavily influenced by access to irrigation water. If there is no conflict during the irrigation season, which is mostly between June and September, then the mayor is considered as duly performing his duties. This was one of the most important lessons I learnt during the first fieldwork. The mayor was very helpful to me in our first meeting, and he suggested me to visit the springs of all water sources in Ağlasun. I was a bit surprised by that suggestion, but I was also very curious to visit the springs. He called one of the water chiefs to his office and he ordered the water chief to accompany me while visiting the springs. Therefore, my first informant was the water chief appointed by the mayor. The water chief was responsible for the irrigation system in Ağlasun, including the coordination of the water guards, who are appointed to each irrigation canal to distribute water among farmers daily. Together with the water chief, we visited all springs in Ağlasun. He was a very talkative person, and he was telling me stories about water, the town, and the relationships among local people. I was taking notes about the things I found related to water. The water chief also introduced me to the

water guards and some farmers in the field while we were visiting the water springs. During these encounters, I paid attention to how the water chief was interacting with farmers. To some, he was very friendly, whereas to others he was more formal. I was puzzled by this difference in the beginning. While the water chief was explaining the role of the municipal government in water management, he was explicitly mentioning how certain farmers are very good friends of the mayor and they have 'priority' access to reach the mayor via phone or visit him in his office whenever they want. Then, it became clear to me how the relationship with local authorities influences access to water in Ağlasun. After visiting all 24 water sources, I decided not to spend more time with the water chief since I observed that there was tension between the water chief and some farmers, and I did not want to be considered a 'friend' of the water chief so as not to undermine my interactions with farmers.

For the rest of the fieldwork, I followed another strategy, meeting farmers alone and on my own initiative. I used a 'following the water' approach. First of all, I decided to focus on one of the springs and its irrigation network as representative of the other 23 springs. After I made my choice, I was following the irrigation canal and tried to find where the water was flowing in that irrigation network every morning. Since it was during the irrigation season, I was sure to find at least one (irrigating) farmer on the land where the water was flowing. The following the water approach was helpful for me to meet farmers independently on the field. It also helped me to make observations and witness the interactions between the water guard and the farmers. The water guard that was responsible for the irrigation network I chose to focus on gave me his phone number and he suggested me call him while I was visiting the irrigation network. Calling each other via phone was common among farmers and local people in Ağlasun. The farmers were also communicating with the water guard via phone. One day, I called the water guard and informed him that I was on the field. However, he said that he would not visit the field on that day, adding that he was very busy with other duties given by the municipal government. I continued my routine and followed the water. After I arrived at the land where the water was flowing, the farmer invited me to join him for the tea break. I happily accepted his invitation and talked about my research while drinking the delicious tea prepared on the wood fire. While we were talking, the water guard appeared, and he was very surprised to see me sitting next to the farmer. The water guard added that he decided to visit the field since the farmer I was sitting with was his close friend and he had called the water guard since he was not happy with the quantity of water. The water guard went to the spring and increased the flow rate of the water for 'his friend'. This experience showed me different lessons together. First, it showed me how social relations played a significant role in access to water. Second, it also showed me why I should be cautious about the information that the water guard shared with me, and I should not solely rely on the information given by the water guard.

After I finalized the first fieldwork in 2018 and came back to Belgium, I focused on the role of social **institutions** and political relations among farmers and local authorities and how these relations (co)shape access to water. The details of this part can be found in Chapter 3.

During the fieldwork in 2019, I started to interview the old farmers (see Annex 3) to better understand how irrigation water was governed in the past. One of the main issues that almost all older farmers mentioned was the importance of canal cleaning, which is crucial for maintaining the irrigation system and preventing water loss. The canal cleaning in Ağlasun was done collectively until 2009. All the farmers who were taking water from the same irrigation canal would meet at the head of the canal and walk down the hill, cleaning the main canal until its end. Each farmer was supposed to contribute to cleaning the main canals until arrival on their land. However, this arrangement was causing conflicts since the farmers whose lands were close to the water source worked much less compared to the ones located far away from the water source. In 2009, one of the candidates running for mayor promised to make the municipal government responsible for cleaning the collective canals. This promise helped him win the mayoral election, and the farmers stopped cleaning the main canals. Moreover, this institutional change in canal cleaning enabled the introduction of collective drip irrigation infrastructure by the municipal government. By having the new drip irrigation infrastructure, there would be no need to clean the canals and the water loss would be almost zero. After interviewing the old farmers, I continued interviews with the farmers who implemented the drip irrigation infrastructure on their land. Since it was not possible to switch from surface irrigation to drip irrigation without modifications and investment in drip irrigation at the farmer level, there were very few farmers who already made this switch. I also interviewed the municipal actors such as the mayor, the water chiefs, and the water guards to understand their perceptions of the changes in irrigation infrastructures. After the interviews with farmers and municipal actors, I clearly recognized the significant role of infrastructure in access to water. Therefore, I decided to dig deeper into how **infrastructure** triggered social and institutional changes.

To understand the role of infrastructures in irrigation systems in Ağlasun, I thought mapping the material characteristics of the whole irrigation network and a detailed analysis of one of the irrigation networks could be useful. Since it was not possible to collect data for mapping and continue interviews, I asked for help from two cartographers to collect raw data. We agreed on the symbols to indicate each type of material characteristic (concrete, soil, and plastic) of irrigation canals. Also, for the detailed analysis of one of the irrigation networks, I chose the 'Ulupinar' irrigation network, which had plots with both drip irrigation and surface irrigation and we agreed on the specific symbols with cartographers to collect raw data for both irrigation canals and plots for the chosen irrigation network. Every morning, I was having a short meeting with the cartographers about which irrigation network should be mapped and specific things such as the number of drip irrigation users and the drip irrigation infrastructure. I had already talked to all the water guards and gained insights into each

irrigation network, and I was sharing this information with the cartographers. Then, the cartographers were walking along the irrigation canals around 20-25 km each day to indicate GPS points via handled GPS (see Annex 6 for the symbols used during collecting GPS points for crops and infrastructure and Annex 7 for the general layout of GPS waypoints). We were having another meeting at the end of the day to discuss their observations and experiences for each irrigation network. Finally, we were transferring the raw data to QGIS to map the irrigation network in Ağlasun as seen in Figure 3 in section 2.1. Also, by using the raw data collected for the Ulupinar irrigation network, the map in Figure 5 was prepared.

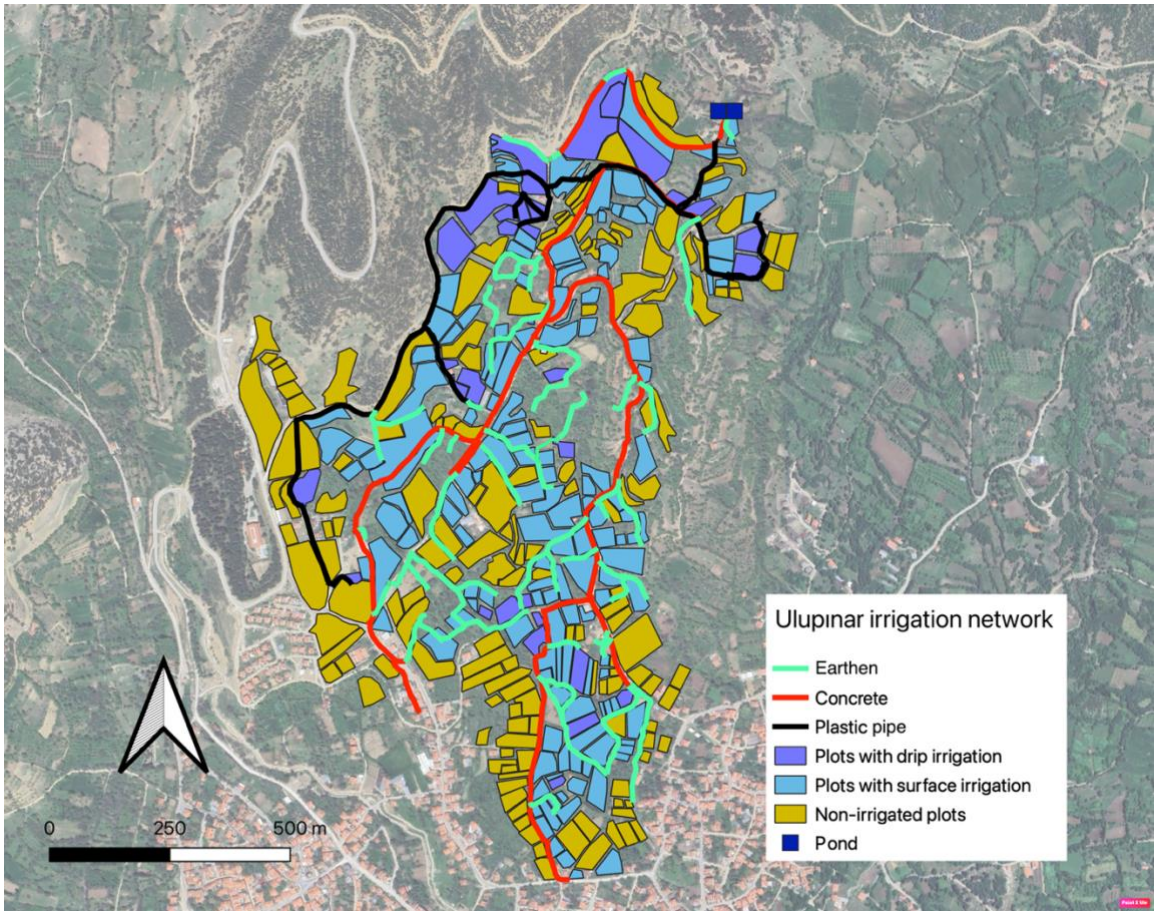


Figure 5. Map of the Ulupinar irrigation network (Source: Adnan Mirhanoğlu & Enrico Roets)[2].

I could not conduct the most important fieldwork in 2020, since there was no possibility of travelling to Turkey and collecting data due to the Covid-19 pandemic. I planned to conduct online interviews. However, the farmers did not accept being interviewed online. Therefore, I had to postpone my final fieldwork to the summer of 2021.

[2] The earthen and the concrete canals are open whereas the plastic pipe canals are closed.

In 2021, I conducted my final fieldwork. There were many changes in Ağlasun since the last fieldwork I conducted in 2019. One of the most significant changes was the arrival of the second bottled-water company. The new 'actor' in Ağlasun highly influenced the amount of available water for farmers. Therefore, I decided to focus on the role of **actors** in access to water for my final fieldwork. My initial aim was to understand the source of the conflicts among the farmers and bottled water companies. Therefore, I interviewed the farmers that had land connected to the water sources that the bottled-water companies also used. Most farmers were blaming the municipal government and the state officials to let the bottled-water companies get permission to bottle water in Ağlasun. After listening to these complaints from farmers, I decided to interview state officials. However, it was not easy to arrange an interview with the state officials since the water access issue was sensitive in Ağlasun and they preferred not to be interviewed. After trying different strategies, I managed to meet one of the key people in Ağlasun, who was a member of the leading party. This person helped me to arrange meetings with the state officials. Furthermore, I interviewed the previous mayor since the first bottled-water company got permission during his mayorship. Finally, I interviewed the manager of the new bottled-water company and tried to understand the water access issues from the perspective of the bottled water companies.

2.5. Reflections on positionality

I have explained my background and motivation to conduct research on water for this thesis in section 1.1. Coming from a farmer family and experiencing injustices in access to water deeply influenced my positionality in the field. Also, I was born into a Kurdish family, and I have experienced injustices because of my ethnic identity. I explain in the next sections how my ethnic identity and coming from a farmer family influenced my positionality during the three fieldworks in Ağlasun.

2.5.1. Language and ethnic identity

One of the most common questions you may hear when you meet a new person in Turkey, especially in rural areas, is 'which city are you from?'. This question can even be the second question following after asking your name. Therefore, it is important to understand why this question is very common when you meet a new person in Turkey. Although the question may seem innocent, the answer can give crucial information to the person who asked the question. For example, by answering this question, you may reveal your ethnic and/or religious identity, which is highly contested in Turkey. The Kurdish question is one of the most contested issues in Turkey, which has the largest population of Kurdish people in the world, according to Kelbaugh & Conley (2021). There has been an ongoing conflict between Kurds and the Turkish state since the establishment of the Turkish Republic in 1923 (Saatci, 2002). Therefore, the Kurdish question also influences daily conversations.

The majority of people in Ağlasun are Muslim and vote for right-wing parties both for local and national elections. In the last local election in 2019, only 10 % of votes were given to the Republican People's Party (in Turkish: Cumhuriyet Halk Partisi, CHP) which is considered a social democratic political party. The rest of the votes were shared among right-wing parties. A similar tendency occurred during the last national elections, which occurred in 2018. CHP received only 12% of the votes, whereas the rest of the votes were received by the right-wing parties (Ağlasun Seçim Sonuçları, 2019).

I checked the results of the elections before I started the fieldwork in Ağlasun and I had to prepare myself for any political discussion that may occur during the interviews. After introducing myself and the research to the interviewees, most of them started with the same question: Which city are you from? Although I was aware that revealing my hometown, Mardin, which is a Kurdish-populated city, could bring tension during the interviews, I was honest, and I told them that I was from Mardin. I could clearly see the changes in the body language of some participants. The follow-up questions sometimes were highly contested questions, and they were irrelevant to the research. I tried to be professional and calm down myself, but it was not always easy. After the first year of fieldwork, I came up with an extra explanation during the second and third years of fieldwork. Whenever the participants were asking the famous question 'Which city are you from?', I was explaining more detailed information, stating that I was born in Mardin, but we moved to Izmir when I was 14 years old. Izmir is a Turkish-populated city and is the third most populated city in Turkey. Interestingly, almost all participants during the second and the third year of the fieldwork neglected my 'Kurdish identity' and they were talking and asking questions only about Izmir. This extra explanation helped me to get rid of the contested discussions about the Kurdish question and I could focus more on the water access issues in Ağlasun.

2.5.2. Insider/outsider and in-betweenness

Insider/outsider categorization in positionality debates is articulated as a continuum that incorporates a multitude of categories, including gender, age, sexuality, ethnicity, first language, geographic location, and social class and status that can be present independently or simultaneously (Bourke, 2014; Mullings, 1999; Sikes, 2004). According to Cui (2015), a 'researcher-researched relationship is dynamic and subject to negotiation' (p. 356) which influences both researcher to researched and researched to researcher (Ryan & Golden, 2006). During the three fieldworks, I experienced not only being an insider or outsider, but also being in-between. For example, while talking to the farmers, I was mentioning my farming experiences as a farmer, which made the farmers feel more comfortable talking to 'another farmer' instead of talking to a researcher coming from abroad. Second, I recognized that there were certain words used in different ways in Ağlasun. One of the most common words for farmers was 'rain' which is 'yağmur' in Turkish. However, people in Ağlasun were using the word 'rahmet' - which has a religious reference meaning the mercy of God - instead of 'yağmur' to refer to rain. Since this was one of the most frequently used words during the

interviews, I also started using it. The farmers looked happy when I used the local words, and this strategy also helped me make the farmers feel more comfortable. These experiences made me feel more 'insider'. However, being Kurdish and interviewing right-wing participants sometimes made me feel as 'outsider'. Therefore, instead of the duality of being either an insider or outsider, I had the position of 'in-betweenness', which has been acknowledged more recently in positionality debates (Irgil, 2021).

After I reflected on the interviews with farmers, I recognized that the strategy to start the interview with my personal experiences as a farmer made the farmers more comfortable. Also, they were seeing me more as a farmer who could understand their problems rather than a researcher. Therefore, I continued a similar strategy with other actors, and I emphasized my different identities during the interviews. For example, while interviewing the state officials, I was starting the interview by mentioning the previous universities I studied in Turkey. The state officials had at least a bachelor's degree, and talking about their university experiences made them feel more comfortable. Identifying oneself based on certain universities is still strong in Turkey and the graduates of the same university feel more connected. For example, I met some state officials who graduated from the same universities as I did, and these people were very helpful to me and they introduced me to other state officials which was very useful to gain insights into the broader discussion of water access issues in Turkey.

Finally, during the second and the last fieldwork, I managed to build intimate relations with farmers and local people in Ağlasun. They invited me to their daily social activities and also weddings. When there was a wedding in Ağlasun, the families of the bride and groom were supposed to prepare food for the guests. It was an open call to everyone living in Ağlasun and the wedding time and location were announced through the loudspeakers of the municipal government. I was invited to 8 different weddings during my fieldworks in Ağlasun and these moments were very special for me to feel more 'insider'. The water access issues were also discussed during the wedding parties, which were generally starting with lunch and continuing until midnight. The water guards, the water chief and the mayor were also joining the weddings. I had the chance to observe the relationship between local authorities and farmers in another context. Furthermore, I was also happily helping the families of the bride and groom to prepare food for the guests during some weddings. The below photo was taken during the preparation of food for around 700 people, and I was helping the kitchen crew.



Figure 6. Preparing food for the guests of the wedding ceremony (Ağlasun, 02 August 2019, Source: Adnan Mirhanoğlu).

The farmers coming to the weddings were a bit surprised to see 'a researcher' volunteering in the kitchen and preparing food for them. Such volunteering experience helped me to better communicate with local people during interviews. Some of the interviewees who came to the weddings easily recognized me before starting the interview. I also met some farmers at the weddings, and they invited me to their lands, which helped me involve new participants in the interviews. Finally, I felt more welcomed by the local community after joining the weddings and spending time with local people. They sometimes invited me to their homes for dinner or offered help before I was asking. I felt grateful for the intimate moments when the local people shared their daily life activities with me.

2.6. References

Ağlasun Yerel, Genel Seçim Sonuçları. (2019). *Burdur Ağlasun Yerel, Genel Seçim Sonuçları, Oy Oranları—Endeksa*. https://www.endeksa.com/tr/analiz/burdur/aglasun/secim

Aksu, H. H., & Güngör, A. (2020). Coğrafi Bilgi Sistemleri İle Burdur İli Yağış Analizi Ve Değerlendirilmesi. *Ömer Halisdemir Üniversitesi Mühendislik Bilimleri Dergisi*. https://doi.org/10.28948/ngumuh.499325

Aydın, Z. (2001). Yapısal uyum politikaları ve kırsal alanda beka stratejilerinin özelleştirilmesi: Söke'nin Tuzburgazı ve Sivrihisar'ın Kınık köyleri örneği. *Toplum ve Bilim*, *88*, 11–31.

Aydın, Z. (2010). Neo-Liberal Transformation of Turkish Agriculture. *Journal of Agrarian Change*, *10*(2), 149–187. https://doi.org/10.1111/j.1471-0366.2009.00241.x

Boeije, H. (2009). *Analysis in qualitative research*. Sage publications.

Bourke, B. (2014). Positionality: Reflecting on the Research Process. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2014.1026

Bulut, İ., Değişgeç, C., Güney, H., & Uzun, O. (2017). Kültürel Peyzaj Açısından Geleneksel Ağlasun Evleri. *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*.

Çelik, E. (2013). *Ağlasun (Burdur) ovasının hidrojeoloji incelemesi* [Master thesis]. Süleyman Demirel Üniversitesi.

Ceylan, S. (2015). *Ağlasun İlçesinin Alternatif Turizm Kaynakları*. Pegem Akademi Yayınları.

Cui, K. (2015). The insider–outsider role of a Chinese researcher doing fieldwork in China: The implications of cultural context. *Qualitative Social Work*, *14*(3), 356–369. https://doi.org/10.1177/1473325014545412

Diop, K., & Liu, E. (2020). Categorization of case in case study research method: New approach. *Knowledge and Performance Management*, *4*(1), 1–14. https://doi.org/10.21511/kpm.04(1).2020.01

Dyer, J. R., & Wilkins, A. L. (1991). Better Stories, Not Better Constructs, To Generate Better Theory: A Rejoinder to Eisenhardt. *Academy of Management Review*. https://doi.org/10.5465/amr.1991.4279492

Gorden, R. L. (1998). *Basic interviewing skills*. Waveland Press.

Irgil, E. (2021). Broadening the positionality in migration studies: *Assigned insider* category. *Migration Studies*, *9*(3), 1215–1229. https://doi.org/10.1093/migration/mnaa016

Kavak, S. (2016). *Rethinking political economy of contemporary water struggles in Turkey: Space, structures and altered agencies from a comparative perspective* [PhD Thesis]. Université Paris-Saclay.

Kelbaugh, M., & Conley, J. (2021). *The Kurds of Turkey: A Tale of Survival, Resilience, and Uncertainty*. 16.

Kibaroğlu, A. (2020). The role of irrigation associations and privatization policies in irrigation management in Turkey. *Water International*, *45*(2), 83–90. https://doi.org/10.1080/02508060.2020.1719382

Kocabıyık, C., & Loopmans, M. (2021). Seasonal gentrification and its (dis)contents: Exploring the temporalities of rural change in a Turkish small town. *Journal of Rural Studies*, *87*, 482–493. https://doi.org/10.1016/j.jrurstud.2020.09.002

Manning, J. (2017). In Vivo Coding. In *The International Encyclopedia of Communication Research Methods* (pp. 1–2). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118901731.iecrm0270

Mullings, B. (1999). Insider or outsider, both or neither: Some dilemmas of interviewing in a cross-cultural setting. *Geoforum*, *30*(4), 337–350. https://doi.org/10.1016/S0016-7185(99)00025-1

Ritchie, J., & Lewis, J. (2003). *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. SAGE.

Ryan, L., & Golden, A. (2006). 'Tick the Box Please': A Reflexive Approach to Doing Quantitative Social Research. *Sociology*, *40*(6), 1191–1200. https://doi.org/10.1177/0038038506072287

Saatci, M. (2002). Nation–states and ethnic boundaries: Modern Turkish identity and Turkish–Kurdish conflict. *Nations and Nationalism*, *8*(4), 549–564. https://doi.org/10.1111/1469-8219.00065

Saldaña, J. (2013). *The coding manual for qualitative researchers* (2nd ed). SAGE.

Sikes, P. (2004). Methodology, procedures and ethical concerns. *Doing Educational Research*, 15–33.

Sırma. (2023). *Su Kaynaklarımızdan Dünyaya*. https://www.sirma.com.tr/kaynagindan-dunyaya

Strauss, A. L. (1987). *Qualitative analysis for social scientists*. Cambridge university press.

The Tenth Development Plan 2014-2018. (2013). https://www.sbb.gov.tr/wp-content/uploads/2022/07/The_Tenth_Development_Plan_2014-2018.pdf

The Turkish Statistical Institute. (2023). https://biruni.tuik.gov.tr/medas/?kn=95&locale=tr

Van Loo, M. (2018). *Human environment interactions in the past Modeling ancient crop yields in a Mediterranean environment* [PhD thesis]. KU Leuven.

Yin, R. K. (2018). *Case study research and applications: Design and methods* (Sixth edition). SAGE.

3. SOCIAL HEAD-ENDERS: ACCESS AND AUTHORITY IN IRRIGATION GOVERNANCE

Abstract

Inequalities in access are a major concern for the management of common pool resources. In the case of irrigation water, inequalities are often explained by spatial 'head-ender/tail-ender' distinctions, determined by distance to the water source. However, inequalities in access are also produced by social relations and social institutions. Drawing from ethnographic research in Ağlasun, a rural town in the southwest of Turkey, we examine socio-spatial inequalities vis-à-vis water access in a small-scale, locally managed irrigation system. Our findings demonstrate that spatial 'head-ender/tail-ender' differences in the irrigation system intersect with social relations. By introducing the concept of 'social head-enders', we emphasize how social and political relations may introduce a complementary asymmetry in access to water between farmers. Analyzing the socio-spatial dynamics in such asymmetric systems allows us to further explore the interaction between access and authority. This leads us to illustrate important conditions for more equitable and democratic local irrigation governance.

Keywords: access theory, authority, common pool resources, irrigation governance, power, social head-enders, Turkey

An earlier version of this chapter was published as:

Mirhanoğlu, A., Loopmans, M., & Özerol, G. (2022). Social Head-Enders: Access and Authority in Irrigation Governance. *Society & Natural Resources*, *35*(2), 185-203, DOI: 10.1080/08941920.2021.2009944

3.1. Introduction

Common pool resources (CPR) theory emerged as a response to 'the tragedy of commons' hypothesis (Hardin, 1968). Scholars from different parts of the world have studied myriad cases where people access, use and collectively govern CPR, such as fisheries, forests and irrigation water. The primary concern of CPR scholars has been to analyze under which conditions these resources are sustainably used and how they can be collectively governed (Janssen et al., 2011; Johnson, 2004; Ostrom, 2005; Ostrom et al., 1994).

Canal irrigation systems are complex CPR management systems, shaped by ecological, social, cultural, political, historical, material, and economic factors. Irrigation canals do not only constitute the infrastructure to carry water. They also connect people, land, other infrastructures, and systems of rules and institutions. The material characteristics of canal irrigation systems introduce a 'spatial' hierarchy, with farmers situated upstream (head-enders) assuming better and easier access to water sources than farmers situated downstream (tail-enders) (Ostrom & Gardner, 1993). However, this spatial asymmetry between head-enders and tail-enders is not the only factor determining access to water. In this paper, we analyze the impact of the intersections of socio-spatial and socio-political relations on access to water. By introducing the concept of "social head-enders", we emphasize how social and political relations may introduce a complementary asymmetry in access to water between farmers. Although theoretically spatial head-enders have easier access to water, social and political inequalities amongst farmers may intersect with and complicate the spatial hierarchy of access. Our aim is to improve the understanding of this socio-spatial hierarchy. Building on ethnographic research in Ağlasun, a rural town in the southwest of Turkey, we focus on how the relations between farmers and authorities affect inequality in access. Authorities control and regulate access to irrigation water. They include not only the higher-ranked decision makers involved in irrigation governance but also canal operators responsible for day-to-day management (cf. Rap & Van der Zaag, 2019; Van der Zaag & Rap, 2012).

We emphasize the co-construction of access and authority, thereby extending the theorization of Sikor and Lund (2009) on the relation between property and authority. We build upon critical CPR theory, particularly Ribot and Peluso's (2009)[3] relational theory of access (Quintana & Campbell, 2019). We examine the underpinnings of socio-spatial inequalities of access to water in a local irrigation system.

Local, collectively managed irrigation systems have been studied intensively in Turkey. Many have already discussed inequities in access to water and to decision making in these systems. Harris (2008) argues for the importance of socio-economic and gender equity in water use for the democratic and sustainable governance of irrigation in southeastern Turkey, where a very

[3] The first version of this paper has been published in Rural Sociology in 2003. Therefore, it is important to consider this detail to understand how the other papers cite 'theory of access' paper since 2003.

large irrigation scheme was started in the early 1990s. Also focusing on large-scale irrigation in southeastern Turkey, Özerol (2013) shows how rules based on the ownership or size of land favor certain farmers' participation in the management of Water User Organizations (WUOs). Harris (2006) claims that WUOs cause inequality in access to the water together with inequalities in prestige and power in irrigation management. Studies on decentralization equally emphasize inequalities. Kadirbeyoğlu and Özertan (2015) examine the effects of power asymmetries and local context on user satisfaction in WUOs. Kadirbeyoğlu (2017) discusses the importance of the local context in collectively managed irrigation systems through a comparative study of WUOs in two provinces of Turkey. She shows how civic engagement can reduce inequalities in resource and power distribution. Finally, Kibaroğlu (2020) analyzes the systemic and governance problems of local irrigation management in Turkey. She explains the government's attempts to take back control over WUOs in the 2010s as a response to persistent inequities and inefficiencies in the administrative-technical functioning of WUOs.

As the above review shows, most studies of irrigation governance in Turkey focus on large-scale irrigation systems constructed by the national *State Hydraulic Works* (DSİ) and transferred to WUOs. Instead, we examine a small-scale irrigation system, long controlled by the municipal government, providing new insights into the role of local authorities in irrigation governance and their relationships with water users. Furthermore, studies in Turkey often analyze either formal rules and regulations (Kadirbeyoğlu & Özertan, 2015; Kibaroğlu, 2020), or the characteristics and experiences of water users whose access to the management and use of irrigation water is hampered (Harris, 2006, 2008; Özerol, 2013). With this paper, we add a new, relational perspective to these debates. This perspective implies not only understanding governance and inequality in interaction but also considering water as co-constitutive with social and political relations, rather than an external object to be managed (Krause & Strang, 2016); a dialectic mediated by socio-spatial infrastructure like irrigation canals (Bakker, 2012). Expanding Sikor and Lund's (2009) analysis, we discuss the interaction of farmers with authorities beyond formal rights-based access. We investigate the various ways in which social relations are deployed to access water. In doing so, we illuminate how these strategies are grafted upon existing local socio-spatial and socio-political hierarchies, and serve to reinforce them. Importantly, we will show how authorities do not only derive their authority from setting or implementing the rules (i.e., delineating and distributing 'property' rights), but also from their ability to bend them.

3.2. Theoretical framework: access and authority in irrigation governance

The literature on CPR governance has been expanding since the 1980s and absorbed many of the critiques it received (Quintana & Campbell, 2019). One of the most persistent critiques, according to Quintana and Campbell (2019) focuses on the lack of attention on structural inequalities in resource access. Critics of mainstream CPR theory argue that the evaluation of

the sustainability of resource governance remains incomplete without analyzing winners and losers (Agrawal, 2014; Robbins, 2011). Johnson (2004) explains how critical commons scholars (such as Jodha, 2001; Mosse, 1997) shift the focus of concern from effective governance and resource depletion towards creating and maintaining access for the poor and other marginalized groups, and integrate aspects of power into their analysis (Agrawal, 2005; Agrawal and Gibson, 1999; Clement, 2010; Kashwan, 2016; Kashwan et al., 2019). Among the most explicit attempts to include power in debates on resource governance is Ribot and Peluso's (2009) theory of access. They argue for a nuanced and multifaceted analysis of how access to resources is organized and how inequalities in access are established. Their flexible and often implicit use of concepts of power has received criticism: their unsystematic treatment of the role and sources of power is said to hamper empirical studies on the relationship between access and power (Myers and Hansen, 2020). Distinguishing between gaining and maintaining access on the one hand, and controlling access on the other, they attribute an important role to authorities (Milgroom and Ribot, 2020), defined as "individuals or institutions with the authority to make and implement laws" (Ribot and Peluso, 2009:170). This focus might obfuscate alternative forms of power and leave the diverse origins and operations of authority unexplored.

In response, Sikor and Lund (2009) explore the dialectic between access, rights, and authority in more detail. Focusing on property rights, they explain that struggles over property are as much about the scope and formation of authority as about access to resources. Parallel to the competition for access amongst resource users, a competition over authority emerges between authorities (Ribot, 2009; Roth, 2009). As people seek to secure property rights, they also seek access to the authorities that legitimize and sanction such claims. In establishing relations with the entities that oversee the distribution, controlling and sanctioning of property rights, the latter are strengthened in that they gain in authority to do so. Authority, as Weber (1978) has taught, is grounded in the belief that the actor giving a command is legitimated to do so. This legitimacy can be based on various grounds, but needs continued public confirmation to hold. Resistance to an authority is expressed by ignoring its orders or rules, thus rejecting its legitimacy (Haugaard, 2018). When actors reject access control by an authority and seek out alternative ways to gain and maintain access, they potentially reinforce the legitimacy of alternative authorities (Boelens, 2015).

The water rights framework (Beccar et al., 2002; Boelens & Doornbos, 2001) seeks to expand our understanding of authority and rights in irrigation by focusing on the competition between modernist, state-imposed rights to access and decision making, and traditional, community-based rights. Boelens (2009, 2015) emphasizes how different rights sets compete for legitimacy and authority, and in doing so, shape each other and influence access of various groups. He discusses the intersection of formal state-sanctioned rights and informal community-sanctioned ones. Yet, in what he calls 'water rights in action', Boelens (2015) also acknowledges how these rules and rights are principles which, in practice, might be

circumvented, rejected, or counterposed to secure privileged access. Similarly, in their original formulation of access theory, Ribot and Peluso (2009:163) hint at illicit forms of access and maintain that often, the distribution and warranting of rights is not what makes state agents 'powerful', but rather the delegation of privileges and ambiguity in rights enforcement. Indeed, the very insecurity and instability of rights increases the importance of maintaining relations with authorities. In this paper, we similarly recognize the constitutive relationship between formal and informal water rights on the one hand, and the inconsistencies in their deployment on the other. We contend that not just formally setting or implementing rules, but also informally bending them is essential to organize and gain access in an unequal system, legitimizing the existence of a political hierarchy that allows for such practices. This rule bending creates a grey zone between legitimate and illicit access to water, the relations of which with authority remain underexplored in irrigation studies (but see Anand (2015) on the conscious 'leakiness' of *urban* water systems).

Additionally, we connect access theory more explicitly to reflections on the socio-spatial politics of irrigation governance. Two complementary, yet separate, perspectives on the socio-spatial nature of irrigation systems can be discerned, both of which predict asymmetries. First, mainstream CPR scholars discussed the spatial head-ender/tail-ender asymmetry in irrigation systems as a collective action problem. Ostrom (1990) and Ostrom and Gardner (1993) argued that farmers close to the water source get better water access than farmers further away. This argument has been confirmed in various studies across the world (e.g., Janssen et al., 2012; Tang, 1992), revealing how unchecked water-greed by spatial head-enders can leave spatial tail-enders with insufficient water and stress the need for control mechanisms to undo this imbalance.

Second, Mollinga (2016) describes irrigation water, following Bakker (2003), as an 'uncooperative commodity': an irrigation network's material characteristics make it hard to correctly monitor the flow and discharge of water, or agree on a just distribution of it. Socio-spatial opacities also create an information asymmetry between those controlling access to water and those desiring access, which increases the authority of the former (Rap and van der Zaag, 2019; Van der Zaag and Rap, 2012). Exacerbating this asymmetry through information governance can become an important authority-building strategy by those who control access to water.

Early on, scholars pointed out how social relations develop to mitigate the effect of material inequalities in access to water and information (Boelens, 2009; Gillingham, 1999), adding more complexity to the study of water access (Brugnach, 2017). Ambiguities are often maintained and exploited by those in power to retain authority and control over access. For instance, Gillingham (1999) explains how informal rules sometimes override formal rules of access in irrigation systems, and the monitoring and enforcement of those rules might differ from user to user. These ambiguities stimulate actors seeking access to invest in permanent

relations with those in power, thereby strengthening the latter's authority. Kramm and Wirkus (2010) analyze how farmers invest their social status in relations with authorities who control water access. Farmers with more financial capital can access more water illegally, either by paying fines when they do not follow the institutional rules or by bribing the person in charge of water delivery. Similarly, Saldías et al. (2013) show that access to capital, labor and community membership shape access to irrigation water in peasant communities in Bolivia. Mollinga (2016) suggests that understanding these social and political dynamics behind access to water requires a theory of access beyond mere property rights. In this paper, we respond to this call and examine access to irrigation water, with a particular focus on the role of authorities in locally managed systems.

3.3. Research materials and methods

3.3.1. Case study background

Ağlasun is a municipality of the Burdur province in the southwest of Turkey (Figure 1) with a population of 8,537 (TSI, 2020). The total area of arable land is 6,830 hectares (BPDAF, 2020). The dominant economic activities in this rural mountain town are agriculture and livestock. In the 1960s, driven by national agricultural policies, farmers switched to cash crops, such as sugar beets and roses (Coetzer, 2019). The town was hard hit by the 1990s agricultural liberalization in Turkey. It lost access to cash crop value chains as its mountainous location and terrace agriculture inhibited farm upscaling. Rural-to-urban migration increased, especially among the young generation, leaving the municipality with an aging population (Kocabıyık and Loopmans, 2020). In response, farmers switched to labour-extensive tree crops, such as cherry and walnut, or focused on animal husbandry and feed crops. The main crops cultivated in Ağlasun nowadays are apples, cherries, walnuts, roses, clovers, beans, corn, and wheat. Additional income is derived from seasonal employment in the nearby Sagalassos archeological excavation or larger farms, fish farming, shops, and rental income from seasonal tourists and students (Kocabıyık and Loopmans, 2020).

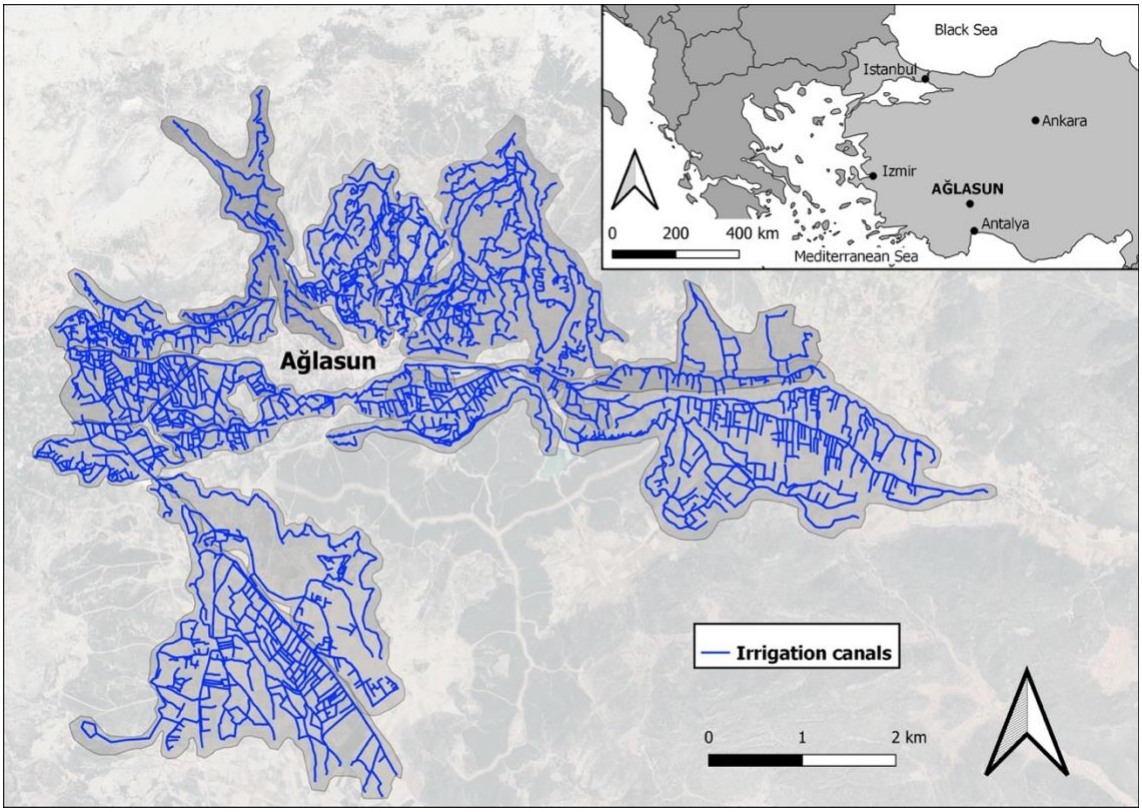


Figure 1: Map of the case study location and the majority of irrigation network (Source: Own data)

Ağlasun's agricultural production is heavily dependent on irrigation. Official data on the area size of irrigated land are lacking, but according to a 2016 farmer survey (n= 675), 78% of the respondents claimed to irrigate at least parts of their land (Kocabıyık, 2021). Ağlasun has 24 water springs, 10 groundwater pumping stations and two small dams to collect rainwater.

WUOs in Turkey range from irrigation associations (most common) to irrigation cooperatives, village legal entities, municipalities and research organizations (Özerol, 2013). The establishment law of DSİ in 1953 (no. 6200), the Irrigation Associations Law established in 2011 (no. 6172) and the laws on local governmental authorities (no. 442, 1580 and 5442) regulate irrigation governance (Ghazouani et al., 2012; Kibaroğlu, 2020). While irrigation associations typically manage large-scale irrigation systems, which span the jurisdictions of multiple local authorities, other types of WUOs manage small-scale irrigation systems, usually within a single local authority (Özerol and Bressers, 2015). The small-scale irrigation system in Ağlasun is managed by the municipal government, the only legal entity with the authority to establish the rules on the operation and maintenance of the irrigation canals, to distribute water and to collect water fees. The municipality holds property rights of the water springs and the canals and decides about the use of rights. Decisions are taken by the mayor and the municipal council and implemented by water guards or canal operators, overseen by a water chief. Each natural spring, groundwater pumping station or dam has a water guard

responsible for the water fee administration and water distribution. The majority of gravity-driven irrigation network is shown in Figure 1. Some springs have concrete storage ponds to adjust the water flow rate; irrigation water reaches the fields through an elaborate canal system. Main canals are mostly concrete, built in the 1970s by the DSİ and the local government. Farmer-constructed soil canals guide the water from the main canal to individual fields, where they mostly practice surface irrigation.

3.3.2. Data Collection and Analysis

Interactions between authority-farmer relations and water access were examined through an in-depth case study of one of the spring-fed irrigation networks in Ağlasun. For confidentiality, we do not disclose the name of the network. It irrigates the fields of more than 100 farmers (own research, 2019). The network is representative of the other 23 springs in terms of irrigation governance and infrastructure and the relations that derive from water distribution and access.

The fieldwork consisted of semi-structured interviews, participatory observations and the collection of secondary data, including the archives of the municipal council, the records of the water guards for each year revealing the amount and time of irrigation, and the water fee charged for each farmer. The first author conducted the fieldwork during the summers (June-August) of 2018 and 2019. Interview questions were informed by the literature but remained mainly exploratory and open-ended, and tailored to the specific role of the participant (ordinary farmers, social head-ender farmers, water guards, former water guards, water chiefs). The interview guide for farmers inquired about problems faced with irrigation, how they are solved, and farmer's relations with local authorities and other farmers. The interviews with the water guards and the water chiefs discuss the operation of irrigation systems in Ağlasun, their daily practice of governing irrigation canals, their social relations with farmers, and their approach to farmers' demands. Farmers were approached through a combination of purposive and snowball sampling. They were identified by the neighborhood headman or were met on their fields when walking along the canals. Farmers were selected according to their location along the irrigation canal (head-, middle-, and tail-ender) and their reputational status in the village.

Figure 2 provides an anonymized, abstracted representation of both the spatial and social position of farmers. The spatial position of farmers was abstracted from a GIS-constructed map of their land in relation to the irrigation network. The social position of farmers (the size of the dots) was determined by scoring the farmers on the basis of a number of criteria and adding up the scores for each criterion. Scores were given when farmers indicated that they are a supporter of the mayor, can afford to pay the water fee, have a good relation with the water guard(s) and have obtained privileges from them at least once, being able to opt out of the irrigation system. Interviewed farmers are numbered from F1 to F28 in both text and figure, so quotes can easily be related to the farmer's socio-spatial hierarchy.

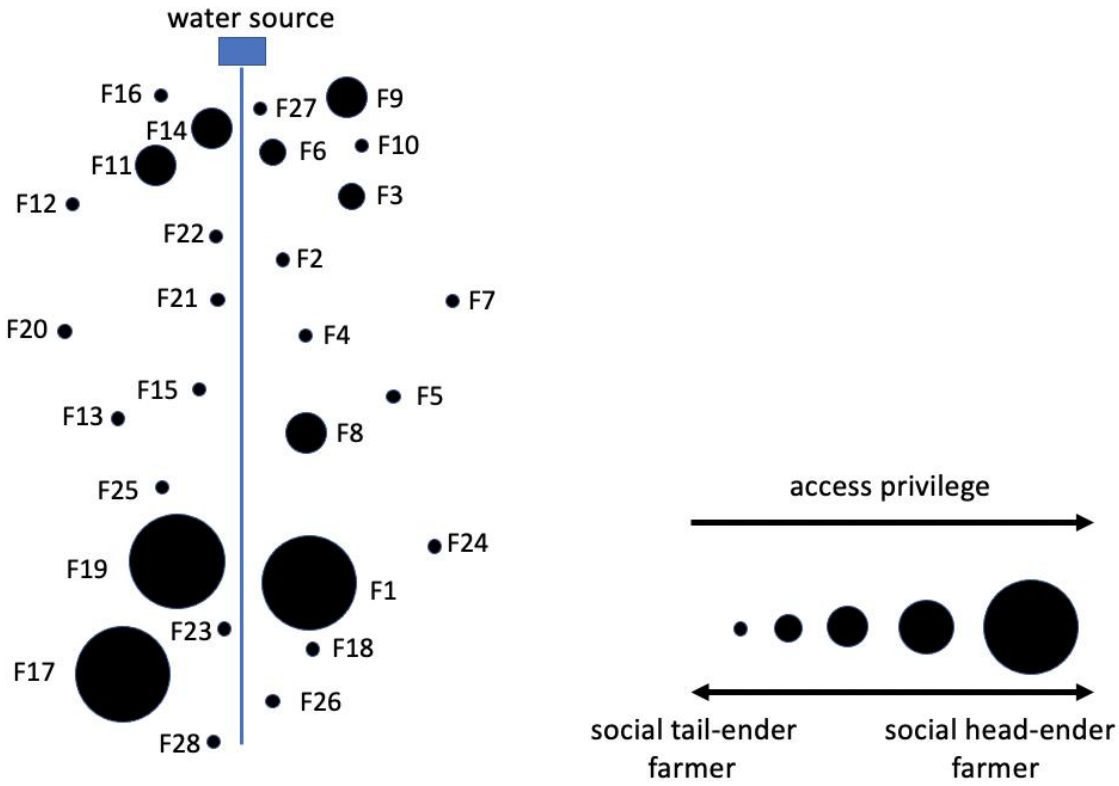


Figure 2: Social and spatial positions of the farmers in relation to water access (Source: Own data)

A total of 32 interviews (one woman, thirty-one men) were conducted with farmers, water guards and water chiefs. Whereas both men and women can work the field, local Muslim tradition considers men responsible for communication with the water guard, making irrigation a 'man's job. Only women who had lost their husband and have no adult male in their family communicate with the water guard directly and receive preferential treatment. Interviews were conducted in the participants' fields, homes and workplaces, or in public places such as coffeehouses and parks. Each interview lasted between 1,5-2 hours and was recorded and transcribed. The interview transcripts and field notes were analyzed by using NVIVO. A general code tree was generated during the first cycle coding. Then, the map of relational concepts was prepared, and the codes were reorganized by using the methods of focused coding and axial coding during the second cycle of coding.

The interviewer's own experience with farming and irrigation in Turkey has helped him communicate with farmers, and more importantly, establish rapport and trust. Farmers felt much more comfortable and communicated more informally after they learned about his rural background. The issue of access inequality was mostly raised by social tail-ender farmers, irrespective of their spatial position in the network. Social head-ender farmers either preferred not to talk about their privileges or blamed social tail-ender farmers for not

switching to water efficient technologies or crops. Social tail-ender perspectives were confirmed by field observations, but given the reluctance of head-enders to discuss their strategies, some of their strategies might be omitted. A more intimate rapport with social head-enders could have unveiled additional access mechanisms.

3.4. Results

This paper focuses on how farmers try to gain and maintain access to water through their relations with authorities controlling access, and how this affects the latter's authority to do so.

In Ağlasun, the WUO is strongly entangled with municipal politics. Given its importance to local agriculture, irrigation water is vital in local politics in Ağlasun. Unsurprisingly, the WUO is chaired by the mayor of Ağlasun and controlled by the municipal council. Irrigation is considered the main duty of the mayor:

> *"The mayor's actual time of duty is for three months during the irrigation season. The other nine months are not so important, and it can more or less be okay. If there are no injustices during these three months, then nothing will happen for the rest of the year."* (F1, Farmer Interview, 1 August 2019)

Practical implementation, however, lies with the team of water chiefs and water guards. In our analysis, we investigate the role of both authorities in rights- or rules-based access to water (making and implementing rules), but also, and more importantly so, in illicit ways of accessing water (bending rules).

3.4.1. Making and implementing rules

Rules-based access to water is based on the interaction between state- and tradition-based water rights (Boelens, 2015). In spring, rain and an abundancy of mountain melting water render the organization of water distribution superfluous. The irrigation network is mostly used by self-organizing spatial head-enders. Only during the dry summer season between June and September, the WUO installs and oversees a rotation system which adapts to changes in supply and demand over the season. Indeed, the discharge of water declines over the summer. Farmers need to water their crops frequently in summer: approximately every 15 days for vegetables and every 30 days for fruit trees. But by the end of the season, they can only be offered water every 70 days or so. Frequency also depends on how long farmers decide to irrigate during their turn and the water guard's care for the system (F2, Farmer Interview, 27 July 2019).

The water guard is indeed a crucial actor, interacting with the farmers on a daily basis to organize the rotation system. He typically starts rotation with the farmer closest to the spring.

After finishing irrigation, the farmer informs the water guard who calls the neighboring farmer, and so the water distribution continues until the last farmer in the irrigation network has received water. Farmers can keep the tap open as long as they see fit but pay per hour. This hourly water fee is set by the municipal government before the start of the irrigation season and restrains farmers from unlimited extraction. Water guards register the water fee that each farmer is due and are supposed to permanently inspect the system to avoid water robbery, which is fined, and maintain the flow of water at a steady rate.

The hourly fee system is an easy solution for the difficulty of measuring discharge along the canal, but disadvantages spatial tail-enders. As the open canals lose water through evaporation and leakages, spatial tail-enders, who pay the same hourly fee, end up with a lower discharge (F3, Farmer Interview, 18 July 2019) and depend on the water guards' knowhow to compensate this by changing the discharge at the spring. On the other hand, some groups are offered formal privileges: Farmers using drip irrigation instead of surface irrigation are offered a guaranteed 15days rotation. The few women who have no male adult in the family to take care of irrigation are given the privilege of daytime irrigation so that they need not be in the field at night. The formal rules of irrigation management can be reevaluated by the mayor and the municipal council if there is a demand or complaint from farmers. For example, when the discharge of water at the springs declined more than expected in August 2018, the mayor and council members decided to restrict the irrigation time allowed per turn and to allocate water according to the size of the irrigated land.

3.4.2. Bending the rules

The spatial tail-ender farmers in particular try to compensate their hampered 'rights-based access' (Ribot and Peluso, 2009). Privileged access to authorities is key to this goal. Authorities are important, because they not only set and implement rules but also have the authority to bend them and provide water illicitly. As indicated earlier, the opacity and complexity of irrigation management allows a gap to occur between the rules and how they are implemented in practice (Gillingham, 1999; Suhardiman, 2018). These relations are instrumental to both, as they also provide benefits to the people in positions of authority. According to Ribot and Peluso (2009), "to maintain access, subordinate actors often transfer some benefits to those who control it. They expend resources to cultivate relations or transfer benefits to those who control access to derive their benefit."

Interestingly, different actors in the political hierarchy can be convinced with different kind of benefits, which offers the farmers a variety of strategic choices. Some of these strategies reinforce the system and the authority of those controlling water access, while some can be seen as forms of resistance to the system itself. In addition to the political hierarchy amongst those controlling access, and the spatial hierarchy between fields, the ability to choose from different available strategies introduces a social hierarchy amongst the farmers. This social

hierarchy is based upon farmers' access to authorities and intersects with the materiality of infrastructure to determine a farmer's access to water: *"They are all like from the same company. The water chief, the water guard, and three of the farmers. [The water guard] gives all water when it is their turn, and he cuts down on the amount of water when it is our turn."* (F2, Farmer Interview, 27 July 2019).

The material characteristics of the irrigation infrastructure allow authorities to circumvent the rules they have themselves set. They co-produce an information asymmetry which centralizes the water guard in the operation of the system (Rap and Van der Zaag, 2019). By opening or closing the valve at the spring's water outlet, the water guard can change the discharge and thus the amount of water given to a farmer in a certain time-span. Changes in discharge can be legitimate compensations to tail-enders for water loss along the canal. At the same time, they allow for misuse, as their exact effect for the end user is hard to monitor by others, and only the water guard has the oversight of the individual consumption of each farmer in the network. Consequently, disputations such as the above are frequent, and both the farmers and the water guards indicate privileged misuse by social head-enders in their network: "*These farmers crave for water. They have a lot of land, and they are rich."* (Water Guard Interview, 26 August 2019).

In the next sections, we elaborate on the different strategies that shape this social hierarchy. Figure 3 summarizes the various interactions between authorities and farmers.

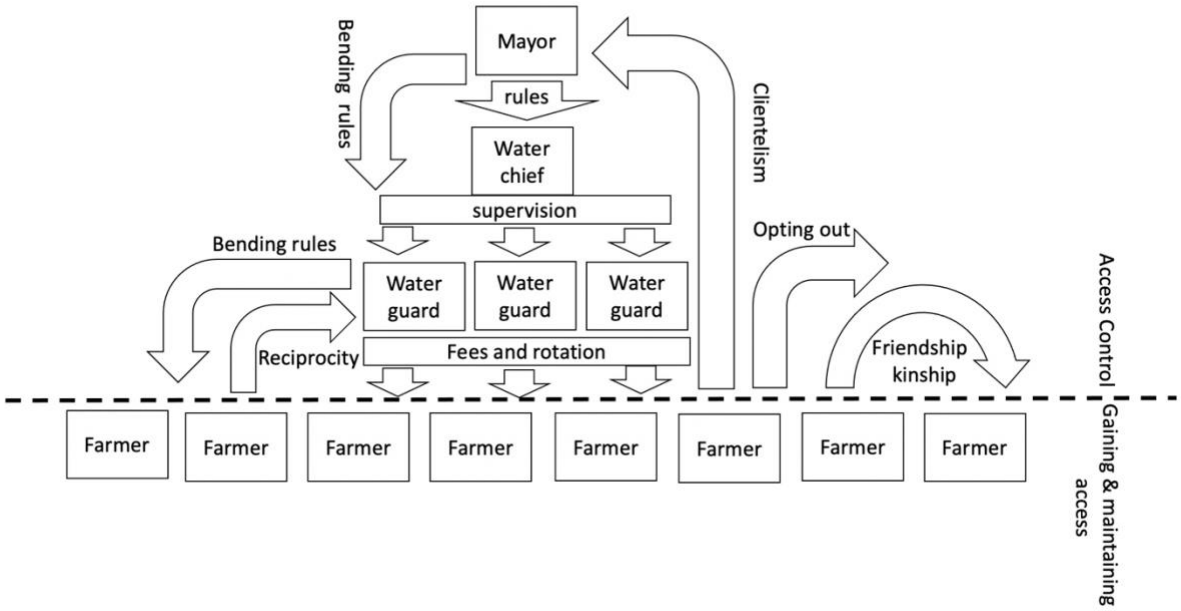


Figure 3: Interactions between authorities and farmers for irrigation water access. Source: Own data, modelled after Ribot & Peluso (2009).

3.4.2.1. Clientelism

Clientelism is defined as the exchange of benefits for votes. The benefits include privileged access to water and cancellation of irrigation debts. The candidates who run for mayor organize their campaigns around irrigation policies to convince farmers to vote for them. This includes offering various 'irrigation privileges' in exchange for votes:

> *"If you are the man of the mayor, give the vote to the mayor and know how to kowtow him, then you can irrigate more frequently than the other farmers. Last year, I was able to irrigate one time and one of the farmers who supports the mayor and whose land is just below mine said at the coffeehouse that he irrigated seven times. He did not hide it and he was very comfortable while saying how he managed to irrigate seven times"* (F4, Farmer Interview, 26 July 2019).

The farmers who voted for the mayor can directly call him to ask for water, even if formally it is not their irrigation turn. In response, the mayor would summon the water guard to switch the water to the specific farmer. Moreover, a farmer who supported the mayor may request the mayor to "delete" his/her irrigation debts. The period before the elections is an ideal moment to address the candidates with such a request. One of the farmers expresses his frustration that he did not have the chance to do so:

> *"You can make a bargain with the candidate mayor and say I will give my vote to you if you accept to delete my irrigation debt once you become the mayor. I had 800 Turkish Lira (TL) irrigation debt and the municipal government sent in the bailiffs. I had to pay an extra 1500 TL for the lawyer. However, if I was the man of the mayor, the municipal government would not send in the bailiffs and my debt would have disappeared easily"* (F4, Farmer Interview, 26 July 2019).

Finally, the water guards are selected and appointed by the mayor, and having mobilized votes for the mayor is an important selection criterion. One of the farmers explains: *"If the guy is the man of the mayor and gave his vote to the mayor, he can be a water guard for five years."* (F5, Farmer Interview, 8 July 2019). When promising a family member to be appointed as a water guard, the mayor may request all family members to vote for him in exchange. This can be an important livelihood strategy for poorer families. Although the salary is low, the water guard's day-to-day control of the system allows him to top it up with bribes and favors from the farmers.

3.4.2.2. Access to irrigation water via reciprocity

Farmers often complement clientelism to the mayor by developing reciprocal relations with their water guard. Directly offering bribes and favors to the water guard also allows farmers

with more limited access to the mayor to gain privileged access to water. One of the social head-ender farmers explains the relation between him and the water guards as follows:

> *"[The water guard] helps as much as he can for many years. While we were reorganizing our field, there were many trees, and I said to him that he can herd his animals in my field. He was coming and herding his animals. The ensuing year, he allowed me to take water freely […] I was nice to him, and he also had to be nice to me. He can take tree branches, eat any fruits and vegetables in my field, in exchange he turns a blind eye.*" (F6, Farmer Interview, 6 August 2019).

Furthermore, water guards can ask help from the farmers to reduce their workload and in return give water illicitly. For example, the water guard is supposed to come to the water source in the mornings to open the valve of the main pond and again in the evenings, to close the valve. However, the water source is far away from the water guard's home. The municipality gives 15 liters of diesel fuel for the motorbike of the water guard, which is insufficient for the whole irrigation season. Therefore, the water guard asks for help from a farmer, whose land is not far from the water source, to open the valve in the morning, in exchange for privileged access to water. The farmer explains this "help" as follows:

> *"We make each other's work easier. I say I will use water for 30 minutes, but it may last 45 or 60 minutes. Then, the water guard asks me to release water to the main canal just after I finish my irrigation and by doing this, I save him not to come to the water source*" (F3, Farmer Interview, 18 July 2019).

3.4.3. The constitution of authority

Although many social tail-ender farmers complain about the privileges offered to social head-enders, the system itself is rarely put into question. The need to mitigate the spatial asymmetry legitimates the existence of a social asymmetry in access, and the system's information asymmetry makes irregularities difficult to assess. Moreover, a variety of strategies exist and those who fail to obtain a favorable position in the social hierarchy today might expect to turn the tables in the next elections. Clientelism only offers privileged access for as long as the mayor's term lasts, and bribes to the water guards are always an alternative as these are, to a certain extent, a competing authority. This might explain why complaints about a particular mayor or water guard are rarely extended towards the system of clientelism and reciprocity itself. Some farmers claim that a previous mayor lost the election for exaggerating the privileges to his supporters. Nicknamed 'the mayor of phone calls' for his many interventions in the daily business of water guards, he was voted out of office. The mayor lost his personal authority, but the authority of the office he occupied remained. Irrigation governance remains the dominant issue in local elections. Consequently, the local

ruling party often differs from the national ruling party, even if political congruence between both levels helps to attract national investments to the local territory.

Water guards constitute a competing authority to the mayor, limiting the privileges of clientelism. In general, water guards support the mayor and follow his commands. But they also command a superior knowledge of the irrigation system and operate a competing system of bribes and favors which keeps the mayor's clientelism in check. One of the interviewed water guards explained how he abandoned his job in the middle of the irrigation season, furious about the mayor's interference with his irrigation work. As the mayor couldn't find anyone with the necessary knowhow to replace the water guard, he agreed to restrain his meddling with the water guards' work.

Simultaneously, farmers rarely question the differences in access to authorities between 'social head-enders' and 'social tail-enders'. Instead, these differences were naturalized, even by the victims of the system. A farmer used the metaphor of a knife to refer to this power imbalance: *"The farmers who have a sharper knife say it is my [irrigation] turn. Farmers who are ordinary and poor like me say, so be it!* (F7, Farmer Interview, 30 July 2019).

3.4.4. Resistance to authority

Farmers who fail to obtain water through their relations with authorities would be expected to resist. As shown above, such resistance mostly focuses on the individuals occupying positions of authority, rather than the system itself. We observe three types of strategies that the farmers use to resist the authorities' authority to control access to water. Through these strategies, farmers access water without calling upon authorities to bend the rules.

3.4.4.1. Friendship and kinship

Previous studies show how state-based control of resources is often contested by alternative systems of organization based on kinship and tradition (Roth, 2009; Ribot, 2009; Boelens, 2015). In the case of Ağlasun, friendship and kinship could potentially compete with the socio-political hierarchy based upon clientelism and reciprocity. Some farmers explain how mutual support between neighbours can offer alternative means of access:

> *"One of the neighbour farmers helped me while I was drilling the borehole two years ago and we became friends since then. There was not enough water last year and my neighbour's walnut trees were about to dry. He asked me for help, and I shared the water in one of my ponds with him. We pumped the water from my pond to his land"* (F6, Farmer Interview, 6 August 2019).

However, kinship or friendship are not common ways to obtain access in Ağlasun. Kinship ties often suffer from divisive inheritance conflicts, which may linger for a long time. Moreover, the instrumental reciprocal logic of the water control system seems to overrule and affect more basic social relations. Family ties can fail to guarantee privileged access to the water guard:

> *"The water guard is my cousin. I do not want to commit a sin, but I hope a scorpion will sting him. I asked him for water. The water in the canal was as deep as a waist is thick, but he gave me water as deep as the width of a leg only. He purposely gave me less water. When it was my neighbors' turn, he was giving water like the waist"* (F2, Farmer Interview, 27 July 2019).

The vital importance of water also stimulates farmers who control access to a sub-canal to use this as a leverage in mutual conflicts with kin and neighbors, thereby reproducing the instrumental logic of the wider system:

> *"My adjacent land belongs to one of our family members and we are sharing the same sub-canal for irrigation. He asked me to cut one of my walnut trees since it gave harm to his cherry trees. But, when I asked him to cut one of his oak trees since it gave harm to my roses, he refused […]. I warned him again and said I would not let him use my sub-canal anymore. After two years of discussion, he finally cut his oak tree. It is my canal, and nobody can say anything"* (F8, Farmer Interview, 31 July 2019).

3.4.4.2. Building Ponds

In addition to the discharge, water guards also determine the time between irrigation turns for each farmer. As regular watering is at least as important for crop survival as the amount of water, this puts farmers in a heavily dependent position vis-à-vis the water guard. At the same time, when long waiting times are questioned by farmers, the water guard can always shift the blame to other farmers' excessive consumption, decreasing water availability, or weather conditions, as the system is too large for farmers to oversee. Some farmers try to escape their dependence on the authority of the water guard by constructing ponds to store water over longer periods. When it is their turn to irrigate, they do not only water their land but also fill up the pond to be able to wait out the next round. One of the farmers explains:

> *"I made the pond because the water [level] in the irrigation canal was decreasing. Because I cannot irrigate my walnuts when I want. […] If I wait until my regular round of irrigation time, I do not know when it will be my turn."* (F9, Farmer Interview, 3 August 2019).

The ponds enable farmers to manage the uncertainties of the water guard's rotation system by decreasing their dependence on it. However, building ponds causes extra costs for farmers. Therefore, farmers that own relatively small lands do not build ponds.

3.4.4.3. Opting out

A final strategy to sideline the authorities is to opt out of the system altogether. Farmers do so by ending their dependence on the canal irrigation system and the whims of the water guard. Some farmers access water via a private borehole and decouple from the irrigation network. However, drilling a borehole is costly, and the uncertainty of finding phreatic water in this karstic environment is high (Erdoğan, 2013). Farmers opting for their own borehole are generally wealthier than others, able to invest financial capital in their independence. Most boreholes are situated in the alluvial zone, where the chances of success are higher. Given these advantages, they are often social head-enders themselves and their choice to opt out is often more complementary to, than against the social head-ender hierarchy.

3.5. Discussion and conclusion

In this paper, we expand the theory of access' analysis of power by introducing and applying the concept of "social head-enders". We particularly build upon Sikor and Lund's (2009) study on the relation between authority and property rights, combining it with Boelens' (2015) understanding of competition between water rights frameworks and Rap and Van der Zaag's (2019) analysis of the role of canal operators' everyday practices and knowhow. Based on data from ethnographic fieldwork about irrigation governance in Ağlasun, a rural town in the southwest of Turkey, we expand their insights into three distinctive ways.

Firstly, we confirm the basic findings of access theory that farmers depend on controlling authorities to gain and maintain access to water (Ribot and Peluso, 2009). However, we have shown how this dependence extends beyond rules or rights-based access to include authorities' capacity to bend the rules. In our case study, farmers and authorities have developed relatively stable relations of clientelism and reciprocity to complement rules-based access. These relations define a hierarchy between social head-enders and tail-enders, which intersects with the classic asymmetry between spatial head-enders and tail-enders (Ostrom & Gardner, 1993). Expanding Sikor and Lund's (2009) analysis of the interaction between access and authority, we claim that this capacity to bend the rules and provide illicit access to farmers strengthens, rather than undermines, the legitimacy of irrigation authorities. Their authority depends on the flexibility of this illicit system and their capacity to amend disfunctions of rules-based access. The power to bend the rules in itself is kept in check through the elective system, and the fact that mayor and water guards are to a certain degree mutually competitive authorities, much like the competition between water rights frameworks in the analysis by Boelens (2015). Although resentment is voiced against mayor and water guards when they excessively favor specific farmers, the authority of their position itself is rarely questioned. In contrast with the cases studied by Ribot (2009) and Roth (2009),

alternative systems of access control are not able to challenge the system of favoritism. Access through kinship and friendship seems largely dominated by and embedded in the wider instrumental logic of relations with those controlling access. On the other hand, the option to opt out of the irrigation system by drilling private boreholes is restricted to those who, as social head-enders, often have privileged access to irrigation water as well as other resources. Finally, we have demonstrated how the relations between authority and access are connected to the socio-spatial characteristics of irrigation systems. These relations produce a basic asymmetry in access to water and information. The asymmetry between spatial head- and tail-enders in rule-based access to water stimulates the latter to build social relations with irrigation authorities that are able to bend the rules. This rule-bending capacity depends on the socio-spatial opacity of water flows. The spatial and governance complexity of the irrigation system prevents oversight for individual farmers, thus underpinning the information privilege of water guards. This information asymmetry in everyday irrigation management between water guards and farmers allows mayors to offer farmers clientelist favors through their power over the water guards. But water guards also hold a knowledge advantage vis-à-vis the mayor and water chiefs, allowing them to set up a competing system of direct reciprocal exchange with farmers.

Applying the concept of social head-enders reveals how social distance to authorities, like spatial distance to a water source, affects access to water. It indicates how inequalities in access to water cannot be identified by studying rules-based water rights only. To investigate social asymmetries in access between water users, we need to shift the focus away from 'rule-setting' to also include practices of 'rule-bending' in irrigation governance. 'Rule-bending' authority is an important addition to studies of water rights and the relation between water rights and authority: 'rule-bending' practices are an integral and legitimate part of everyday water governance and deserve as much attention as the setting and implementation of rules. Further investigation is needed to better understand the role of rule-bending in the stabilization and legitimacy of water rights. Moreover, additional, comparative case studies could offer insights into the various ways rule-bending affects the constitution of authority of actors involved in the control of water access. Such studies should also investigate the diverse relationships of local authorities with regional, national and international actors, as well as the multi-level interactions among these actors and the equity implications of those interactions.

Our analysis also provides insights on the legitimacy of interventions in irrigation governance in Turkey and beyond. Changes in irrigation systems, even when aiming for more equity in access, have been shown to be a source of conflict and the defense of privilege (Hoogesteeger, 2013; Boelens & Vos, 2014). We have shown how such resistance lies not only in the defense of existing rules, but also in the established practices of illicit access. Systems of illicit access to water should not be assumed to lack legitimacy. Initiatives to improve equity in irrigation governance, which only investigate how equitable current rules are or how such

rules could be transformed in a more democratic way, might fail to see illicit forms of access, their function and legitimacy, and their effect on access equity. 'Bending the rules' is integral to the overall complexity of everyday irrigation governance and should be given due consideration both in research and in policy interventions.

3.6. References

Agrawal, A. (2005). *Environmentality: Technologies of Government and the Making of Subjects*. Duke University Press.

Agrawal, A. (2014). Studying the commons, governing common-pool resource outcomes: Some concluding thoughts. *Environmental Science and Policy*, *36*, 86–91. https://doi.org/10.1016/j.envsci.2013.08.012

Agrawal, A., and Gibson, C. C. (1999). Enchantment and disenchantment: The role of community in natural resource conservation. *World Development*, *27*(4), 629–649. https://doi.org/10.1016/S0305-750X(98)00161-2

Anand, N. (2015). Leaky states: Water audits, ignorance, and the politics of infrastructure. *Public Culture*, *27*(2 (76)), 305-330.

Bakker, K. J. (2003). *An Uncooperative Commodity: Privatizing Water in England and Wales*. Oxford University Press.

Bakker, K. (2012). Water: Political, biopolitical, material. *Social Studies of Science, 42*(4), 616-623.

Beccar, L., Boelens, R., & Hoogendam, P. (2002). Water rights and collective action in community irrigation. *Water rights and empowerment*, 1-21.

Boelens, R. and Vos, J. (2014). Legal pluralism, hydraulic property creation and sustainability: The materialized nature of water rights in user-managed systems. Current Opinion in Environmental Sustainability, 11, pp.55-62.

Boelens, R. (2009). The politics of disciplining water rights. *Development and Change*, *40*(2), 307–331. https://doi.org/10.1111/j.1467-7660.2009.01516.x

Boelens, R. (2015). *Water, power and identity: The cultural politics of water in the Andes*. Routledge. https://doi.org/10.4324/9781315867557

Boelens, R., & Doornbos, B. (2001). The battlefield of water rights: Rule making amidst conflicting normative frameworks in the Ecuadorian highlands. *Human Organization*, 343-355.

Brugnach, M. (2017). The space in between: Where multiple ways of knowing in water management meet. *Journal of the Southwest*, *59*(1–2), 34–59. https://doi.org/10.1353/jsw.2017.0005

Burdur provincial directorate of agriculture and forestry (In Turkish). (n.d.). Retrieved December 12, 2020, from https://burdur.tarimorman.gov.tr/Sayfalar/Detay.aspx?SayfaId=14

Clement, F. (2010). Analysing decentralised natural resource governance: Proposition for a "politicised" institutional analysis and development framework. *Policy Sciences*, *43*(2), 129–156. https://doi.org/10.1007/s11077-009-9100-8

Coetzer, J., 2019. An Exploration into the Changing Rural Landscape of a Turkish Small Town: the Case of Ağlasun, Turkey, Unpublished Master Thesis. University of Leuven, Leuven.

Erdoğan, M. (2013). *Burdur-Ağlasun havzasının hidrojeoloji incelemesi (Master Thesis,Institute of Science and Technology, İstanbul Technical University)*.

Ghazouani, W., Molle, F., & Rap, E. (2012). Water users associations in the NEN region: IFAD interventions and overall dynamics. *Draft, submitted to IFAD*.

Gillingham, M. E. (1999). Gaining access to water: Formal and working rules of indigenous irrigation management on Mount Kilimanjaro, Tanzania. *Natural Resources Journal*, *39*(3), 419–441.

Hardin, G. (1968). The tragedy of the commons. In *Science* (Vol. 162, Issue 3859, pp. 1243–1248). American Association for the Advancement of Science. https://doi.org/10.1126/science.162.3859.1243

Harris, L. M. (2006). Irrigation, gender, and social geographies of the changing waterscapes of southeastern Anatolia. *Environment and Planning D: Society and Space*, *24*(2), 187–213. https://doi.org/10.1068/d03k

Harris, L. M. (2008). Water Rich, Resource Poor: Intersections of Gender, Poverty, and Vulnerability in Newly Irrigated Areas of Southeastern Turkey. *World Development*, *36*(12), 2643–2662. https://doi.org/10.1016/j.worlddev.2008.03.004

Haugaard, M. (2018). What is authority? *Journal of Classical Sociology*, *18*(2), 104–132. https://doi.org/10.1177/1468795X17723737

Hoogesteger, J. (2013). Trans-forming social capital around water: Water user organizations, water rights, and nongovernmental organizations in Cangahua, the Ecuadorian Andes. Society & Natural Resources, 26(1), 60-74.

Janssen, M. A., Anderies, J. M., and Cardenas, J. C. (2011). Head-enders as stationary bandits in asymmetric commons: Comparing irrigation experiments in the laboratory and the field. *Ecological Economics*, *70*(9), 1590–1598. https://doi.org/10.1016/j.ecolecon.2011.01.006

Janssen, M. A., Bousquet, F., Cardenas, J. C., Castillo, D., and Worrapimphong, K. (2012). Field experiments on irrigation dilemmas. *Agricultural Systems*, *109*, 65–75. https://doi.org/10.1016/j.agsy.2012.03.004

Jodha, N. S. (2001). *Life on the edge : sustaining agriculture and community resources in fragile environments*. Oxford University Press.

Johnson, C. (2004). Uncommon ground: The "Poverty of History" in common property discourse. *Development and Change*, *35*(3), 407–433. https://doi.org/10.1111/j.1467-7660.2004.00359.x

Kadirbeyoğlu, Z. (2017). The Impact of Power and Civic Engagement in the Decentralized Management of Natural Resources: The Case of Turkey. *Public Administration and Development*, *37*(4), 277–291. https://doi.org/10.1002/pad.1809

Kadirbeyoğlu, Z., and Özertan, G. (2015). Power in the Governance of Common-Pool Resources: A comparative analysis of irrigation management decentralization in Turkey. *Environmental Policy and Governance*, *25*(3), 157–171. https://doi.org/10.1002/eet.1673

Kashwan, P. (2016). Integrating power in institutional analysis: A micro-foundation perspective. *Journal of Theoretical Politics*, *28*(1), 5–26. https://doi.org/10.1177/0951629815586877

Kashwan, P., MacLean, L. M., and García-López, G. A. (2019). Rethinking power and institutions in the shadows of neoliberalism: (An introduction to a special issue of World Development). *World Development*, *120*, 133–146. https://doi.org/10.1016/j.worlddev.2018.05.026

Kibaroglu, A. (2020). The role of irrigation associations and privatization policies in irrigation management in Turkey. *Water International*, *45*(2), 83–90. https://doi.org/10.1080/02508060.2020.1719382

Kocabıyık, C., & Loopmans, M. (2020). Seasonal gentrification and its (dis) contents: Exploring the temporalities of rural change in a Turkish small town. *Journal of Rural Studies*.

Kocabiyik, C., & Loopmans, M. (2021). Staying on: Small Farmers' Livelihood Strategies in a Rural Small Town in Turkey. Unpublished Manuscript.

Kramm, J., and Wirkus, L. (2010). *Local Water Governance: Negotiating Water Access and Resolving Resource Conflicts in Tanzanian Irrigation Schemes* (MICROCON Research Working Paper No. 33). https://doi.org/10.2139/ssrn.1707589

Krause, F., & Strang, V. (2016). Thinking relationships through water. *Society & Natural Resources*, *29*(6), 633-638.

Milgroom, J., and Ribot, J. (2020). Children of Another Land: Social Disarticulation, Access to Natural Resources and the Reconfiguration of Authority in Post Resettlement. *Society and Natural Resources*, *33*(2), 184–204. https://doi.org/10.1080/08941920.2019.1590668

Mollinga, P. P. (2016). Secure rights and non-credibility: the paradoxical dynamics of canal irrigation in India. *Journal of Peasant Studies*, *43*(6), 1310–1331. https://doi.org/10.1080/03066150.2016.1215304

Mosse, D. (1997). The symbolic making of a common property resource: History, ecology and locality in a tank-irrigated landscape in South India. *Development and Change*, *28*(3), 467–504. https://doi.org/10.1111/1467-7660.00051

Myers, R., and Hansen, C. P. (2020). Revisiting A Theory of Access: A review. *Society and Natural Resources*, *33*(2), 146–166. https://doi.org/10.1080/08941920.2018.1560522

Ostrom, E., Gardner, R., Walker, J., Walker, J. M., and Walker, J. (1994). *Rules, games, and common-pool resources.* University of Michigan Press. https://doi.org/10.1017/CBO9781107415324.004

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.

Ostrom, E. (2005). Understanding Institutional Diversity. In *Public Choice*. NJ: Princeton University Press. https://doi.org/10.1007/s11127-007-9157-x

Ostrom, E., and Gardner, R. (1993). Coping with Asymmetries in the Commons: Self-Governing Irrigation Systems Can Work. *Journal of Economic Perspectives*, *7*(4), 93–112. https://doi.org/10.1257/jep.7.4.93

Özerol, G. (2013). Institutions of farmer participation and environmental sustainability: a multi-level analysis from irrigation management in Harran Plain, Turkey. *International Journal of the Commons*, *7*, 73–91.

Özerol, G., & Bressers, H. (2015). Scalar alignment and sustainable water governance: The case of irrigated agriculture in Turkey. Environmental Science and Policy, 45, 1–10. https://doi.org/10.1016/j.envsci.2014.09.002

Quintana, A., and Campbell, L. M. (2019). Critical commons scholarship: A typology. In *International Journal of the Commons* (Vol. 13, Issue 2, pp. 1112–1127). https://doi.org/10.5334/ijc.925

Rap, E., & van der Zaag, P. (2019). Engaging with flows: Embodied cognition in water provision. *Water*, *11*(9), 1751.

Ribot, J. C. (2009). Authority over Forests: Empowerment and Subordination in Senegal's Democratic Decentralization. *Development and Change*, *40*(1), 105–129. https://doi.org/10.1111/j.1467-7660.2009.01507.x

Ribot, J. C., and Peluso, N. L. (2009). A Theory of Access. *Rural Sociology*, *68*(2), 153–181. https://doi.org/10.1111/j.1549-0831.2003.tb00133.x

Robbins, P. (2011). *Political Ecology: A Critical Introduction* (Vol 16). John Wiley and Sons.

Roth, D. (2009). Property and Authority in a Migrant Society: Balinese Irrigators in Sulawesi, Indonesia. *Development and Change*, *40*(1), 195–217. https://doi.org/10.1002/9781444322903.ch9

Saldías, C., Speelman, S., and Van Huylenbroeck, G. (2013). Access to Irrigation Water and Distribution of Water Rights in the Abanico Punata, Bolivia. *Society and Natural Resources*, *26*(9), 1008–1021. https://doi.org/10.1080/08941920.2012.729651

Sikor, T., and Lund, C. (2009). Access and property: A question of power and authority. In *Development and Change* (Vol. 40, Issue 1, pp. 1–22). https://doi.org/10.1111/j.1467-7660.2009.01503.x

Suhardiman, D. (2018). Linking Irrigation Development with the Wider Agrarian Context: Everyday Class Politics in Water Distribution Practices in Rural Java. *The Journal of Development Studies*, *54*(3), 413–425. https://doi.org/10.1080/00220388.2016.1228878

Tang, S. Y. (1992). *Institutions and collective action: self-governance in irrigation* (Issue September). ICS press.

The Turkish Statistical Institute. (n.d.). (In Turkish). https://biruni.tuik.gov.tr/medas/?kn=95andlocale=tr (accessed February 20, 2020)

Van der Zaag, P., & Rap, E. (2012). The pivotal role of canal operators in irrigation schemes: The case of the canalero. *Irrigation and Drainage*, *61*(4), 436-448.

Weber, M. (1978). *Economy and society : an outline of interpretive sociology*. University of California Press.

Acknowledgement:

We thank to the participants for sharing their time for this research and we thank to Dr. Ekin Kurtiç, Dr. Sinem Kavak and Dr. Marjan Moris for their valuable comments on earlier versions of the paper. Also, we would like to thank to the editor and the two anonymous referees for their useful suggestion. The research was supported by the Research Fund of KU Leuven, Belgium.

4. SOCIO-MATERIAL BRICOLAGE: (CO) SHAPING OF IRRIGATION INSTITUTIONS AND INFRASTRUCTURES

Abstract

Drip irrigation is often considered a technological solution to increase water useefficiency and crop productivity. However, all too often, its social and institutional entanglements are ignored. This paper treats drip irrigation as a socio-material assemblageand discusses the social and institutional changes triggered by the introduction of drip irrigation infrastructure in Ağlasun, a rural town located in the southwest of Turkey. Through an ethnographic study, we investigate how the switch from surface irrigation to drip irrigation entails an interaction of institutional re-arrangements, materialinfrastructures and strategizing actors to reshuffle the operation and maintenance of irrigation infrastructures, water distribution rules and water pricing. Expanding the concept of institutional bricolage to socio-material bricolage, we offer a nuanced understandingof how material infrastructures and institutions are mutually shaped by individual and collective agency.

Keywords:

drip irrigation, infrastructure, irrigation governance, socio-material bricolage, Turkey

An earlier version of this chapter was published as:

Mirhanoğlu, A., Özerol, G., Hoogesteger, J., Van den Broeck, P., & Loopmans, M. (2023). Socio-Material Bricolage: (Co) Shaping of Irrigation Institutions and Infrastructures. *International Journal of the Commons*, 17(1), pp. 69–86. DOI: 10.5334/ijc.1188

4.1. Introduction

One of the first things that hits the eye when visiting Ağlasun are the many shades of green on the slopes of the surrounding mountains and in the valley. The Ağlasun River is fed by dozens of springs, most of them located between the foothills and the mountains (Erdoğan & Karagüzel, 2016). Flowing down the hills towards the valley, the water gives life to a lush vegetation. A certain amount of water follows its 'natural' route and arrives at the small Ağlasun River in the valley. However, most water is, and has historically been, diverted to agricultural terraces on the hillslopes via an intricate network of irrigation systems with earthen and concrete canals. From above, the network can be traced visually following the lines of trees that grow on both sides of the canals. Nature seems folded around the 'traditional' irrigation network since centuries. Here and there, plastic pipes have been installed inside the canals. These are used for drip irrigation. Also, there are long and thin plastic pipes on some of the terraced fields (as shown in Figure 5, section 4.2), together with small ponds where water is stored.

On a hot summer morning in 2019, the first author was following the water, meeting farmers along the canals and listening to their stories. There was no water in the concrete canals nor in the pressurized pipes, and he could not figure out where the water was flowing. He walked up to the spring and saw that one farmer and the water guard[4] were trying to understand the problem. The farmer was visibly annoyed since he could not start watering his walnut trees. In this section of the irrigation system, drip irrigation pipes had just been installed by the municipal government. The new water guard had just started his job, and he[5] did not have any experience with drip irrigation. Therefore, he called the water chief to ask for a solution, but the water chief was not an expert either. In fact, there was no expert on drip irrigation to be found in the whole municipality. The water guard spent almost half a day to check each pipe and finally found a pipe clogged. Both the farmer and the water guard relaxed, and the farmer could finally start watering his walnut trees, assured that the water would come. The problem was solved, but it would not be the last issue with the newly installed technology.

This was not the first time for farmers in Ağlasun to experience changes in the irrigation system. There have been various institutional and technological changes since the municipal government was established in the 1930s. For instance, when the earthen canals were replaced with concrete ones in the 1970s, the municipal government, particularly the mayor, became a decisive actor of irrigation governance. When later, the municipal government also took over the maintenance of the system from the users, its role became even more central, making water a major clientelist instrument in municipal elections (Mirhanoğlu et al., 2022). What kind of changes did the introduction of drip irrigation to Ağlasun set in motion? How

[4] Water guards are responsible for the daily water distribution and the water fee administration. There is a water guard for each irrigation network whereas water chiefs are responsible for supervision of water guards.

[5] We use "he" to define water guards since water guards have reportedly been men throughout the irrigation history of Ağlasun.

did this last change affect and shape institutions of water distribution, the operation and maintenance of irrigation canals and water fee rules?

Investigating the recent changes in the Ağlasun irrigation system, particularly the introduction of drip irrigation, our paper seeks to offer a deeper understanding of how changes to infrastructure (re)shape the interactions among actors as well as water governance institutions and their entanglements with infrastructures. We claim that the introduction of a technological novelty triggers processes of institutional and infrastructural bricolage as actors reposition themselves around it. Through this analysis, the paper contributes to the broader debates on irrigation modernization and the impacts it has on irrigation governance.

The outline of the paper is as follows. In section 2, we present and explore the theoretical notions that inform our analysis. We introduce the perspective of socio-material bricolage and explain why including materiality (in this case mainly irrigation infrastructure) is essential to understand bricolage. In section 3, we introduce the case study context and the methods used. In section 4, we discuss the introduction of drip irrigation in Ağlasun and the socio-material bricolage which ensued. In section 5, we conclude with a reflection on the theoretical and practical implications of this analysis.

4.2. Socio-material bricolage in irrigation systems

4.2.1. Institutional bricolage and path dependence

The definition of what constitutes an institution depends on the school of thought. However, in most theories, institutions are considered *social* arrangements that structure human behavior (North, 1990; Ostrom, 1990; de Koning, 2011). In line with critical institutionalism, we assume that institutions are complex, dynamic, and contingent. They are inherently place-bound, as they are shaped by local politics, culture, and history (Cleaver & de Koning, 2015; Hall et al., 2014; Jones, 2015; Whaley, 2018). Emphasizing spatio-temporal variability, we follow Frances Cleaver's definition of institutions as "arrangements between people which are reproduced and regularized across time and space, and which are subject to constant processes of evolution and change" (Cleaver, 2012, p. 8). Cleaver's empirical work focused mainly on understanding the introduction of new 'external' institutional arrangements and their effects on existing, often 'local' institutional arrangements (Wang et al., 2018). She shows how actors do not readily accept new institutional arrangements, but negotiate these in different ways. These negotiations and adaptations explain the spatial and temporal variability of institutions. To better understand this 'negotiation' process and its outcomes, Cleaver introduced the notion of institutional bricolage (Cleaver, 2001, 2002). This notion seeks to unveil how people, both consciously and un-consciously, modify institutional arrangements based on the social relations, resources, and materials available to them (Cleaver, 2001; Cleaver & De Koning, 2015). Cleaver (2002) discusses various institutional bricolage practices. De Koning (2011) categorizes them into three types: **aggregation,**

alteration, and articulation. She argues that these processes occur when there is an encounter between newly introduced institutions and pre-existing socially embedded institutions which structure local practices (Cleaver, 2002; de Koning, 2011).
Aggregation is defined as the integration of existing institutions with newly introduced ones (de Koning, 2014). This leads to new hybrids that combine or add up unaltered elements from pre-existing 'local' institutions with those of the 'newly' introduced ones. (Boelens & Doornbos, 2001; Hoogesteger, 2015; García-Mollá et al., 2020).
Alteration is explained as the adaptation of institutions, which implies that the existing, socially embedded institutions and the newly introduced institutions exert a mutual pressure to change. This process entails a redesigning of rules, relations, and norms (de Koning, 2014).
Articulation happens when newly introduced institutions are rejected or resisted (Gebara, 2019). This process takes place especially when there is a disagreement between the existing, socially embedded institutions and the newly introduced ones (de Koning, 2011, 2014), leading to conflicts and confrontations (Boelens, 2015; Boelens et al., 2015).

Institutional bricolage elaborates and explains the concept of path dependence, which exists when choices made in the past affect choices in the present and the future. Institutional bricolage explains path dependence of institutions through the agency and interests of actors, who patch together institutions from the logics available to them, allowing for the simultaneous change and persistence of institutional elements in the process (Sehring, 2009). Power relations are vital in orienting the path dependence of institutions. Thelen (1999) argues that institutions often deepen power asymmetries by giving privilege to particular groups and excluding others (see Chapter 3 in relation to irrigation). Sehring (2009) connects path dependence with these asymmetries, claiming that institutions are persistent because they both perform a certain function and serve certain interests. A particularly elaborate framework on the role of power asymmetries and path dependence has been developed from Jessop's (2001) work on 'strategic relationality', which explains the dialectics between structurally oriented strategic calculation and structurally inscribed strategic selectivity. This body of work not only stresses the selectivity of institutions, which privilege some and hinder other actors; it also explains how actors' capacities of imagining, creating, (re)producing, maintaining and changing institutions are structured by the very institutions they are embedded in (Jessop & Oosterlynck, 2008). Such a strategic-relational perspective on institutions can explain why institutional change takes the shape of bricolage. Communities of practice develop who share an interest in, and understanding of, certain institutions, defending their persistence even when pressured to change (Van den Broeck, 2010; see also Cleaver et al., 2021). Consequently, actors and institutions are connected through continuous and non-linear processes of institutional bricolage (Servillo & Van Den Broeck, 2012). In this process, Cleaver seems to reserve a role for a material dimension to institutional bricolage by asserting that "an understanding of the ways in which social arrangements also manifest physically (through labour, infrastructure and resource use practices) would significantly strengthen institutional analysis" (2012, p. 20). This opening to 'the material', which in

irrigation mainly manifests as irrigation technology and infrastructure, is further explored in the next section.

4.2.2. Introducing 'the material' into institutional bricolage

Importantly, the work of Benouniche et al. (2014) shows that 'bricolage' in irrigation is not limited to institutions, but also happens in relation to material infrastructures. They discuss how farmers and welders tinker with infrastructures for drip irrigation to take control over the process of technological innovation. They emphasize how such material bricolage occurs in response to -and simultaneously shapes- social institutions, e.g. the adaptation of design standards and regulations. Implicitly, Benouniche et al. (2014) discuss examples of socio-material 'aggregation' (e.g., when imported drip irrigation equipment is *inserted* in local irrigation practices to 'make it work') or 'alteration' (when locally fitted irrigation equipment was adapted to subsidy standards, and subsidizing institutions adapted their regulations and control to allow for local ingenuity). This echoes earlier work of, for instance, Winner who argues that "individuals are actively involved in the daily creation and recreation, production and reproduction, of the world in which they live" (1986, pp. 14-15) through the use of technologies and infrastructures. The latter alters and (re)create work in social labor arrangements (Pfaffenberger, 1988). Therefore, technologies and infrastructure -and changes in them- bring about 'significant alterations in patterns of human activity and human institutions' (Winner, 1986, p. 6). Literatures on infrastructures also emphasize how infrastructure plays a key role in state-society relations (Harris et al., 2018; Kooy & Bakker, 2008; Larkin, 2013; Rodina & Harris, 2016). These insights have received much echo in the irrigation literature where several authors have studied different dimensions of socio-technological transformation (Boelens, 2008; Bolding et al., 1995; Obertreis et al., 2016). Bringing these insights back to the study of institutions, van der Kooij et al. (2015) emphasize "that technical modifications, innovations and tinkering form an intrinsic part of processes of institutional bricolage" (pp. 148-149). Van der Kooij et al. (2015)'s emphasis on the agency of infrastructure and its centrality in institutional bricolage has been taken up in several studies. Ortega-Reig et al. (2017) show how the introduction of drip irrigation triggers both organizational change and adaptations to operating rules (see also Garcia-Molla et al., 2020). Similarly, Kemerink-Seyoum et al. (2019) and Chitata et al. (2021) consider the lens of socio-technical tinkering a way to re-appreciate the materiality of water, its infrastructures, and technologies, and how it influences irrigation governance. From a somewhat different angle, Özerol & Bressers (2017) emphasize the mutual relationship between institutional and material changes triggered by the introduction of large-scale irrigation to a heterogeneous social structure. These studies highlight that technology and infrastructure exist through their replicability; albeit with permutations (Sese-Minguez, 2017; Van der Kooij et al., 2017). This reminds us that, "no technology can be said to exist unless the people who use it can use it over and over again" (Pfaffenberger, 1988, p. 241). The notion that technology exists only in relation to its use through the (altered) reproduction of associated technological behaviors

and institutions (Hommes et al., 2022; Shah & Boelens, 2021) is important for a better understanding of the process of institutional bricolage; especially when it concerns socio-material bricolage (see below). Another important notion is that 'new' technology and infrastructures are interpreted, understood, adapted, and integrated by its users in very diverse ways that often do not correspond with the original ideas of those that implement them. (Bolding et al., 1995; van Halsema, 2002; Venot et al., 2017). As Hommes et al., (2022) point out, this comes from 'fissures and fractures' in both how the infrastructure 'behaves bio-physically', and more importantly in how actors use, re-use and adapt the technology according to their own interests, knowledge, and institutional/power embeddings.
These and other studies (see, for instance, Dwiartama & Rosin, 2014) point at the realization that technological systems such as irrigation systems are neither social, material, or symbolic only, but 'all at once' (Boelens, 2014; Reyes Escate et al., 2022). However, through which mechanisms these different elements influence and relate to each other is often analytically not clear. In the next section, we elaborate on these mechanisms through the notion of socio-material bricolage.

4.2.3 Socio-material bricolage

In critical institutional studies, the technological or infrastructural dimension of institutional change, as described above, has not received sufficient attention. To bring analytical clarity and a better understanding of the processes through which institutions transform through infrastructural change (in this specific case irrigation modernization), we turn to the notion of 'socio-material bricolage'.

Socio-material bricolage was coined by Johri, (2011) to describe how global software development depended on developers' 'making do' with the ad hoc set of materials and colleagues at hand. Building on the attention to the agency of material artifacts in Actor-Network Theory (ANT) and Science and Technology Studies (Latour, 1987, 2005; Law, 1992; Winner, 1986) and the understanding of how institutional arrangements and actors' practices co-shape each other in critical institutionalism (Cleaver, 2012; Cleaver & de Koning, 2015), we propose to translate this idea of socio-material bricolage to the study of irrigation systems. Our aim is not to investigate the 'making do' of irrigation actors, but to expand the concept of institutional bricolage and bring materiality to its heart, and to capture the interactions between actors, institutions, and infrastructures. The concept of socio-material bricolage helps us to understand the essence of materiality in institutional bricolage, which we reconceptualize as a strategic-relational dynamic of actors, institutions, and material infrastructures (Benouniche et al., 2014; Boelens & Vos, 2014; García-Mollá et al., 2020; Van der Kooij et al., 2015). It focuses on how both infrastructures and institutions constitute strategic selectivities in enabling or disabling the practices of human actors, and how actors relate to changes in either of them through socio-material bricolage, connecting the old and

the new in various ways. In doing so, actors advance and safeguard their interests in, understanding of and control over the system.

Based on these notions, we define irrigation systems as assemblages of water flows, irrigation infrastructures, and institutions, bound together and interwoven with actors and their strategizing practices (see also Hoogesteger et al., 2023a). To analyze the dynamics of these relations, socio-material bricolage captures the material and immaterial interactions between existing and new actors, institutions, and infrastructures. Within these dialectical and differential interactions, power relations and power structures emerge from (1) the diversity of calculating but structured strategies of various actors, some hegemonic, some excluded, some counterhegemonic, (2) the agency of non-human material infrastructures, (3) the strategic selectivity imbued in institutions by actors and their interactions with material infrastructures, and (4) the strategic selectivity of irrigation infrastructures as materialized institutions. Changes in irrigation infrastructures introduced by certain, often new, actors through irrigation modernization projects, imply not only changes in water flows but also simultaneous and entangled alterations in actors' access to resources, their social positions and power relations, and institutional arrangements (Figure 1). Expanding de Koning's (2011) systematization of institutional bricolage to socio-material bricolage leads us to redefine aggregation, alteration and articulation as mechanisms not only occurring between new and existing institutions but also as mechanisms that can be identified where new and existing irrigation infrastructures, or new infrastructures and existing institutions (and vice versa) meet. Identification of these three mechanisms of socio-material bricolage brings, we argue, a detailed perspective to the study of socio-material transformations in irrigation systems, while also creating openings for broader socio-material explorations in critical institutional studies.

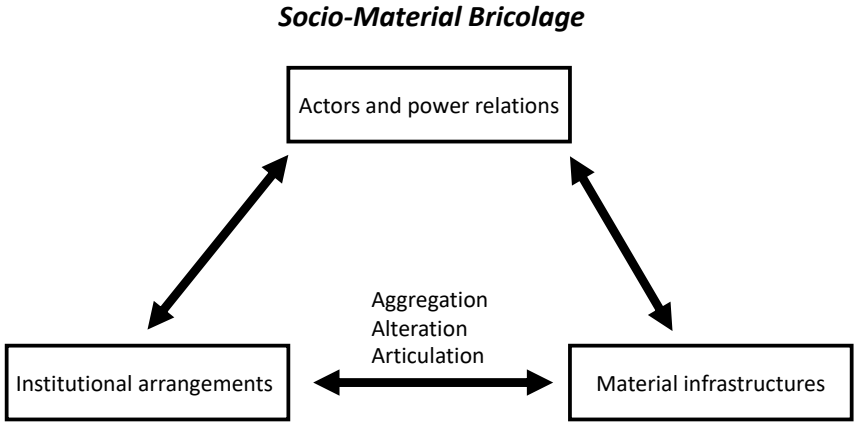


Figure 1. Conceptual framework of socio-material bricolage (Source: authors)

In this paper, we expand on and systematize the work of Benouniche et al. (2014) by discussing to what extent de Koning's categories of institutional bricolage can add analytical clarity to the understanding of socio-material bricolage. To do so, we build on empirical data from a case study of a small-scale irrigation system in southwest Turkey, where drip irrigation is currently being introduced. We will expand upon the mechanisms of socio-material bricolage related to water access, water distribution and infrastructure maintenance and management in section 4.

4.3. Irrigation in Ağlasun, southwest Turkey

4.3.1. Case study background

Ağlasun is one of the districts of Burdur province and located in the southwest of Turkey shown in Figure 2. The population of Ağlasun is 7,540 (The Turkish Statistical Institute, 2021), making it a somewhat larger town in the region. Situated in a rather narrow valley, farmland is distributed between valley bed farming and small plot irrigated terraced farming on the valley slopes. In combination with its relative distance to markets, this topography has inhibited Ağlasun's smallholders from upscaling in the face of agricultural globalisation and neoliberalisation (Kocabıyık & Loopmans, 2019). Consequently, many younger families have either emigrated or found off-farm jobs in nearby cities, whereas tourism has increased the demand for construction land (Kocabıyık & Loopmans, 2021), leaving farming and irrigation largely in the hands of the older generation. Farmers in Ağlasun mostly use water to irrigate apples, cherries, walnuts, roses, clovers, beans, corn, wheat, and vegetables, such as tomato, pepper, eggplant, and zucchini.

The Ağlasun Municipal Government is the only legal actor responsible for governing irrigation water in the studied irrigation system. Decisions about irrigation management are taken through the mayor and the municipal council, and there are water chiefs and water guards implementing the decisions in the field. The water guard system has been in force since the 1930s. The municipal government also determines the water fee per hour every year before the irrigation season starts. Water guards record the fee that farmers need to pay while distributing water. Each farmer is responsible for paying their fee to the municipal government by the end of the irrigation season, which is typically the end of September.

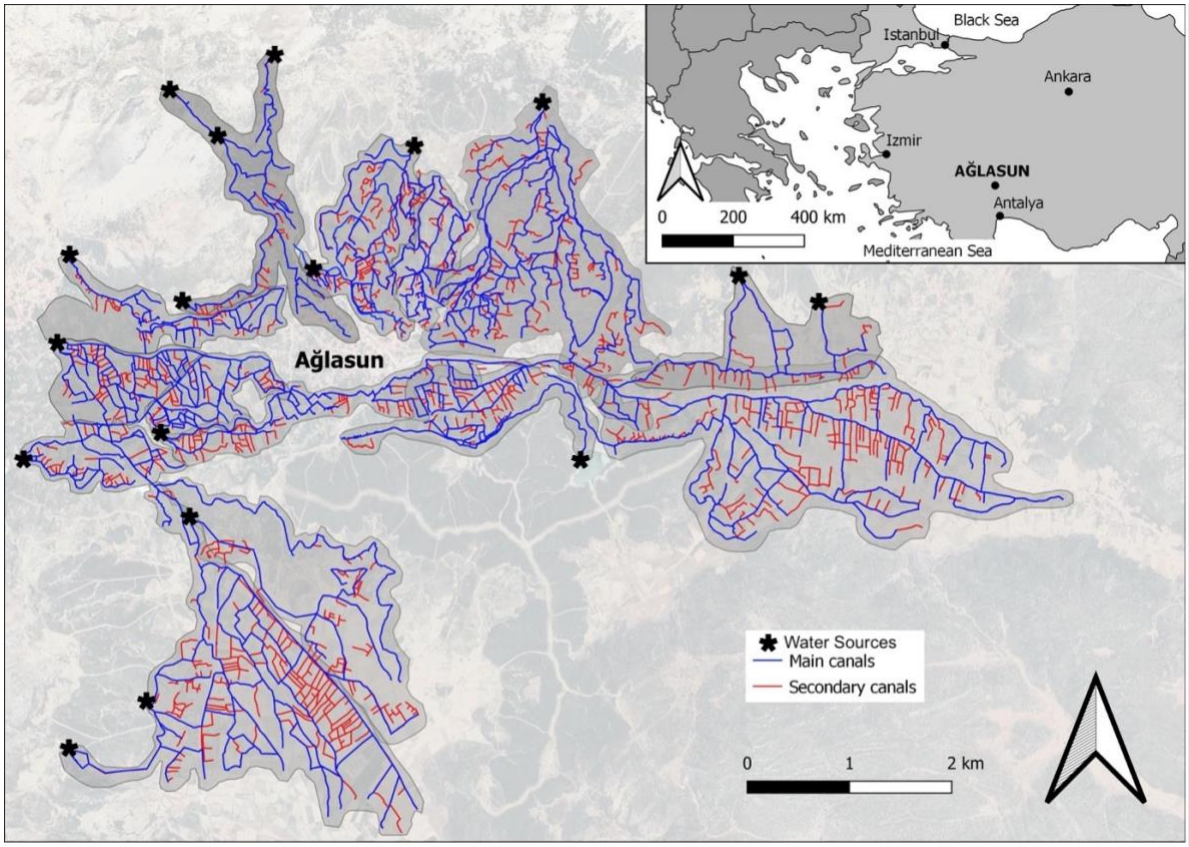


Figure 2. Map of the Ağlasun irrigation network (Source: Adnan Mirhanoğlu & Enrico Roets)[6].

There are 24 water sources in the Ağlasun valley which have been used for irrigation over centuries. Since the 1970s, most of the irrigation canals are lined with concrete after important investments were made by the General Directorate of State Hydraulic Works (Devlet Su İşleri, DSİ), the national agency responsible for management of water resources in Turkey. Also, metal irrigation valves were installed along the concrete canal so that farmers could easily diverge water from the main canal to the secondary canals and their fields. Also in the 1970s, the municipal government constructed ponds at some sources to accumulate water and stabilize the flow rate. During this technological modernization, secondary canals, which are the canals that run through the fields to carry water to plots that are not connected to the main canal, remained untouched, and were kept as simple earthen trenches (see Figure 2). A lack of maintenance and difficulties to access canals for cleaning because of vegetation in and around the canals means that clogging and leakages are recurrent problems. Since 2009, the Ağlasun Municipal Government has invested in the pressurization of these irrigation systems with the aim to facilitate the introduction and use of drip irrigation. However, not all irrigation canals have been replaced by pressurised pipes and different technologies exist side by side in the studied irrigation system (see Figure 3).

[6]Figure 2 shows 17 water sources. The remaining sources were not added to Figure 2 since they are being used by neighboring villages.

The pressurised pipes have separate valves for each plot, which only the water guard is allowed to open and close. Farmers whose lands are irrigated by a pressurised pipe can switch to drip irrigation after installing the necessary equipment on their plots, whereas the farmers using water from the open canals need to dig ponds on their own land to install drip irrigation. Digging ponds, buying a water pump, and using energy to pump water cost farmers a lot of money, which few of them can afford. Hence, drip irrigation is mostly installed in the fields connected to the new piped system (see Figure 3). Farmers can receive state subsidies to switch to drip irrigation. However, one of the requirements to apply for those subsidies is to irrigate a plot of at least 1 hectare. In the mountainous, highly fragmented agricultural landscape around Ağlasun, plots of this size are rare, and few farmers qualify for these subsidies.

The relationships between actors, irrigation infrastructure and institutions were examined through a case study of one irrigation system shown in Figure 3. To conduct in-depth field work on how the materiality of irrigation infrastructure shapes and is shaped by institutional arrangements and actors after the introduction of drip irrigation in Ağlasun, we chose to focus on one of the 24 irrigation networks. The 24 Ağlasun networks are managed in the same way, are all more or less the same size and equipped with similar infrastructure. In the selected Ulupinar network, 128 farmers are involved. The municipal government installed pressurised pipes (110 mm diameter, Figure 4) in one canal, whereas three of them are still the original concrete open canals, allowing us to compare experiences of farmers affected and unaffected by pipe irrigation.

4.3.2. Data Collection and Analysis

During the fieldwork, data were gathered through semi-structured interviews, participatory observation, and from the archives of the Ağlasun Municipal Government. The irrigation networks shown in Figures 2 and 3 were traced with handheld GPS, measuring all main canal sections and their material characteristics, and, where allowed, also the earthen distributary canals in the fields. The types of the material infrastructures (earthen, concrete, pipe) of the studied irrigation network were mapped in detail (Figure 3).

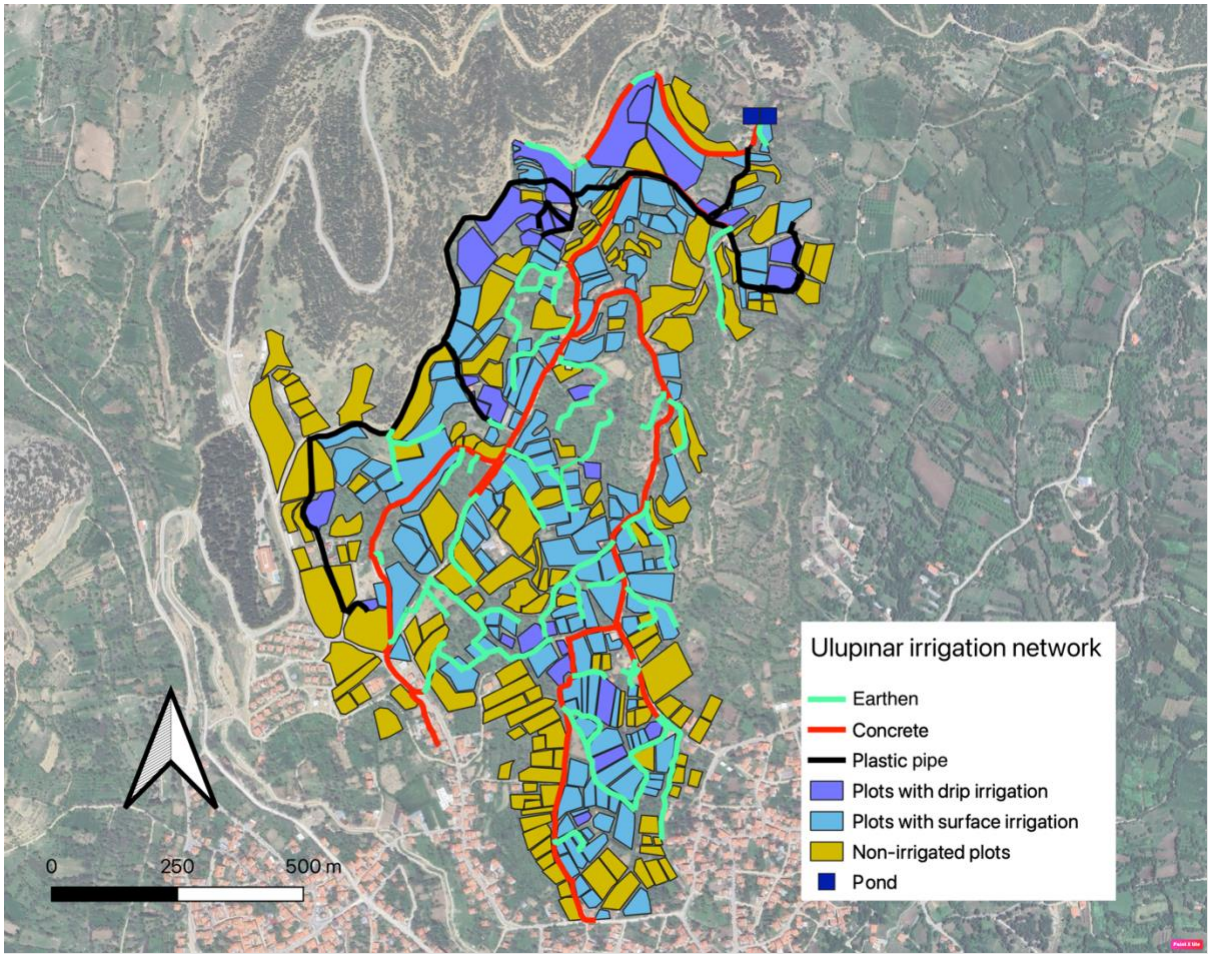


Figure 3. Map of the case study (Source: Adnan Mirhanoğlu & Enrico Roets).

The first author conducted the fieldwork during the summers (June-August) of 2018, 2019 and 2021, and the raw data of mapping of the irrigation network was gathered by two cartographers during the summers of 2019 and 2021. A total of 42 farmers, 3 water guards, 1 water chief, the current mayor and the former mayor were interviewed during the fieldworks.

Three interview guides were prepared before the fieldwork. First, an interview guide was prepared for farmers to understand what kind of problems they face during irrigation, specifically related to infrastructure and irrigation methods, how they solve these problems and their perception of the introduction of drip irrigation. Second, the focus of the interviews with the water guards and the water chiefs was mainly on how they manage the irrigation systems on a daily base, the maintenance of infrastructure and their strategies to solve the problems they received from farmers. Third, the interview guide for the mayors essentially included the questions about how they manage the irrigation systems, how they decide to introduce drip irrigation, and challenges they face during their mayorship.

The interview transcripts and field notes were analysed using NVIVO. During the first coding cycle, a general code tree was produced from the transcripts. Then, a map of relational concepts demonstrating the relationships between the codes was prepared and analysed together with the code tree during the second coding cycle.

4.4. The introduction of drip irrigation as socio-material bricolage

Various institutional changes took place in relation to drip irrigation in Ağlasun. The central actors in the irrigation system in Ağlasun are the General Directorate of State Hydraulic Works (DSİ), the municipal government, and the farmers. The mayor, the council members, the water chiefs, and the water guards of the municipal government oversee irrigation governance in Ağlasun. Material infrastructures are earthen and concrete canals, ponds, plastic and metal pipes, connectors, and valves to regulate the flow rate of water. The institutional arrangements that have been reshaped after the introduction of drip irrigation include the operation and maintenance of canals, water distribution, and water pricing.

Drip irrigation arrived around 20 years ago in Ağlasun. In the early 2000s, some farmers of Ağlasun learned how to use drip irrigation from farmers in Antalya, the largest neighbor city, and they brought the technology to Ağlasun. However, these were only individual attempts by a select number of farmers. The water was transferred from the spring to agricultural plots via concrete or earthen canals, and there was no pressurized pipe system. Therefore, the farmers aspiring to switch to drip irrigation had to dig a pond on their own land and pressurize the water by using pumps, expensive investments which few were willing or able to make. Moreover, most farmers, especially the old ones, were in favor of surface irrigation, for which they had accumulated know-how and which they believed to be more efficient than drip irrigation. Whereas these individual initiatives of entrepreneurial farmers did not significantly alter the wider irrigation governance system, a mayoral initiative to introduce collective infrastructure for drip irrigation set in motion an impactful process of socio-material bricolage.

4.4.1. Bricolage of collective infrastructures

During the mayoral elections of 2009, drip irrigation rose as an issue in the electoral campaign. The new mayor was elected partly based on the promise to facilitate the adoption of drip irrigation by farmers. He invested in the pressurization of the irrigation system by introducing a plastic pipe network to replace the main canals.

For lack of funds, the replacement became a matter of ***aggregation*** of collective infrastructures. The pipes did not replace the entire system but were installed in a part of the network high up the slope which had only earthen canals and was suffering from operational and maintenance problems and causing heavy water loss. Some nearby farmers had already arranged their land for drip irrigation and set up their boreholes and pressured the mayor to

make the collective infrastructure fit to feed their drip irrigation. Additionally, most of the farmers owning lands on the newly replaced irrigation network were supporters of the new mayor. Therefore, the mayor consciously chose that part of the irrigation network, which can be considered as clientelism (Mirhanoğlu et al., 2022). What resulted from this aggregation of a new pipe network was a hybrid system where water is guided through pressurized drip irrigation pipes in some parts of the irrigation network and by concrete canals and earthen canals in others. Moreover, the plastic pipe network made good use of the existing concrete canals. Not only were these already connected to all the distributary earthen canals but also, they offered the necessary protection to the plastic pipes so that no new trenches had to be dug for the latter. Hence, the pressurized system of plastic pipes and tubes was installed following the trajectory of the existing main and secondary canals, and most tubes were placed inside the existing canals, an example of ***alteration*** of the concrete canals into protective instead of water-bearing infrastructure as shown in Figure 4.



Figure 4. Most of the pressurized drip irrigation pipes were placed inside the existing main concrete canals.

Many farmers, even those not using drip irrigation, welcome the new infrastructure as it reduces their workload. They are no longer responsible for cleaning the canals (see below) and they also started to receive water without system conveyance losses, since water was carried through new and closed pipes.

Yet the collective drip irrigation infrastructure also meets with ***articulation*** or resistance, based on farmer's worldviews, in particular their understandings about the material entanglements of the current irrigation network with the wider landscape. Farmers resisting the new infrastructure emphasize how the original canals do not only water their fields but also serve the rest of nature. They value the green areas in Ağlasun that sprout from them and emphasize how Ağlasun is well-known in the region for its lush landscape and fresh air. People living in neighboring cities visit Ağlasun over the weekend, and a significant group stays for the whole summer, renting apartments from the local population (Kocabıyık & Loopmans, 2021). Hence Ağlasun residents are proud of their green mountain slopes, which they do not only see as an additional source of income through this yayla (highland) tourism, but also consider to be part of their local identity. Some farmers in Ağlasun are strongly against a switch to drip irrigation since they believe that their "green Ağlasun" will be affected negatively. As explained by one of the farmers, whereas the original streams, or even the leaks in the concrete canals, water the plants in their surroundings, pipes do not leak:
"Our first target is to protect the green area in Ağlasun. The greenery is the heritage of our ancestors. You see how it is very green. If we switch to drip irrigation, most trees along the irrigation canals will not have access to enough water and we will lose these green areas" (Farmer Interview, 22 July 2018).

Some farmers argue that water is not only for the trees but also for the other living beings of Ağlasun. They consider drip irrigation a disruption of solidarity with animals and plants:

> *"They put pipes along the open canal to switch to drip irrigation and transferred water from the canal to the closed pipes. The fruit trees and other trees along the canal are getting dry. Also, the birds, the wolves, and many animals were getting a share of the pie from the open canal. Now, there is no water for them" (Farmer Interview, 2 August 2019).*

4.4.2. Bricolage of irrigation infrastructure at plot level

Where the pressurized pipes were installed, farmers are stimulated to **aggregate** it with their private drip irrigation system. Farmers wishing to switch to drip irrigation must redesign the irrigation infrastructure in their own field and they must make investments to acquire and install drip lines and solve the problems and challenges that the new infrastructure brought along. First, they need to buy drip irrigation lines which are small, tiny pipes with small holes,

connect them to the pressurized pipe system and lay them down on the field, as shown in Figure 5.



Figure 5. Farmers must redesign the irrigation infrastructure in their own field to switch to drip irrigation.

The aggregative character of the introduction of collective drip irrigation infrastructure forces some farmers to make ***alternative investments*** themselves. For farmers whose fields are not connected to the pressurized system, switching to drip irrigation is more difficult. They need to adapt the water flow from the concrete canal to create a pressurized system at plot level. This is done by constructing a water pond in between the main canal and their drip pipes. Buying drip irrigation pipes and building individual ponds require significant investments, and not all farmers can afford such costs. One of the farmers explains why he has not switched to drip irrigation:

> *"I do not have the water pond in my field. Constructing a water pond is very costly. Therefore, I am waiting for the municipality to replace the main concrete canal with the pressurized pipe system. Then, the costs will be relatively less. Otherwise, you need to construct a water pond in your field. Then, you need a pump to transfer water from the pond to your field and you also need electricity for your pump. These are all extra costs, and I cannot afford all of them" (Farmer Interview, 31 July 2019).*

Farmers who adopt drip irrigation at the plot level are mainly those who are short in labour time. Farm labour has become a scarce commodity in Ağlasun, as the population is aging and the younger generation seeks employment outside agriculture, and eventually also outside the region. Most farmers are now combining their farm work with other activities (Kocabıyık & Loopmans, 2021). Switching to drip irrigation saves time in irrigation, as drip irrigation requires less supervision, thus allowing for alternative livelihood strategies to ***aggregate*** with farming. Additionally, it allows farmers to plant water-sensitive, but less labour-intensive crops. Hence, changes in irrigation infrastructure also aggregate with material changes in land use. In the section of the irrigation system connected to the pipe network, many farmers turned their rose gardens into orchards with walnut trees. In the studied irrigation system, 92 out of 376 plots were recently planted with walnut trees. An older farmer, who recently switched to walnuts, explains how they save labour:

> *"When you get older, even if you do not shake the walnut, it comes down by itself. I said to my wife the other day: in the future, we get older, we will get our walking stick in our hands and weed walnuts with the walking stick. Gather them and come home. Put them in a bag." (Farmer Interview, 06 August 2019).*

Moreover, some farmers whose plots are adjacent to the pressurized pipe system do not necessarily switch to drip irrigation themselves, but resort to ***aggregation*** of the pressurized system with their traditional surface irrigation practice, as shown in Figure 6.



Figure 6. The farmers hesitating to switch to drip irrigation receive water via drip irrigation pipes but they continue surface irrigation.

These farmers hesitated to switch to drip irrigation, not only for the additional costs but also because of their understanding of the interactions between water, the land and the crops growing on it. They fear their crops will not get enough water via drip irrigation. This points again at the importance of existing knowledge systems in the local 'communities of practice' formed around irrigation institutions and infrastructures. Ağlasun farmers have been doing surface irrigation for centuries, having learnt this method from their ancestors. Drip irrigation conflicts with their accumulated knowledge about how the wider socio-natural system of farming works. One of the farmers explains why he is not in favour of drip irrigation:

> *"I do not use drip irrigation because it is like dripping water to a person who is dying of thirst. Therefore, I do not use it and I do not like it" (Farmer Interview, 08 July 2019).*

Finally, some farmers claim that their soil type is not suitable for drip irrigation. Especially old farmers raised this argument during the interviews. One of the farmers explains as follows:

"I guess our soil is not suitable for drip irrigation because it is clay soil. The water does not go below the soil easily. So, look at my field, I irrigated it yesterday evening at 5 pm and you can walk on it now [it is dry]. I irrigated my field for 2 hours yesterday but if I had drip irrigation, I should have irrigated it for 4-5 hours" (Farmer Interview, 27 July 2019).

Resultantly, the new pressurized pipe system near their plots is not tapped into for drip irrigation. Instead, it is aggregated with the material infrastructure used for traditional surface irrigation, by opening the valves into the distributary soil trenches towards the field, or leading the main pipe directly into the field (Figure 6).

Depending on the farmer's own know-how and interests, 'modern' and 'old' infrastructures, like institutions, are 'patched together' (Cleaver, 2012) rather than being designed and crafted as a whole.

4.4.3. Institutional bricolage related to collective infrastructure maintenance and management

The infrastructural bricolage discussed above is tightly related to instances of bricolage related to the institutions governing the collective infrastructure, particularly those related to cleaning and maintenance.

Cleaning of canals is essential to keep the irrigation system operational and avoid water losses. As a result, canal cleaning has been one of the most controversial issues in Ağlasun. Until 2009, canal cleaning was a collective responsibility of farmers. The farmers that use water from the same irrigation canal would gather at the head of the canal and walk down the hill, cleaning the main canal until its end. Each farmer was supposed to contribute to cleaning by providing manual labor until reaching the level of their own field. This arrangement often caused conflicts since head-ender farmers, whose field was close to the source, would work less compared to tail-ender farmers, who had to continue working until the end. One of the candidates running for mayor used the canal cleaning issue as a political campaign in the 2009 election and promised to make the municipal government fully responsible for canal cleaning. That campaign won him the elections, and farmers stopped cleaning the canals collectively by themselves. This institutional change triggered a cascade of other minor changes which facilitated the introduction of collective drip irrigation infrastructure. Indeed, whereas farmers could stop cleaning the main canal, they had to continue cleaning the distributary, mostly earthen canals (secondary canals) since the municipal government only took over the cleaning of the main canals. Simultaneously, farmers were dissatisfied with the cleaning by the municipal workers, who would not do it as carefully as they used to do themselves. Therefore, when the municipal government proposed to install the pressurized pipes for the drip irrigation system, the farmers considered

this as a beneficial **material alteration** to the new situation, anticipating that they would no longer have to worry about the cleaning of the main and secondary canals and water losses would significantly decrease.

Subsequently, the introduction of pressurized pipes triggered institutional changes regarding the maintenance of the collective infrastructure. The municipal government is in principle responsible for the maintenance of the main canals, which is now composed of a network of pipes and the valves used to regulate water flows. But unclarity has emerged over the pipes connecting the main canals to the individual fields. The earthen canals were clearly the responsibility of farmers, although this also occasionally led to conflicts between neighboring farmers. However, this time, the conflict is about the institution regulating the responsibilities of municipality and farmers regarding maintenance, pressuring for **alteration** of old and new institutions:

> *"The T-pipe that channels water to my land was broken and nobody knows who broke it. I asked the water guard to change it, but they refused to change it since they claim that the T-pipe is not a part of the main pipe. I cannot change the direction of water and I think it is the responsibility of the municipality to channel water to my land"* (Farmer Interview, 16 July 2019).

4.4.4. Institutional bricolage related to water access and distribution

Finally, drip irrigation brought new institutional arrangements for water distribution and use. These arrangements were adapted through redesigning and bargaining by both the municipal government and farmers. Water distribution has been disputed in Ağlasun, at least since the municipal government's involvement in it since the 1930s. The municipal government appoints a water guard to each irrigation network who organizes the rotation system among farmers during the irrigation season, which typically starts at the beginning of June and lasts until the end of September. One of the main reasons for water sharing conflicts was the favoritism by the water guards (Mirhanoğlu et al., 2022). Typically, they were selected from among the supporters of the mayor and would prioritize the farmers who had voted for the elected mayor. Such unfairness was the cause of many conflicts, including severe physical violence, since the stakes were high: agriculture was the main economic activity in Ağlasun until well in the 1990s, and irrigation water was vital for the farmers. Proposals for a 'fairer' water distribution system became a recurrent element in mayoral election campaigns, although it took until the 1984 elections before a mayor succeeded in gaining broad support for a new system. From that time onwards, rules implied that the water guard starts rotation with the head-ender farmer, who calls the water guard after having finished irrigation. Then, the water guard informs the next farmer in line, and the water distribution continues until the last tail-ender farmer gets water. Farmers pay a fixed fee per hour that water is diverted to their fields. The clarity of the rule succeeded in seriously mitigating conflict. Therefore,

although water guards and mayors still try to 'bend the rules' (Mirhanoğlu et al., 2022) to favorize specific farmers, this rule has now been firmly socially embedded in Ağlasun.

However, some farmers suspect that the materiality of drip irrigation infrastructure has given water guards again greater leeway for favoritism. Water guards decide about the network's flow rate by controlling the opening of the valves of the two large ponds at the head of the irrigation networks. In the network's concrete, open canals with a standard diameter, farmers can perform a visual check of the flow rate and confront the water guard if they suspect any unfair treatment vis-à-vis their fellow farmers. In the closed pipes, such visual control is impossible. Some farmers suspect that the introduction of drip irrigation has thus led to an ***alteration*** of the informal institutions governing irrigation water, reinvigorating clientelism and favoritism as water guards might abuse the system's opacity to covertly increase the discharge rate for some while decreasing it for others. This issue is explained by one of the farmers:

> *"I follow water along the canal and want to see how much water is flowing to my land. When there is a closed pipe system, I will not be able to see the amount of water. If the water guard does not like me or if I am not the supporter of the mayor, the water guard may decrease the flow rate of water from the main valve and I will not be able to check since I will not see the amount of water"* (Farmer Interview, 07 July 2021).

To be clear, the switch to drip irrigation is not only accompanied by informal institutional changes. To incentivize farmers to adopt the new infrastructure, the municipal government proposed two new formal rules in 2009. These stipulate that farmers using drip irrigation would be guaranteed access to water every 15 days and would only pay half of the hourly water fee. Under the earlier rotation system, farmers had to wait up to 70 days between two irrigation turns, meaning that the new rotation rule offers significant benefits to drip irrigation users, which allows them to plant more water-sensitive crops. However, the introduction of the rule caused resistance from other farmers. Very few farmers have switched to drip irrigation in the network under scrutiny. Only eight out of 128 farmers are using drip irrigation on 32 of the 376 plots in the system. Prioritizing these would mean that most farmers would have to wait even longer between turns, although drip irrigation farmers were expected to use less water. Since the drip irrigation farmers are located in different parts of the irrigation network (see Figure 3), the water guard needs to redirect water for each drip irrigation farmer every 15 days which causes more delays for surface irrigation farmers. Through their majority representation in the municipal council, surface irrigation farmers were able to resist the formalization of the rule:

> *"They decided to guarantee water access every 15 days for the drip irrigation users last year. However, they did not make the rule official because most of the council members are farmers, and they do surface irrigation. So, they did not want to give official priority to the drip irrigation users"* (Farmer Interview, 15 July 2019).

However, most drip irrigation farmers are 'social head-enders', having close social and political relations with the authorities and controlling significant resources (Mirhanoğlu et al., 2022). Notwithstanding the resistance against the new rule, and the impossibility to have it officially adopted, water guards are told by the mayor and their water chief to implement it and prioritize drip irrigation users. However, ***articulation*** against the rule remained strong:

> *"I faced many problems because of the rule of accessing water every 15 days for the drip irrigation users. I asked the water chief and the mayor, and they said the new rule should be followed. But then the surface irrigation users went to the municipal government and made a complaint about me. The mayor told me that I should not have given water twice to drip irrigation users before giving one time to the surface irrigation users. They said the rule is valid, but they do not want to follow the rule they set up. Therefore, it caused a bit of a mess"* (Water Guard Interview, 26 August 2019).

Forced towards ***alteration***, the mayor has now agreed to a more informal, ad hoc regulation of water distribution. The new water distribution rule is implemented, until midway the irrigation season, when water becomes scarcer, protest from farmers using surface irrigation rises and forces the water guard to bend the rule, after which drip irrigation users may need to wait more than 15 days.

To avoid conflicts appearing on his desk, the new 2019 mayor decided to decentralize water distribution rules. He commanded all headmen[7] to ask the farmers in their neighborhood whether they approve the new rule or whether they had different suggestions. This created an even more hybridized system: not only will the different parts of the network apply different rules (a case of ***aggregation***), but also a new actor (the neighborhood's headman) is included in the governance network. Some of the headmen resisted their incorporation and instrumentalization and did not consult (all the) farmers. This gave rise to additional conflicts between farmers and municipal government.

[7] Headman is the representative of the neighborhood whom the neighborhood residents choose via a separate election. There are 6 headmen in Ağlasun.

4.5. Discussion and conclusion: aggregation, alteration and articulation in socio-material bricolage

This paper analyzed the transformations that took place after the modernization of the irrigation system (to drip) in Ağlasun, Turkey. Our analysis was informed by the bricolage typology of de Koning (2011), based on which we investigated the individual and collective processes of socio-material aggregation, alteration, and articulation (see Table 1).

Table 1: Levels and processes of socio-material bricolage in Ağlasun's irrigation system.

LEVEL	PROCESS	AGGREGATION	ALTERATION	ARTICULATION
Individual	Infrastructural bricolage	Combination of drip irrigation infrastructure with surface irrigation at plot level (section 4.2) Redesigning irrigation infrastructure (building ponds) at plot level to switch to drip irrigation (section 4.2)		
	Livelihood (land/labour use) bricolage	Less supervision of drip irrigation allowing alternative income strategies combined with farming (section 4.2)	Switching to less-labour intensive crops after the introduction of drip irrigation (section 4.2)	Rejecting drip because the soil type is not suitable for it and the crops will not get enough water (section 4.2)
Collective	Infrastructural bricolage	Adding pressurized pipes to an existing open canal network (section 4.1)	Pressurized pipes placed inside existing canals, which obtained a protective function rather than a waterbearing one (section 4.1)	Rejecting pressurized pipes to protect green areas along the main irrigation canal and to make water accessible for wild animals (section 4.1)
	Formal institutional bricolage	The decentralization of the water distribution rules related to the priority use of water by drip irrigation users (section 4.4)	Shifting responsibility for the maintenance and cleaning of collective infrastructure from the users to the municipality (section 4.3)	Resistance against the priority use of water by drip irrigation users (section 4.4)
	Informal institutional bricolage		Increased power of water guard as farmers can no longer perform a visual check of the flow rate (section 4.4) Informal priority for drip-using social head-enders (section 4.4.)	

Our analysis presents four key contributions to the literature on socio-material change in general, and water resource governance in particular.

First, we expand the concept of institutional bricolage by bringing materiality to its heart. Our approach creates openings for broader socio-material explorations in critical institutional research. Analyzing institutional and infrastructural changes together as 'socio-material

bricolage' offers a deeper understanding of the intrinsic interconnectedness of institutions, actors, and material infrastructures.

Second, we have shown how de Koning's (2011) three forms of institutional bricolage (aggregation, alteration, and articulation) can be usefully expanded to the study of socio-material transformations in irrigation systems. We discuss socio-material bricolage as institutional, technical and natural, individual and collective processes, 'all at once'. De Koning's framework helps to bring analytical clarity in studying these complex multiscalar entanglements (see table 1).

Third, in focusing on the role of human actors in socio-material bricolage, we have also highlighted the way the strategic relationality of infrastructural-institutional entanglements directs their actions. Farmers, water guards, and municipal actors reacted to technological changes by trying to (re)shape both infrastructures and institutions according to their own contextually bound worldviews and interests, but also in relation to wider socio-natural relations and how meaning is given to these relations and their transformation (see Hoogesteger et al., 2023b; and Reyes-Escate et al., 2022).

Finally, together, these three insights allow us to discuss path dependence as the frictions that emerge from infrastructures, institutions and the way human actors are related to them and, through them, the wider socio-natural system. The introduction of innovations will never occur in a vacuum, but will require a certain degree of bricolage with pre-existing infrastructures and institutions. This necessary bricolage will limit and direct the pathways of changes that are available to a system.

This also allows us to draw important conclusions on the policy consequences of our analysis. Indeed, when introducing technological innovations, policy makers rarely consider its ramifications in wider society. Our paper shows that it would be wise to map out how existing technological infrastructures are entangled with institutions, interests, and worldviews, and consider how infrastructural innovations might reverberate in these various parts of the system. Innovations are likely to be faced with aggregations, alterations, and articulations which, if not taken into account, might lead to unexpected and unwelcome consequences. The analytical framework developed here, which distinguishes forms of bricolage in collective and individual infrastructures and institutions, as well as its interpretations by human actors, can help to map out and predict such consequences, both in fundamental and policy-oriented studies.

4.6. References

Benouniche, M., Zwarteveen, M., & Kuper, M. (2014). Bricolage as Innovation: Opening the Black Box of Drip Irrigation Systems. *Irrigation and Drainage*, *63*(5), 651–658. https://doi.org/10.1002/ird.1854

Boelens, R. (2008). *The rules of the game and the game of the rules: Normalization and resistance in Andean water control*. Wageningen University.

Boelens, R. (2014). Cultural politics and the hydrosocial cycle: Water, power and identity in the Andean highlands. *Geoforum*, *57*, 234–247. https://doi.org/10.1016/j.geoforum.2013.02.008

Boelens, R. (2015). *Water, power and identity: The cultural politics of water in the Andes*. Routledge. https://doi.org/10.4324/9781315867557

Boelens, R., & Doornbos, B. (2001). The Battlefield of Water Rights: Rule Making Amidst Conflicting Normative Frameworks in the Ecuadorian Highlands. *Human Organization*, *60*(4), 343–355.

Boelens, R., Hoogesteger, J., & Baud, M. (2015). Water reform governmentality in Ecuador: Neoliberalism, centralization, and the restraining of polycentric authority and community rule-making. *Geoforum*, *64*, 281–291. https://doi.org/10.1016/j.geoforum.2013.07.005

Boelens, R., & Vos, J. (2014). Legal pluralism, hydraulic property creation and sustainability: The materialized nature of water rights in user-managed systems. *Current Opinion in Environmental Sustainability*, *11*, 55–62. https://doi.org/10.1016/j.cosust.2014.10.001

Bolding, A., Mollinga, P. P., & Van Straaten, K. (1995). Modules for modernisation: Colonial irrigation in India and the technological dimension of agrarian change. *Journal of Development Studies*, *31*(6), 805–844. https://doi.org/10.1080/00220389508422392

Chitata, T., Kemerink-Seyoum, J. S., & Cleaver, F. (2021). *Engaging and Learning with Water Infrastructure: Rufaro Irrigation Scheme, Zimbabwe*. *14*(3), 27.

Cleaver, F. (2001). Institutional Bricolage, Conflict and Cooperation in Usangu, Tanzania. *IDS Bulletin*, *32*(4), 26–35. https://doi.org/10.1111/j.1759-5436.2001.mp32004004.x

Cleaver, F. (2002). Reinventing Institutions: Bricolage and the Social Embeddedness of Natural Resource Management. *The European Journal of Development Research*, *14*(2), 11–30. https://doi.org/10.1080/714000425

Cleaver, F. (2012). *Development through bricolage: Rethinking institutions for natural resource management*. Routledge.

Cleaver, F., & de Koning, J. (2015). Furthering critical institutionalism. *International Journal of the Commons*, *9*(1), 1–18. https://doi.org/10.18352/ijc.605

Cleaver, F., Whaley, L., & Mwathunga, E. (2021). Worldviews and the Everyday Politics of Community Water Management. *Water Alternatives*, *14*(3), 19.

de Koning, J. (2011). *Reshaping institutions: Bricolage processes in smallholder forestry in the Amazon*. Wageningen University and Research.

de Koning, J. (2014). Unpredictable Outcomes in Forestry—Governance Institutions in Practice. *Society & Natural Resources*, *27*(4), 358–371. https://doi.org/10.1080/08941920.2013.861557

Dwiartama, A., & Rosin, C. (2014). Exploring agency beyond humans: The compatibility of Actor-Network Theory (ANT) and resilience thinking. *Ecology and Society*, *19*(3). http://www.jstor.org/stable/26269633

Erdoğan, M., & Karagüzel, R. (2016). A new hydrogeologically based approach to determining protected areas in drinking water supply reservoirs: A case study in the Ağlasun sub-basin (Burdur, Turkey). *Environmental Earth Sciences*, *75*(2), 126. https://doi.org/10.1007/s12665-015-4845-1

García-Mollá, M., Ortega-Reig, M., Boelens, R., & Sanchis-Ibor, C. (2020). Hybridizing the commons. Privatizing and outsourcing collective irrigation management after technological change in Spain. *World Development*, *132*, 104983. https://doi.org/10.1016/j.worlddev.2020.104983

Gebara, M. F. (2019). Understanding institutional bricolage: What drives behavior change towards sustainable land use in the Eastern Amazon? *International Journal of the Commons*, *13*(1), Article 1. https://doi.org/10.18352/ijc.913

Hall, K., Cleaver, F., Franks, T., & Maganga, F. (2014). Capturing Critical Institutionalism: A Synthesis of Key Themes and Debates. *The European Journal of Development Research*, *26*(1), 71–86. https://doi.org/10.1057/ejdr.2013.48

Harris, L. M., Kleiber, D., Rodina, L., Yaylaci, S., Goldin, J., & Owen, G. (2018). Water Materialities and Citizen Engagement: Testing the Implications of Water Access and Quality for Community Engagement in Ghana and South Africa. *Society & Natural Resources*, *31*(1), 89–105. https://doi.org/10.1080/08941920.2017.1364818

Hommes, L., Hoogesteger, J., & Boelens, R. (2022). (Re)making hydrosocial territories: Materializing and contesting imaginaries and subjectivities through hydraulic infrastructure. *Political Geography*, *97*, 102698. https://doi.org/10.1016/j.polgeo.2022.102698

Hoogesteger, J. (2015). *Normative structures, collaboration and conflict in irrigation; a case study of the Píllaro North Canal Irrigation System, Ecuadorian Highlands*. *International Journal of the Commons,* 9(3): 398–415.

Hoogesteger, J., Bolding, A., Sanchis-Ibor, C., Veldwisch, G. J., Venot, J. P., Vos, J., & Boelens, R. (2023a). Communality in farmer managed irrigation systems: Insights from Spain, Ecuador, Cambodia and Mozambique. *Agricultural Systems,* 204, 103552. https://doi.org/10.1016/j.agsy.2022.103552

Hoogesteger, J., Konijnenberg, V., Brackel, L., Kemink, S., Kusters., M., Meester, B., Mehta, A., ’t Hart, T., van der Poel, M., van Ommen, P., Boelens, R., and Sanchis-Ibor, C. (2023b) Imaginaries and the commons: Insights from irrigation modernization in Valencia, Spain. *International Journal of the Commons,*

Jessop, B. (2001). Institutional Re(turns) and the Strategic – Relational Approach. *Environment and Planning A: Economy and Space*, *33*(7), 1213–1235. https://doi.org/10.1068/a32183

Jessop, B., & Oosterlynck, S. (2008). Cultural political economy: On making the cultural turn without falling into soft economic sociology. *Geoforum*, *39*(3), 1155–1169. https://doi.org/10.1016/j.geoforum.2006.12.008

Johri, A. (2011). Sociomaterial bricolage: The creation of location-spanning work practices by global software developers. *Information and Software Technology*, *53*(9), 955–968. https://doi.org/10.1016/j.infsof.2011.01.014

Jones, S. D. (2015). Bridging political economy analysis and critical institutionalism: An approach to help analyse institutional change for rural water services. *International Journal of the Commons, 9(1)*.

Kemerink-Seyoum, J. S., Chitata, T., Domínguez Guzmán, C., Novoa-Sanchez, L. M., & Zwarteveen, M. Z. (2019). Attention to Sociotechnical Tinkering with Irrigation Infrastructure as a Way to Rethink Water Governance. *Water*, *11*(8), Article 8. https://doi.org/10.3390/w11081670

Kocabiyik, C., & Loopmans, M. (2019). Ağlasunlular-The People of Ağlasun. In *Meanwhile in the Mountains-Bir Zamanlar Toroslar'da* (pp. 293–299). Yapi Kredi Kültür Sanat Yayincilik PEN International Publishers Circle; Istanbul. https://lirias.kuleuven.be/retrieve/644143

Kocabıyık, C., & Loopmans, M. (2021). Seasonal gentrification and its (dis)contents: Exploring the temporalities of rural change in a Turkish small town. *Journal of Rural Studies*, *87*, 482–493. https://doi.org/10.1016/j.jrurstud.2020.09.002

Kooy, M., & Bakker, K. (2008). Technologies of Government: Constituting Subjectivities, Spaces, and Infrastructures in Colonial and Contemporary Jakarta: Technologies of government in colonial and contemporary Jakarta. *International Journal of Urban and Regional Research*, *32*(2), 375–391. https://doi.org/10.1111/j.1468-2427.2008.00791.x

Larkin, B. (2013). The Politics and Poetics of Infrastructure. *Annual Review of Anthropology*, *42*(1), 327–343. https://doi.org/10.1146/annurev-anthro-092412-155522

Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through Society*. Harvard University Press.

Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory.* Oxford University Press.

Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy, and heterogeneity. *Systems Practice*, *5*(4), 379–393. https://doi.org/10.1007/BF01059830

Mirhanoğlu, A., Loopmans, M., & Özerol, G. (2022). Social Head-Enders: Access and Authority in Irrigation Governance. *Society & Natural Resources*, *35*(2), 185–203. https://doi.org/10.1080/08941920.2021.2009944

North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press. https://doi.org/10.1017/CBO9780511808678

Obertreis, J., Moss, T., Mollinga, P. P., & Bichsel, C. (2016). *Water, Infrastructure and Political Rule: Introduction to the Special Issue*. *9*(2), 14.

Ortega-Reig, M., Sanchis-Ibor, C., Palau-Salvador, G., García-Mollá, M., & Avellá-Reus, L. (2017). Institutional and management implications of drip irrigation introduction in collective irrigation systems in Spain. *Agricultural Water Management*, *187*, 164–172. https://doi.org/10.1016/j.agwat.2017.03.009

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge university press.

Özerol, G., & Bressers, H. (2017). How do Farmers Align with the Agri-Environmental Changes in Irrigated Agriculture? A Case Study from the Harran Plain, Turkey. *Irrigation and Drainage*, *66*(1), 45–59. https://doi.org/10.1002/ird.2064

Pfaffenberger, B. (1988). Fetishised Objects and Humanised Nature: Towards an Anthropology of Technology. *Man*, *23*(2), 236. https://doi.org/10.2307/2802804

Reyes Escate, L., Hoogesteger, J., & Boelens, R. (2022). Water assemblages in hydrosocial territories: Connecting place, space, and time through the cultural-material signification of water in coastal Peru. *Geoforum*, *135*, 61–70. https://doi.org/10.1016/j.geoforum.2022.07.005

Rodina, L., & Harris, L. M. (2016). *Water Services, Lived Citizenship, and Notions of the State in Marginalised Urban Spaces: The case of Khayelitsha, South Africa*. *9*(2), 20.

Sehring, J. (2009). Path Dependencies and Institutional Bricolage in Post-Soviet Water Governance. *Water Alternatives*, *2*(1), 21.

Servillo, L. A., & Van Den Broeck, P. (2012). The Social Construction of Planning Systems: A Strategic-Relational Institutionalist Approach. *Planning Practice and Research*, *27*(1), 41–61. https://doi.org/10.1080/02697459.2012.661179

Sese-Minguez, S. (2017). *Transformations Accompanying a Shift from Surface to Drip Irrigation in the Cànyoles Watershed, Valencia, Spain*. *10*(1), 19.

Shah, E., & Boelens, R. (2021). The moralization of hydraulics: Reflections on the normative-political dimensions of water control technology. *Geoforum*, *121*, 93–104. https://doi.org/10.1016/j.geoforum.2021.02.009

The Turkish Statistical Institute. (2021). Retrieved 07 December 2022, from https://biruni.tuik.gov.tr/medas/?kn=95&locale=tr

Thelen, K. (1999). Historical Institutionalism in Comparative Politics. *Annual Review of Political Science*, *2*(1), 369–404. https://doi.org/10.1146/annurev.polisci.2.1.369

Van den Broeck, P. (2010). Analysing social innovation through planning instruments: A strategic-relational approach. In *Strategic Spatial Projects*. Routledge.

Van der Kooij, S., Kuper, M., Zwarteveen, M. Z., & de Fraiture, C. M. S. (2017). A user-centred approach to irrigation performance: Drip irrigation in the Khrichfa area, Morocco. *Water International*, *42*(7), 794–809. https://doi.org/10.1080/02508060.2017.1373319

Van der Kooij, S., Zwarteveen, M., & Kuper, M. (2015). The material of the social: The mutual shaping of institutions by irrigation technology and society in Seguia Khrichfa, Morocco. *International Journal of the Commons*, *9*(1), 129–150. https://doi.org/10.18352/ijc.539

Van Halsema, G. E. (2002). *Trial & Re-Trial: The Evolution of Irrigation Modernisation in NWFP, Pakistan*.

Venot, J.-P., Kuper, M., & Zwarteveen, M. (2017). *Drip Irrigation for Agriculture: Untold Stories of Efficiency, Innovation and Development*. Taylor & Francis.

Wang, R. Y., Liu, T., & Dang, H. (2018). Bridging critical institutionalism and fragmented authoritarianism in China: An analysis of centralized water policies and their local implementation in semi-arid irrigation districts. *Regulation & Governance*, *12*(4), 451–465. https://doi.org/10.1111/rego.12198

Whaley, L. (2018). The Critical Institutional Analysis and Development (CIAD) Framework. *International Journal of the Commons*, *12*(2), xx–xx. https://doi.org/10.18352/ijc.848

Winner, L. (1986). *The Whale and the Reactor*. The University of Chicago Press.

Acknowledgement:

We thank the participants for sharing their time for this research and we also thank Jean-Philippe Venot for his insightful comments on the earlier version of the paper. We are very grateful for the useful comments and suggestions of the two reviewers and the editor. The research was supported by the Research Fund of KU Leuven, Belgium.

5. WATER GRABBING THROUGH INFRASTRUCTURES AND INSTITUTIONS IN RURAL TURKEY

ABSTRACT

The contestation and appropriation of water is a global issue. Capturing the control of water sources determines how and by whom water will be used. This paper examines how water grabbing occurs through both water infrastructures and institutions. Building on the concepts of accumulation by dispossession and infrastructural violence, I investigate the mechanisms employed by bottled-water companies to grab water and conceal the scale of grabbing, which caused the dispossession of local farmers from the water sources they have used for centuries. Drawing from ethnographic research in Ağlasun, a rural town in the southwest of Turkey, my findings reveal two main insights. Firstly, water grabbing occurs through bending the rules, institutions of clientelism, and ambiguities in legislation. Secondly, water grabbing is facilitated by infrastructural changes such as fencing the water sources and the imposition of water-saving agricultural technologies. The paper concludes by bringing attention to a need for clearly defined legislation and a stronger auditing system towards an equitable access of local farmers to water. Finally, understanding these processes of water grabbing through various institutions and infrastructures allows us to illustrate the conditions for a more just and equitable water governance.

Keywords: water grabbing, accumulation by dispossession, infrastructural violence, irrigation governance, Turkey

A version of this chapter has been accepted for publication (subject to revision) by Water Alternatives.

5.1. Introduction

On a hot summer day in 2021, I was walking to one of the water springs in Ağlasun, a rural town in southwest Turkey, to observe what changes occurred over the last two years. I could not conduct fieldwork in 2020 due to the covid pandemic, so I was curious and excited to see what had changed in the last two years. The spring was located at the foothills of the Taurus Mountains, which was a difficult walk. I was walking alone, wearing a round hat and a backpack. It was obvious that I was not one of the locals. After around two kilometres, I saw one tractor passing, and the driver was staring at me. He stopped and sounded the horn to invite me on his tractor. After introducing myself, we continued the journey together. The dirt road to the water spring was in bad condition and slowed down the tractor, giving us time for a conversation. To my surprise, his tractor trailer was full of water, especially since I had witnessed the tractor pass by the water spring without stopping for a fill. Not only that, I could not understand either why he would be carrying so much water from the town up to the mountains. The driver explained: "I am a shepherd, and we are grazing our animals near the water spring. I am carrying drinking water for the family members and our animals. The new water company built a concrete hut around the spring, so we no longer have access to clean water from the spring. They fenced the spring and locked the concrete hut. Therefore, we have to carry drinking water from the town."

There are many reasons why one national and one international bottled-water company managed to grab water in Ağlasun. One main reason is the outdated water legislation, which is based on the Water Law of 831, that came into force in 1926 (Bulut & Birben, 2019). Since then, different regulations have entered into force on top of the outdated water law in water governance. However, these regulations are sometimes contradictory. Despite the plethora of water management regulations in Turkey, there are gaps and ambiguities in these regulations, which cause many conflicts and inequalities. At the same time, this situation leads to overlapping mandates and responsibilities among various institutions (Tatar, 2019). Furthermore, Turkey's water management and policy have been significantly changed as a result of neoliberal transformations in Turkish agriculture (Kibaroğlu et al., 2009).

Between 1950 and 1980, the Turkish state followed a path of national developmentalism (Keyder & Yenal, 2011). During that period, the State Hydraulics Works (Devlet Su İşleri, DSI) was established to advance water resources and there were numerous large-scale investments in the irrigation sector (Özerol, 2013). The global oil crisis in 1973 and the military coup in 1980 laid the groundwork for the neo-liberalization of the Turkish state (Işlar, 2012b). The neoliberal turn highly affected Turkish agriculture, reducing the welfare of smallholder farmers, who are the majority of agricultural producers in Turkey (Özerol, 2013). Through liberalization and globalization in Turkish agriculture, Aydın (2010) claims, capitalist agribusinesses are the winners at the cost of smallholder farmers.

Ağlasun, as a mountainous rural town, has also undergone major transformations due to the neo-liberalization of Turkey. The economic reforms in the 1980s increased rural depopulation (Aydın, 2010; Kavak, 2016) and left Ağlasun with a declining and aging population (Kocabıyık & Loopmans, 2021). Moreover, the neoliberal restructuring of the agricultural sector impoverished the rural population (Aydın, 2001), which created pressure to privatise the natural resources in rural areas.

In the case of Ağlasun, one of the most significant changes was the increase in water grabbing since the 2000s. During this period, one multinational and one national bottled-water company set up bottling plants in Ağlasun. Additionally, many infrastructural and institutional changes took place in the irrigation system of Ağlasun (Mirhanoğlu et al., 2022). Together, these changes in water governance affected access to water, determining for whom, when, how much, and under what conditions water is on offer.

Investigating the major changes in water allocation in Ağlasun, particularly the introduction of bottled-water companies, this paper seeks out the role of water infrastructures and institutions in hiding the water grabbing by bottled-water companies and in the dispossession of local farmers from the water sources they had used for centuries to irrigate their crops. Combining the concept of 'infrastructural violence' (Rodgers & O'Neill, 2012) with 'accumulation by dispossession' (D. Harvey, 2003), I aim to unveil how bottled-water companies control and commodify water through institutional arrangements and infrastructures, which deflect from the power they exert in doing so. I unravel how water grabbing in Ağlasun occurs through ambiguities in legislation, institutions of clientelism, and bending the rules, but is also facilitated by infrastructural changes such as fencing the water sources and the forced imposition of water-saving agricultural technologies. Untangling those processes of exclusion allows us to understand and explore the challenges for a more just and equitable water governance in Turkey.

5.2. Water grabbing through institutional arrangements and infrastructures

Dell'Angelo et al. (2018) offer a detailed analysis of the different definitions used for water grabbing, departing from the special issue on water grabbing edited by Mehta et al. (2012) in this journal. Dell'Angelo et al. (2018) argue that the special issue attempts to conceptualise water grabbing systematically. For example, Wagle et al., (2012) define water grabbing as an illicit transfer of water from agricultural to industrial use in which farmers were highly affected. Bues & Theesfeld, (2012) use the concept of water grabbing as a change in local water governance caused by the arrival of powerful foreign actors. Vélez Torres (2012) uses water grabbing to emphasize how historically marginalized local communities were dispossessed after the implementation of water development projects. As a broad definition, water grabbing is a process in which powerful actors are able to reallocate or control water

resources to their benefit, even though these resources were in use by local communities or were necessary to feed aquatic ecosystems upon which these communities depend for their livelihoods (Franco et al., 2013; Mehta et al., 2012; Veldwisch et al., 2018).

Departing from the broad definition of water grabbing above, in this paper, I focus on how institutional arrangements and water infrastructures are used not only to enable water grabbing but also to hide the scale and effects of grabbing. By doing so, I examine the processes of water grabbing by bringing the accumulation by dispossession and infrastructural violence literature into a conversation to yield new insights on how water grabbing occurs through institutions and infrastructures. The next two subsections explain the insights from the literature on accumulation by dispossession and infrastructural violence, which help understand how the mechanisms and processes of water grabbing occur.

5.2.1. State institutions and water grabbing

The privatization and commodification of commons cause many injustices across the world. Swyngedouw sees privatization as a "legally and institutionally condoned, if not encouraged, form of theft." (2005, p. 82). David Harvey argues that privatization forms the "cutting edge" of accumulation by dispossession and explains that international financial institutions impose privatization of public goods, services, and property on debtor nations in the global South. He explains "... to say nothing of the wave of privatization (of water and public utilities of all kinds) that has swept the world, indicates a new wave of 'enclosing the commons'" (D. Harvey, 2003, p. 148). The implementation of modern enclosures often leads to commodification, along with exclusion, whether this exclusion is through physical or economic means (Jaffee & Newman, 2013). To understand the complex dynamics of the commodification of commons, David Harvey's (2003) prominent concept of "accumulation by dispossession" provides significant insights. Accumulation by dispossession refers to a process of capital accumulation where uncommodified or inaccessible assets are used to generate profits and these assets are incorporated into the market exchange at little or no cost (Jaffee & Newman, 2013). Levien (2013) also argues that dispossession is a deeply political process and requires state power to justify and naturalize apparent inequalities and overcome the limits to dispossession. Swyngedouw (2005) explains how: "without the various state levels paving the way and imposing conditions that guarantee privatization ... this accumulation by dispossession could not possibly take place" (p. 89).

(D. Harvey, 2003, 2005) explains water grabbing as a specific form of accumulation by dispossession under neo-liberalization which causes the privatization of resources, the exclusion of certain groups, and the alteration of different forms of property rights into 'exclusive private property rights' (Mehta et al., 2012). Many scholars examine water grabbing through the lens of accumulation by dispossession. Tetreault & McCulligh (2018) describe how powerful actors in the Zacatecas region of Mexico monopolize access to and

control over water resources as a consequence of institutionalized corruption, resulting in water scarcity for local communities. Birkenholtz (2016) argues that water rights have been shifted from farmers to corporations as a result of the Indian government's prioritization use of water for industry and urban usage. Vélez Torres (2012) analyzes water grabbing in the Alto Cauca in Colombia as a form of accumulation through the racialization and ethnicization of environmental dispossession in the capitalist system. The paper by Işlar (2012a) examines the privatization of hydropower in Turkey and points out that transformations in land and water property regimes can exclude or marginalize communities.

5.2.2. Infrastructural Violence

Water infrastructure plays an equally significant role in water-grabbing practices (Andersen, 2016; Swyngedouw, 2005). Critical infrastructure studies drew upon insights from science and technology studies, geography, and urban studies to conceptualize infrastructure not only as "the physical roads, dams, railways, and irrigation systems that facilitate the circulation of goods and services, but also as the entangled impacts and relationships with ecological, spatial, socio-political, and cultural processes and practices" (Turner, 2022:186). The material and the social are mutually connected. Therefore, focusing on this conceptualization of infrastructure can be useful to understand the embeddedness of material infrastructure with social and political relations, which lead to dispossession.

It has become common knowledge in irrigation studies that the modernization of irrigation infrastructures does not only imply changes in water flows but also concurrent and entangled changes in actors' access to resources, their social positions and power relations, and institutional arrangements (Mirhanoğlu et al., 2023). Irrigation is not only an essential determinant in building social relationships but also connects humans with their surroundings. The 'physical' infrastructure, its surroundings, and the actors playing a key role in building and managing it are visible and easily recognizable. However, the power relations and various forms of control embedded in infrastructure may not be noticed clearly at first glance. Therefore, we need to draw attention "to the silent, unnoticed work done by infrastructures" (P. Harvey et al., 2017).

The concept of "infrastructural power" (Mann, 1984) emphasizes how infrastructure can serve as a powerful institutional instrument to regulate society while the concept of "infrastructural warfare" (Graham, 2004, 2006, 2010) refers to the deliberate targeting of infrastructure networks that can cause tremendous suffering. Building on these two concepts, Rodgers & O'Neill (2012) propose the notion of **infrastructural violence** "to understand when it is that infrastructure becomes violent, for whom, under what conditions, and why" (Rodgers & O'Neill, 2012:402). The notion of infrastructural violence also attempts to connect marginalized groups' suffering to the violent outcomes of institutional arrangements, social structures and political-economic processes (Benson, 2008; Rodgers & O'Neill, 2012).

The concept of infrastructural violence focuses on the capability of the infrastructure to constitute and shape inequalities while questioning the presumed neutrality of infrastructure. Therefore, Kumar et al. (2021) argue that, through the concept of infrastructural violence, the conventional understanding of infrastructure as material and technical is shifted to a socio-technical one. Rodgers & O'Neill (2012) divide infrastructural violence into 'active' and 'passive' forms. Active infrastructural violence occurs when infrastructure is intentionally designed to be violent, whether during development or operation (Rodgers & O'Neill, 2012). As an example of active infrastructural violence, Rodgers (2012) describes the decisions of Baron Haussmann who crisscrossed Paris with wide and straight boulevards to securitise it in the 19th century. Another example Rodgers gives regards how the car bridge over the Grand Central Parkway in New York City was built low in height so that public transport buses, which were mainly used by poor people, could not pass underneath. This shows how elites engage in the appropriation and deployment of infrastructure to police vulnerable populations (Rodgers & O'Neill, 2012; Star, 1999).

The second form of 'passive' infrastructural violence refers to "the socially harmful effects derive from infrastructure's limitations and omissions rather than its direct consequences (Rodgers & O'Neill, 2012:407). Gandy (2006) in Lagos shows how poorer parts of the city were excluded from the infrastructural networks during the urban development of the city in the early 21st century. Chaplin & Kalita (2017) explain the passive infrastructural violence in India: "This passive infrastructural violence, created by the failure of the state to provide adequate sanitation facilities, or effectively maintain those that do exist, exposes women and girls to gendered, caste- and class-based forms of both physical and emotional violence which often inflict lifelong harms and sufferings" (2017:45). In another study on passive infrastructural violence, McIlwaine & Evans (2022) argue that passive infrastructural violence is most often committed by the state not providing sufficient facilities, which can have a disproportionate impact on women, for instance.

The concept of infrastructural violence is also used in urban studies on water governance. Kumar et al. (2021) explore how aspects of legal exclusion, commodification and privatization, poor coordination, planning exclusion, and over-estimation of water supply cause infrastructural violence in the water supply in Delhi, India. Desai (2018) zooms in on the water infrastructure at the public housing resettlement sites in Ahmedabad, India, and their everyday workings, and shows how they create unequal water flows that cause infrastructural violence.

In this paper, building on the concepts of 'accumulation by dispossession' (D. Harvey, 2003) and 'infrastructural violence' (Rodgers & O'Neill, 2012), I focus on water grabbing conflicts specific to the rural context, where water grabbing dispossesses local farmers from irrigation water.

I examine the mechanisms and processes which cause inequities in access to water, with a particular focus on the role of water infrastructures and institutional arrangements in concealing water grabbing. According to Birkenholtz (2016), accumulation by dispossession can be considered a process that combines both institutions and infrastructures to dispossess farmers from their water. He suggests focusing on the water infrastructures' materiality to advance the water grabbing literature (Birkenholtz, 2016) (see, for example, Boelens, (2021) for the role of large-scale water infrastructures in dispossession). I respond to this call by bringing the concept of infrastructural violence into conversation with the literature of accumulation by dispossession to examine the role of water infrastructures together with the institutional arrangements in dispossessing local farmers of their water resources. To do so, I build on empirical data from a case study of a mountainous rural town in southwest Turkey, where bottled-water companies grab the irrigation water. Then in section 4, I explain how both the institutional arrangements and water infrastructures are being used in water grabbing and in the dispossession of local farmers from the water sources they have used for centuries.

5.3. Case study

5.3.1. Case study background

Ağlasun is a rural town located at the foothills of the Taurus Mountains in the southwest of Turkey (Figure 1). It is one of the 15 districts of Burdur province and has a population of 7,408 (*The Turkish Statistical Institute*, 2022). The main economic activities are agriculture and livestock. Between the 1960s and 1990s, farmers were planting cash crops, such as sugar beets and roses, with the support of national agricultural policies, and the primary use of water sources in Ağlasun was agriculture. However, Turkey's agricultural liberalization strongly affected Ağlasun in the 1990s (Kocabıyık & Loopmans, 2021). The farmland in Ağlasun is distributed between a relatively narrow valley and small terraced plots on the valley slopes which constrained the farmers from farm upscaling. Therefore, Ağlasun lost access to cash crop value chains. As a result, farmers either switched to feed crops for their animals or to labour-extensive tree crops, for example, walnut and cherry (Mirhanoğlu et al., 2022). Moreover, fish farming became popular in the 1990s and some of the water sources have been allocated for fish farming.

Ağlasun follows the general trend in Turkey of a devaluation of the peasantry after the implementation of neoliberal policies in agriculture. The young generation prefers to emigrate to nearby cities such as Antalya and Isparta, leaving farming in the hands of their aging parents (Kocabıyık & Loopmans, 2021).

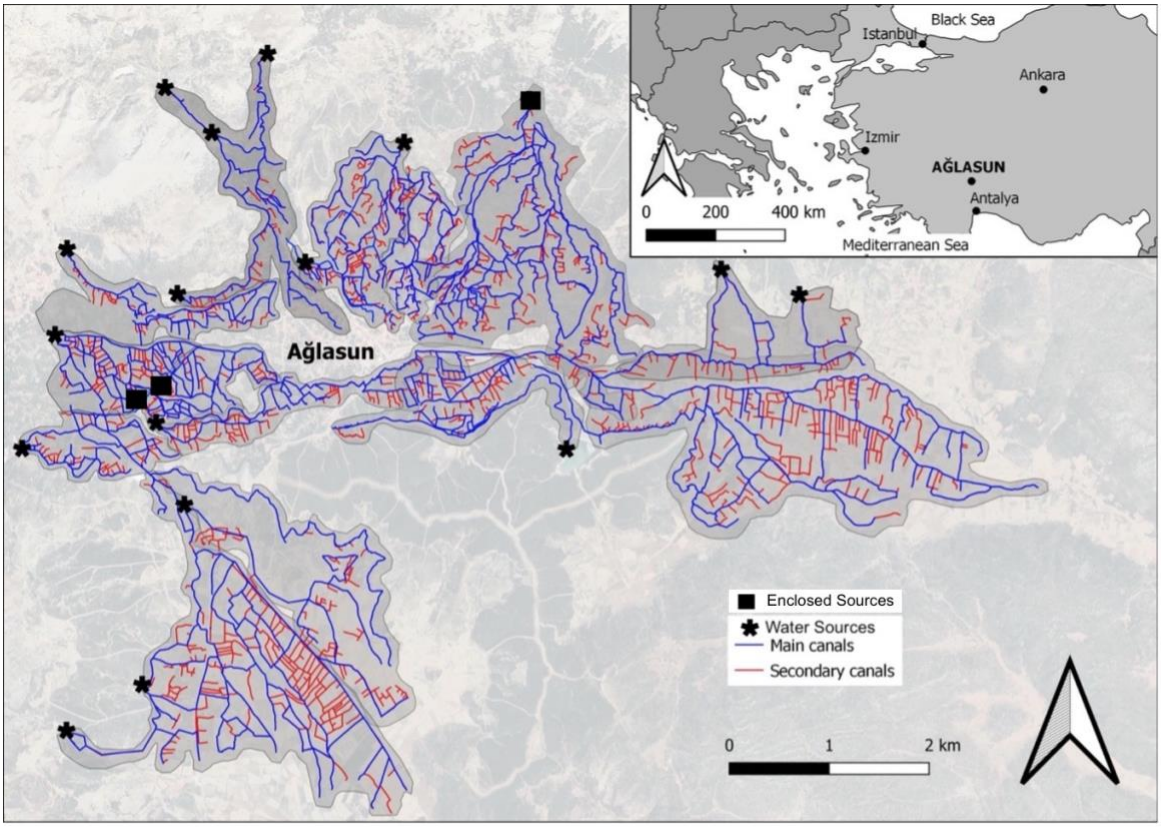


Figure 1. Map of the Ağlasun irrigation network (Source: Adnan Mirhanoğlu & Enrico Roets).

Various actors play key roles in water allocation (‘su tahsisi’ in Turkish) in Turkey. The main responsible institution for water allocation is the State Hydraulic Works (DSI). The requests for water allocation are made through the ministry of agriculture and forestry and the special provincial administrations. The municipalities also have the right to apply directly to DSI for water allocation in case of the need for a domestic water supply. Then, these institutions send the requests to the DSI, which makes a feasibility report. DSI engineers measure the flow rate of water for the requested water source and prepare the report. After the investigation, DSI sends its opinion to the special provincial administrations or to the ministry of agriculture and forestry, which is responsible for the collection of payments for water use for certain periods. The owner of the whole ‘general’ water sources is the Turkish state itself according to the Turkish civil code and the state can lease out the right to use water for a certain period.

Since the number of people in the agricultural sector has been decreasing since the 1990s, the farmers are no longer the primary users of water. The Ağlasun Municipal Government was searching to use the water resources more ‘efficiently’ than solely in agriculture. One of the ways was leasing out the right to use water to private bottled-water companies to bring new job opportunities to Ağlasun. The first bottled-water company arrived in Ağlasun in 2014, and a second one followed in 2020. However, the leasing procedure was not transparent and left many farmers with much less water. This caused many conflicts between farmers and the Ağlasun Municipal Government.

5.3.2. Data Collection and Analysis

I conducted in-depth fieldwork and gathered primary data through semi-structured interviews and participatory observation. I also collected secondary data by reviewing the archives of the Ağlasun Municipal Government, such as the reports prepared after the monthly meetings of the mayor and the council members of the Ağlasun Municipal Government. During data collection, my first aim was to understand how the conflicts happened because of the lack of transparency in leasing out the right to use water to private bottled-water companies and to examine the mechanisms and processes that cause inequalities in access to water after the arrival of bottled-water companies in Ağlasun.

I conducted the fieldwork during the summer periods of 2018, 2019, and 2021. I interviewed 42 farmers, the current mayor, the former mayor, the manager of one of the bottled-water companies, and the state officials from three state institutions that are in charge of water management (State Hydraulic Works, the ministry of agriculture and forestry and the special provincial administration). Since the interviewees were diverse, I built up several strategies to get in touch with them, and I also emphasized different dimensions of my own experiences, which helped the interviewees become more comfortable. For example, I talked about my farming experiences when I was introducing myself to farmers. The farmers were happy to listen to 'another farmer' instead of listening to a researcher. When it comes to the state officials, I introduced myself as an academic researcher rather than coming from a farming family. Finally, when interviewing the mayors, I emphasized the importance of their collaboration and how the results of my research might be helpful for them in making better policies for water governance in Ağlasun. These strategies helped me to communicate with the interviewees in a better and more effective way.

To analyze the interview transcripts and field notes, I used the CAQDAS NVIVO. I prepared a general code tree during the first coding cycle. After that, I prepared a map of relational concepts which helped me to reorganize the codes. Finally, I used focused coding and axial coding for a second cycle of coding.

5.4. The mechanisms and processes of water grabbing in Ağlasun

Water grabbing in Ağlasun occurs through various institutional arrangements and water infrastructures. I discuss the role of both in the following section. The role of institutions is examined by investigating ambiguities in water legislation, clientelism, and bending the rules. The role of water infrastructures was further divided into the enclosing of water sources, and the forced imposition of water-saving agricultural technologies.

5.4.1. Water grabbing through institutional arrangements

5.4.1.1. Ambiguities in the legislation

Water allocation is one of the most challenging and ambiguous issues in Turkey because of a water law dating from 1926 and the ambiguities in the legislation. The current legislations have gaps that cause conflicts and lead to overlapping mandates among different institutions (Çivgin, 2013; Tatar, 2019). Various powerful actors use the ambiguities in legislation and enclose water sources, depriving smallholder farmers of sufficient and good quality of water supply. According to the current legislation, DSI is the only responsible agent in auditing water sources. However, it is not clear how the audit should be done in the new legislation published in 2019 (DSI, 2019. The employee of DSI explains the issues about the audit:

> *"We have not received any official statement about the standards of the audit and how we are going to check the water allocations. According to the current legislation, the special provincial administration is responsible for signing the contract with the stakeholders, leasing out the right to use water for a certain period. Therefore, the special provincial administration should also be responsible for the audit. We are reporting these issues to DSI, and they say they are working on the new water law, but nobody knows when it will be ready and become official." (DSI official interview, 18 August 2021).*

The ambiguities related to the audit system highly affect both the quantity and quality of the water that the farmers in Ağlasun can use. First, the bottled-water companies do not have water storage facilities and they grab more water than permitted when there is a high demand, specifically during the summer periods. The current mayor of Ağlasun explains the situation as follows:

> *"There is a gap in the water allocation legislation. The current legislation says the amount of water being taken per second is calculated from 1 January to 31 December. If the bottled-water company gets permission for 5 l/s, they calculate the amount of water per year and they claim that they can use that amount of water during any period of the year, depending on when they need it most. Mainly, the bottled-water company uses water during the summer period. They have permission for 5 l/s, but they use 10 l/s and sometimes 20 l/s during summer periods and there is no control over it. Therefore, it causes a conflict between the municipal government, the farmers, and the bottled-water companies" (Mayor Interview, 17 August 2021).*

The ambiguity about how much water can be taken by bottled-water companies is explained in various ways by different state institutions. According to the state officials of 18. Regional Directorate of State Hydraulic Works (DSI) in Isparta, the bottled-water companies should take the amount of water assigned to them per second, and the bottled-water companies are supposed to store the water during the winter period to use in the summer period according to the legislation on water allocation published on 10 December 2019. (State officials interview, 18 August 2021). However, I visited both bottled-water companies in Ağlasun and asked them about their storage facilities. Neither of the bottled-water companies in Ağlasun has built any tanks to store water, and they bottle the water directly from the source.

Second, both bottled-water companies rented out the water sources that were previously used for fish farming and they got permission to use a certain amount of the water source to be bottled. Before the arrival of the bottled-water companies, the water of the fish farm continued its course and was used by the farmers after circulating through the fish farm. The amount of water was remaining the same. However, after the arrival of bottled-water companies, some of the farmers argued that the amount of water was decreasing. Since officials do not come to check whether the water is used based on the permitted purpose, farmers claim that the bottled-water companies transfer water from the fish farms to the bottling factories. The current mayor also complains about the possibility of water transfer between aquacultural facilities and the bottled-water company:

> *"Both of the bottled-water companies bought the lands of the fish farms which have their water source. After buying the land with the water source, the bottled-water companies set up factories to bottle water. The strategy is to enclose the maximum water sources so that they can transfer some water from the water sources of the fish farm to their bottled-water companies. The current legislation forbade this transfer. However, the bottled-water companies enclosed the water sources of the fish farm and built concrete huts around them. So, we are not sure whether the water is being transferred to the bottled-water company. There is also no check either from DSI or from the special provincial administration. These institutions should be responsible for the audit." (Current Mayor Interview, 17 August 2021).*

Third, the ambiguities in the audit system also cause water quality problems. The farmers belonging to the irrigation network, which depends on the rented-out spring, complain that the bottled-water company not only reduces the quantity but also the quality of the water in the network. The first bottled-water company takes fresh water from the water source and gives some water back to the irrigation canal, as seen below. However, according to the farmers, the colour and smell of this water are different from the water flowing from the water source (Farmer Interview, 20 August 2021). The bottled-water company uses 19-litre carboys made of polycarbonate. According to the regulations in Turkey, these polycarbonate

carboys can be used for 5 years, starting from their production dates. Therefore, bottled-water companies reuse them, and they need to wash them before refilling them. According to the farmers, the main reason for the change in smell and colour of the water is because of this cleaning process. The bottled-water company washes the used polycarbonate carboys with fresh water and gives 'dirty water' to the farmers. Therefore, the farmers do not trust the quality of the water in this irrigation canal, and they do not drink it. They carry water from home while working at their agricultural plots. Some farmers in Ağlasun are also worried this 'dirty' water can harm their crops (Farmer Interview, 20 August 2021).



Figure 2. The leftover water coming from the bottled-water company to irrigation canals.

The DSI officials explain that the DSI does not allow illicit access and polluting the water, but actual practices may differ from the written legislation as explained by one of the employees of DSI:

> *"The governor, the local officials in the ministry of agriculture and forestry, and the special provincial administration prefer to close their eyes to any illicit enclosing of a water source. The state does not care about how the local water sources are*

being used. The state only cares about the number of investments, which is also used to evaluate the success of the local officials. Therefore, the local officials close their eyes to any misuse of water sources, and they try to increase the number of investments in their region. The local officials in Ağlasun think that the investments are more important than the water itself and they do not care about whether small-scale farmers access enough water" (DSI officials interview, 18 August 2021).

To overcome the above ambiguities and overlapping mandates among different institutions, the state institutions propose changes in the water law. However, there are many reasons why the comprehensive update in the water law has not come into force yet even though it has been discussed since 2010 to adapt it with the European Union Water Framework Directive as a part of the harmonization process with the European Union (Bulut & Birben, 2019). According to the DSI state officials, the main reason is the potential heavy requirements for certain governing institutions after the update in the water law. One of the employees of DSI explains the reasons as follows:

"The update in the water law could not come into force because of issues in water allocations. If the update in the water law comes into force, the requirements for water allocations will be highly affected. It will also impose very serious sanctions and obligations on the governors, the state officials in the ministry of agriculture and forestry, and the special provincial administration. The new water law will also affect the current water allocations which will make everything more complicated, and some officials may be found guilty because of the previous water allocation permissions" (DSI official interview, 18 August 2021).

5.4.1.2. Bending the rules

The first bottled-water company arrived in Ağlasun in 2014. The owner of the bottled-water company 'convinced' the Ağlasun Municipal Government to make a rental agreement for the water source for a longer period than was allowed in the legislation. According to the water regulations in Turkey, the use rights of a water source can be rented for up to 10 years for commercial use (DSI, 2019). However, the Ağlasun Municipal Government did not follow that legislation during the first rental agreement and leased out one of the water sources to the first bottled-water company for 29 years on 17/11/2015. Some farmers made an official complaint to the state about the violation of the maximum time of the rental agreement. The complaints were also made through DSI. Therefore, DSI decided to make a detailed investigation, as explained by one of their employees:

"After we received the official complaints about the violation of the legislation, we started a detailed investigation. However, we could not continue the investigation

because we were warned by the officials of the ministry of interior. The Ağlasun Municipal Government informed the governorship of Burdur, stating that the contract was made to get the investment. The governorship of Burdur convinced the officials of the ministry of interior to stop the investigation. So, we also had to stop the investigation. The politics messed up the legislation. Otherwise, the official and technical parts are very clear. However, we cannot do anything when politics interferes with the issue" (DSI official interview, 18 August 2021).

After convincing the governorship of Burdur and the officials of the ministry of interior, the Ağlasun Municipal Government also convinced the farmers to withdraw the lawsuit. Nonetheless, the municipal government had to cancel the agreement on renting the water source for 29 years to the bottled-water company to convince the farmers. Finally, the municipal government made a new agreement with the bottled-water company on 13/12/2016 and let the water source to the company for 10 years.

5.4.1.3. Clientelism

The most recent legislation about water allocation was published on 10 December 2019 (DSI, 2019). According to this legislation, the same water source can be allocated for different purposes if there is enough water. However, a certain priority must be followed during the water allocation. The priority is for the domestic water supply. If there is not enough water for the domestic water supply, the source cannot be used for any other purposes. If there is a surplus of water, then the water can be allocated for irrigation and fish farming. The third priority is for energy production and industrial water use and the least priority is given to purposes for mining activities and commercial use of water involving permissions for bottled-water companies (DSI, 2019).

The Ağlasun Municipal Government and the bottled-water companies have colluded with each other. The municipal government has the power to request water sources for domestic purposes according to the legislation on water allocation and priority use of water (DSI, 2019). However, there is no official request from the municipal government for the water sources enclosed by bottled-water companies. The DSI official explains the issues in Ağlasun as follows:

"The second bottled-water company asked the previous mayor to send the petition to DSI, stating that the Ağlasun Municipal Government does not need that water source for the domestic water supply. Therefore, the second bottled-water company could get permission for the use of water very easily since the priority of the water sources is first given to the domestic water supply. After the local municipal elections of 2019, some farmers made a complaint about that petition and claimed water allocation from that water source for irrigation purposes. The

court decided to judge the previous mayor and the previous council members and all previous officials in the municipal government since the Ağlasun Municipal Government did not follow the official procedures before sending the petition. They faced both fines and imprisonment. However, the farmers who made the complaint were 'convinced' to withdraw the lawsuit at the last minute. We do not know how the farmers were convinced" (DSI official interview, 18 August 2021).

When the bottled-water company needs help, they first ask the mayor for the possibility of getting services from the municipal government or from the people that the mayor suggests. The bottled-water company also hires workers through the reference of the mayor.

The whole infrastructure to transfer water from the source to the second bottled-water company was built by one of the close supporters of the mayor. This issue has been explained by the previous mayor as follows:

"The person who won the tender to build the infrastructure for the transfer of water to the second bottled-water company is a member of the governing party and he is also a council member of the municipal government. Normally, it is not allowed. If you are a council member of the municipal government, you are not allowed to take part in any tender. But they found a way to do it. When I was the mayor, we were planning to build this infrastructure as the municipal government, and we were planning to ask for 650.000 TL from the bottled-water company. This money would go to the municipal government. However, now the person who won the tender got this money from the bottled-water company. If I were them, I would build the infrastructure as a municipal government and the money could be used for public services. Unfortunately, the new mayor preferred to enrich his supporters instead of the municipal government" (Previous Mayor Interview, 19 August 2021).

The mayor also plays a key role in employing workers in bottled-water companies. I visited the office of the mayor many times during fieldwork in 2018 and 2019 and 2021 and I had the chance to observe the differences. In 2018, the previous mayor was keeping locals waiting at the entrance hall and he was inviting them to his office one by one, listening to their questions and trying to find solutions for them. I was communicating with the people waiting at the entrance and asking the reasons why they wanted to see the mayor. Some people were clearly mentioning that they or their children needed a job, and they were visiting the mayor to request a job in the bottled-water company. The new mayor followed a different strategy than the previous mayor. He was inviting more than one person at the same time and asked them what their requests were. Some locals were feeling shy to ask for a job in the bottled-water company in front of other villagers. This strategy helped the new mayor to avoid more job requests for the bottled-water company. When a supporter of the mayor visited him, the mayor could ask to meet separately either by inviting the person to the meeting room or

closing the door of the office and asking the secretary not to invite any other person to his office. The role of the mayor in employing locals was also explained by one of the farmers:

> *"I went to the new bottled-water company to apply for the work. They said I must visit the mayor and give my CV to the mayor. I went to the office of the mayor and explained my situation. The mayor asked his secretary to note down my contact details, and the secretary said they will contact me in case of further hiring. However, I haven't heard from them for 6 months" (Farmer Interview, 20 August 2021).*

5.4.2. Water grabbing through infrastructures

5.4.2.1. Enclosing the water sources

The first bottled-water company enclosed the water source with a concrete hut, as seen below. Neither farmers nor the Ağlasun Municipal Government can check the amount of water flowing to the bottled-water company and the amount flowing to the irrigation canal.



Figure 3. The concrete hut enclosing the water source.

The farmers have no other choice than to accept the water coming from the hut built by the bottled-water company. The farmers need the water for irrigation during the summer period, which is generally between June and September. This period of the year is also the time when the bottled-water company receives the most orders from its customers. Therefore, the

workers in the bottled-water company have three shifts a day and they bottle the water for 24 hours during the period between June and September. Because of the high demand from the customers of the bottled-water company, less water is available for the farmers during the irrigation period, which is also between June and September. Since the concrete hut is built over the source, farmers cannot prove that the declining discharge of the source is due to the water company's higher intake.

Moreover, there are also various strategies of bottled-water companies to enclose more water sources as a provision for the future. The bottled-water companies want to be sure that they will have alternative water sources in case of any decline in the water source they are currently using. They also need separate sources for each brand name they have. The previous mayor explains the strategies of the first bottled-water company as follows:

> *"The first bottled-water company rented two different groundwater sources other than what they have been using […]. They rented the first water source to bottle water with a different brand name. Up to today, they have not taken any water from that source. The same bottled-water company rented another water source, and they claimed that they will use water to wash the used polycarbonate carboys before refilling. However, they needed electric energy to transfer water from the water source to the bottled-water company, which would not make it profitable because of high energy tariffs. We learnt that the bottled-water company rented the second water source to make a better bargain with the special provincial administration since they pay a high tariff for the first water source. The farmers are not allowed to use water from these sources, and they have been enclosed by the bottled-water company" (Previous Mayor Interview, 19 August 2021) (See Figure 1).*

A similar strategy is followed by the second bottled-water company which started to bottle water in Ağlasun in 2021. It made an official request to the special provincial administration to rent another water source in Ağlasun. The director of DSI explained that the agreement has been approved and the second bottled-water company has the right to use the second water source in Ağlasun (DSI official interview, 18 August 2021). However, the farmers using that water source have not been informed about the future plans of the second bottled-water company although the bottled-water company has the power to enclose the water source in case of an increase in the capacity of the company or a decline in the amount of the water source that is currently being used.

Similar things occurred after the second bottled-water company set up a factory in Ağlasun. The new bottled-water company rented another water source and one of their first actions was to enclose the water source (See Figure 1).

During the fieldwork in 2018, I visited the water source that was to be rented by the second bottled-water company. The water source was covered with an iron lid, and it was easy to open and check the amount of water coming from each of the three different taps that the spring was composed of. They were aggregated by farmers around 30 years ago, after a severe drought year in Ağlasun. Since then, there have been no significant water issues for that spring.





Figure 4. The amount of available water was transparent to everyone before being enclosed by the bottled-water company.

However, the bottled-water company built a new infrastructure and enclosed the water spring. This made it impossible for farmers to check the amount of water flowing to the bottled-water company and the amount of water flowing to the irrigation canal for farmers, as seen below. The bottled-water company put up barbed wire fences and **'no trespassing'** signs. Therefore, there is no transparency, and the farmers can no longer check the amount of water used by the bottled-water company.



Figure 5. The water source was enclosed by the bottled-water company.

When there are complaints from the farmers because of a decrease in water in the irrigation canals, the water guards, the mayor, and the bottled-water company blame 'climate change' and they claim that the discharge declined because of reduced precipitation (Current Mayor Interview, 17 August 2021, Water Guard Interview, 20 August 2021, Manager of the bottled-water company, 19 August 2021).

5.4.2.2. The forced imposition of water-saving agricultural technologies

The irrigation network in Ağlasun has undergone significant changes in 2009 after the mayoral elections. The new mayor invested in a plastic pipe network and replaced some parts of the main canals for the pressurization of the irrigation system. To promote drip irrigation, the Ağlasun Municipal Government made some changes in the rules of the distribution of water and gave priority to drip irrigation users. However, the demand to switch to drip irrigation was much less than expected by the municipal government. Therefore, the new mayor elected in 2019 enforced a new rule for one of the irrigation canals. First, the municipal government changed the infrastructure of the Oteyuz irrigation network to a closed-pipe system. Half of the pipes (around 3000 m in length) were donated by the first bottled-water company (Current Mayor Interview, 17 August 2021). After that change, the municipal government asked the farmers to switch to drip irrigation and buy drip irrigation infrastructure for their plots. However, it was not easy for the farmers to cover the expenses of the drip irrigation infrastructure. The municipal government changed the rules of access to water for that irrigation network and made it mandatory to switch to drip irrigation infrastructure to access water. Farmers who were not able to buy drip irrigation infrastructure

were not given water in that irrigation network and they were excluded from the irrigation system.

The Ağlasun Municipal Government is planning to extend this new rule to other irrigation networks, which will increase the number of farmers deprived of irrigation water. The second irrigation network, where the open canal infrastructure is being replaced by a closed pipe system, is the Kirazli irrigation network. The municipal government chose this irrigation network because the water source is shared with the second bottled-water company. The municipal government asked for financial help from the bottled-water company to replace the main pipes. The bottled-water company donated pipes (around 5000 meters) for the whole irrigation network of Kirazli to make farmers switch to drip irrigation. The municipal government is hoping that the farmers would need less water and there would be fewer complaints about the amount of water being used by the bottled-water company after switching to drip irrigation. The new pipes were installed in 2021 in Kirazli, as shown below. The municipal government is planning not to give water access to the farmers who are not able to buy drip irrigation infrastructure for their plots, as is the case in the Oteyuz irrigation network where the municipal government offers water to plots only having drip irrigation infrastructure.



Figure 6. The drip irrigation infrastructure is being built by the Ağlasun Municipal Government.

Although most farmers I interviewed were complaining about the forced imposition of drip irrigation technology by the municipal government, there was almost no resistance against

this new rule. There was also a lack of resistance against the bottled-water companies. There was only one farmer that went to court and filed a complaint petition against the bottled-water company. I interviewed that farmer. However, he did not want to share the details of the lawsuit and the name of the lawyer he was getting legal support. He was afraid that the bottled-water companies will threaten the lawyer to withdraw the lawsuit if the name of the lawyer becomes known.

5.5. Discussion and conclusion

The paper has shown how water grabbing occurs through both water infrastructures and institutions. Based on the data from ethnographic fieldwork about water governance in Ağlasun, a rural town in the southwest of Turkey, I analyzed how bottled-water companies use water infrastructures and various institutional arrangements to grab water and conceal the scale of grabbing which caused the dispossession of local farmers from their water sources which they have used for agriculture for centuries. My analysis presents three key contributions to the literature on water grabbing.

First, Birkenholtz, (2016) suggests advancing the water grabbing literature by focusing on the water infrastructures' materiality. Departing from the concept of infrastructural violence (Rodgers & O'Neill, 2012), I answered this call by analyzing various water infrastructures and how they were used not only to grab water but also to *conceal* the scale of the grabbing. My findings reveal that the infrastructural changes such as the fencing off of water sources and the forced imposition of water-saving agricultural technologies dispossess farmers of sufficient and good quality water. Additionally, the farmers who were not able to buy drip irrigation infrastructure were excluded from the irrigation system.

Second, I combined the concept of 'infrastructural violence' (Rodgers & O'Neill, 2012) with the idea of 'accumulation by dispossession' (D. Harvey, 2003) to show how the material and the social are mutually connected and how "the silent, unnoticed work done by infrastructures" (P. Harvey et al., 2017) was used to do water grabbing. My findings in Ağlasun show how the bottled-water companies grabbed water through bending the rules, institutions of clientelism, ambiguities in legislation, the fencing off of water sources and the forced imposition of water-saving agricultural technologies.

Third, I explained why the bottled-water companies managed to grab irrigation water in this mountainous rural town. Turkish agricultural and water policies have been profoundly changed after the neoliberal transformations in Turkey starting in the 1980s. These neoliberal policies mostly ignored rural areas and peasant lives, which resulted in the grabbing of natural resources in rural areas. In addition, the local officials were rewarded for attracting the investments although these investments caused enclosing the water sources which left farmers with insufficient and bad quality water.

With this paper, I show the importance of updating water laws based on the needs of peasants to access water equitably, which also requires stronger auditing. Policymakers should consider how ambiguities in laws and legislations are easily abused by powerful actors which may cause severe injustices in access to water, excluding poor and marginalized people (Veldwisch et al., 2018). For future research, the academic community might focus on the conditions of resistance to prevent water grabbing. In the present case, farmers in Ağlasun couldn't manage to create a strong basis for resistance. Therefore, future research might examine the links between grabbing and (successful) resistance. Furthermore, my research reveals preliminary insights on how water grabbing creates opportunities for land grabbing as water grabbing forces irrigation-dependent farmers to give up their land. Conducting future studies might reveal the interconnectedness of water and land more explicitly. Therefore, there is a need to combine studies on water grabbing with land grabbing since it is not easy to grab land without also grabbing water, and vice versa (Rulli et al., 2013; Woodhouse, 2012).

5.6. References

Andersen, A. O. (2016). Infrastructures of progress and dispossession. *Focaal*, *2016*(74), 28–41. https://doi.org/10.3167/fcl.2016.740103

Aydın, Z. (2010). Neo-Liberal Transformation of Turkish Agriculture. *Journal of Agrarian Change*, *10*(2), 149–187. https://doi.org/10.1111/j.1471-0366.2009.00241.x

Aydın, Z. (2001). Yapısal uyum politikaları ve kırsal alanda beka stratejilerinin özelleştirilmesi: Söke'nin Tuzburgazı ve Sivrihisar'ın Kınık köyleri örneği. *Toplum ve Bilim*, *88*, 11–31.

Benson, P. (2008). EL CAMPO: Faciality and Structural Violence in Farm Labor Camps. *Cultural Anthropology*, *23*(4), 589–629. https://doi.org/10.1111/j.1548-1360.2008.00020.x

Birkenholtz, T. (2016). Dispossessing irrigators: Water grabbing, supply-side growth and farmer resistance in India. *Geoforum*, *69*, 94–105. https://doi.org/10.1016/j.geoforum.2015.12.014

Boelens, R. (2021). *Chapter X.32: Large-scale water infrastructure, territorial transformation and water rights dispossession*. https://doi.org/10.4337/9781783477005.X.32

Bues, A., & Theesfeld, I. (2012). Water Grabbing and the Role of Power: Shifting Water Governance in the Light of Agricultural Foreign Direct Investment. *Water Alternatives*, *5*(2).

Bulut, M., & Birben, Ü. (2019). Effect of the EU Water Framework Directive on water resources management in Turkey. *Turkish Journal of Forestry | Türkiye Ormancılık Dergisi*, 221–233. https://doi.org/10.18182/tjf.562550

Chaplin, S., & Kalita, R. (2017). *Infrastructure, gender and violence Women and slum sanitation inequalities in Delhi: Final Research Report*. https://doi.org/10.13140/RG.2.2.18704.30724

Çivgin, M. (2013). *Avrupa Birliği Su Çerçeve Direktifi kapsamında Türkiyede entegre havza yönetimi*. Sosyal Bilimler Enstitüsü.

Dell'Angelo, J., Rulli, M. C., & D'Odorico, P. (2018). The Global Water Grabbing Syndrome. *Ecological Economics*, *143*, 276–285. https://doi.org/10.1016/j.ecolecon.2017.06.033

Desai, R. (2018). Urban Planning, Water Provisioning and Infrastructural Violence at Public Housing Resettlement Sites in Ahmedabad, India. 11(1), 20.

Franco, J., Mehta, L., & Veldwisch, G. J. (2013). The Global Politics of Water Grabbing. *Third World Quarterly*, *34*(9), 1651–1675. https://doi.org/10.1080/01436597.2013.843852

Gandy, M. (2006). Planning, Anti-planning and the Infrastructure Crisis Facing Metropolitan Lagos. *Urban Studies*, *43*(2), 371–396. https://doi.org/10.1080/00420980500406751

Graham S (2004) Constructing urbicide by bulldozer in the occupied territories. In: Graham S (ed.) Cities, War, and Terrorism: Towards an Urban Geopolitics. Oxford: Blackwell, 192–213.

Graham S (2006) Urban metabolism as target: Contemporary war as forced demodernization. In: Heynen N, Kaika M and Swyngedouw E (eds) In the Nature of Cities: Urban Political Ecology and the Politics of Urban Metabolism. London: Routledge, 245–265.

Graham S (2010) Disrupted Cities: When Infrastructure Fails. London: Routledge.

Harvey, D. (2003). *The new imperialism*. Oxford University Press.

Harvey, D. (2005). *A brief history of neoliberalism*. Oxford University Press.

Harvey, P., Jensen, C. B., & Morita, A. (2017). Infrastructures and social complexity. *New York: Routledge*, *10*, 9781315622880.

Işlar, M. (2012a). Privatised hydropower development in Turkey: A case of water grabbing? *Water Alternatives*, *5*(2).

Işlar, M. (2012b). Struggles for recognition: Privatisation of water use rights of Turkish rivers. *Local Environment*, *17*(3), 317–329. https://doi.org/10.1080/13549839.2012.665858

Jaffee, D., & Newman, S. (2013). A Bottle Half Empty: Bottled Water, Commodification, and Contestation. *Organization & Environment*, *26*(3), 318–335. https://doi.org/10.1177/1086026612462378

Kavak, S. (2016). *Rethinking political economy of contemporary water struggles in Turkey: Space, structures and altered agencies from a comparative perspective*.

Keyder, Ç., & Yenal, Z. (2011). Agrarian Change under Globalization: Markets and Insecurity in Turkish Agriculture. *Journal of Agrarian Change*, *11*(1), 60–86. https://doi.org/10.1111/j.1471-0366.2010.00294.x

Kibaroğlu, A., Baskan, A., & Alp, S. (2009). Neoliberal Transitions in Hydropower and Irrigation Water Management in Turkey: Main Actors and Opposition Groups. In D. Huitema & S. Meijerink, *Water Policy Entrepreneurs* (p. 13428). Edward Elgar Publishing. https://doi.org/10.4337/9781849803366.00029

Kocabıyık, C., & Loopmans, M. (2021). Seasonal gentrification and its (dis)contents: Exploring the temporalities of rural change in a Turkish small town. *Journal of Rural Studies*, *87*, 482–493. https://doi.org/10.1016/j.jrurstud.2020.09.002

Kumar, A., Singh, N., Cooper, S., Mdee, A., & Singhal, S. (2021). Infrastructural Violence: Five Axes of Inequities in Water Supply in Delhi, India. *Frontiers in Water*, *3*, 727368. https://doi.org/10.3389/frwa.2021.727368

Levien, M. (2013). Regimes of Dispossession: From Steel Towns to Special Economic Zones. *Development and Change*, *44*(2), 381–407. https://doi.org/10.1111/dech.12012

Mann, M. (1984). The autonomous power of the state: Its origins, mechanisms and results. *European Journal of Sociology / Archives Européennes de Sociologie*, *25*(2), 185–213. https://doi.org/10.1017/S0003975600004239

McIlwaine, C., & Evans, Y. (2022). Navigating migrant infrastructure and gendered infrastructural violence: Reflections from Brazilian women in London. *Gender, Place & Culture*, 1–23. https://doi.org/10.1080/0966369X.2022.2073335

Mehta, L., Veldwisch, G. J., & Franco, J. (2012). *Introduction to the Special Issue: Water Grabbing? Focus on the (Re)appropriation of Finite Water Resources*. *Water Alternatives*, *5*(2).

Mirhanoğlu, A., Loopmans, M., & Özerol, G. (2022). Social Head-Enders: Access and Authority in Irrigation Governance. *Society & Natural Resources*, *35*(2), 185–203. https://doi.org/10.1080/08941920.2021.2009944

Mirhanoğlu, A., Özerol, G., Hoogesteger, J., Broeck, P. V. den, & Loopmans, M. (2023). Socio-Material Bricolage: (Co)Shaping of Irrigation Institutions and Infrastructures. *International Journal of the Commons*, *17*(1), Article 1. https://doi.org/10.5334/ijc.1188

Özerol, G. (2013). *Aligning the multiplicities in natural resource governance: A study on the governance of water and land resources in irrigated agriculture*.

Rodgers, D. (2012). Haussmannization in the tropics: Abject urbanism and infrastructural violence in Nicaragua. *Ethnography*, *13*(4), 413–438. https://doi.org/10.1177/1466138111435740

Rodgers, D., & O'Neill, B. (2012). Infrastructural violence: Introduction to the special issue. *Ethnography*, *13*(4), 401–412. https://doi.org/10.1177/1466138111435738

Rulli, M. C., Saviori, A., & D'Odorico, P. (2013). Global land and water grabbing. *Proceedings of the National Academy of Sciences*, *110*(3), 892–897. https://doi.org/10.1073/pnas.1213163110

Star, S. L. (1999). The Ethnography of Infrastructure. *American Behavioral Scientist*, *43*(3), 377–391. https://doi.org/10.1177/00027649921955326

Swyngedouw, E. (2005). Dispossessing H $_2$ O: The contested terrain of water privatization. *Capitalism Nature Socialism*, *16*(1), 81–98. https://doi.org/10.1080/1045575052000335384

Tatar, S. (2019). *Türkiye ve Avrupa Birliği'nde Yerüstü Su Kaynaklarının Yönetimi*. Ankara: Üniversitesi: Fen Bilimleri Enstitüsü: Biyoloji Anabilim Dalı.

Tetreault, D., & McCulligh, C. (2018). Water grabbing via institutionalised corruption in Zacatecas, Mexico. *Water Alternatives*, *11*(3), 572.

The Turkish Statistical Institute. (2022). https://biruni.tuik.gov.tr/medas/?kn=95&locale=tr

Turner, S. (2022). Slow forms of infrastructural violence: The case of Vietnam's mountainous northern borderlands. *Geoforum*, *133*, 185–197. https://doi.org/10.1016/j.geoforum.2021.11.024

Veldwisch, G. J., Franco, J., & Mehta, L. (2018). Water Grabbing: Practices of Contestation and Appropriation of Water Resources in the Context of Expanding Global Capital. In R. Boelens, T. Perreault, & J. Vos (Eds.), *Water Justice* (1st ed., pp. 59–70). Cambridge University Press. https://doi.org/10.1017/9781316831847.004

Vélez Torres, I. (2012). Water Grabbing in the Cauca Basin: The Capitalist Exploitation of Water and Dispossession of Afro-Descendant Communities. *Water Alternatives*, *5*(2).

Wagle, S., Warghade, S., & Sathe, M. (2012). Exploiting Policy Obscurity for Legalising Water Grabbing in the Era of Economic Reform: The Case of Maharashtra, India. *Water Alternatives*, *5*(2).

Woodhouse, P. (2012). New investment, old challenges. Land deals and the water constraint in African agriculture. *The Journal of Peasant Studies*, *39*(3–4), 777–794. https://doi.org/10.1080/03066150.2012.660481

Acknowledgement:

I would like to thank the participants for sharing their time for this research and I also would like to thank Maarten Loopmans and Gül Özerol for their insightful comments on the earlier version of the paper. I am very grateful for the useful comments and suggestions of the reviewers and the editor. The research was supported by the Research Fund of KU Leuven, Belgium.

6. CONCLUSION

In this final chapter, I concisely present the findings of the three empirical chapters, with the aim of providing answers to the research questions outlined in the Introduction chapter. Then, I discuss the extent to which the findings from this thesis contribute to the existing literature and the solidarity recommendations for smallholder farmers that can be drawn from the thesis. Finally, I reflect on the directions for further research.

6.1. Revisiting the research questions

In this thesis, I attempted to answer the overarching research question: How and why do actors, institutions, and infrastructures form a water governance system and why some actors can easily access water while others cannot? I answered this research question by focusing on three aspects, namely *actors, institutions, and infrastructures,* in three sub-research questions.

6.1.1. How and why do institutions influence access to water and who benefits from this influence?

In chapter 3, I examined how institutions co-shape access to water. I investigated how farmers build various social relations with local authorities and how these relations help them to access water illicitly. My departure point was analysing the inequalities in access to water in one of the canal irrigation networks in Ağlasun. There are 24 irrigation networks in Ağlasun and I chose one of the networks which was similar to the other 23 networks when it comes to irrigation governance and infrastructure. By applying the spatial head-ender/tail-ender concepts in CPR theory, I was expecting to reach similar conclusions as in CPR theory which argues how farmers close to water sources have certain advantages compared to farmers far away from the water source in canal irrigation systems. Therefore, CPR scholars argue that water access is mainly determined by the distance to the water source in canal irrigation systems. However, I ended up with different conclusions than the arguments of CPR scholars in the studied irrigation network. After analysing the water access dynamics and the interactions between authority and farmer relations, I found that there were certain farmers managed to get priority in access to water illicitly, although they were far away from the source. I expanded the spatial head-ender/tail-ender concepts in CPR theory by defining these farmers as ‘social head-ender farmers’. I illustrated how the relationships between authority and access are associated with the socio-spatial features of irrigation systems. The farmers investing in building relations with authorities managed to ‘bend the rules’ and access water illicitly while the other farmers had to wait long periods to access water.

6.1.2. How and why do infrastructures influence access to water and who benefits from this influence?

In chapter 4, I focused on the role of infrastructures in access to water. I examined how the switch from surface irrigation to drip irrigation in the studied case entailed an interaction of institutional re-arrangements, a bricolage of material infrastructures and strategizing actors. I focused on one of the irrigation networks (Ulupinar irrigation network) where drip irrigation technology was being introduced. My departure point for this research was to analyse the institutional changes after the introduction of drip irrigation technology through the concept of institutional bricolage (Cleaver, 2002; de Koning, 2011). However, I recognized that not only institutions but also irrigation infrastructures played a significant role in access to water in the studied case. Therefore, I decided to bring materiality to the heart of the problem by expanding the concept of institutional bricolage to socio-material bricolage. Through the concept of socio-material bricolage, I aimed to gain insights into how the individual and collective agency has an impact on material infrastructures and institutions. In the studied case, the drip irrigation technology introduced by the local municipal government highly affected the institutional arrangements. I specifically focused on how the new infrastructures affected and shaped institutions of water distribution, the operation and maintenance of irrigation canals and water fee rules. The farmers who had sufficient financial means to invest in drip irrigation infrastructure in their fields managed to switch to drip irrigation and got priority access to water, while the farmers who couldn't make investments to acquire and install drip irrigation infrastructure on their land had to wait much longer to access water.

6.1.3. How and why do actors influence access to water and who benefits from this influence?

In chapter 5, I focused on the role of actors in access to water. I examined how the arrival of the new bottled-water company, together with the existing bottled-water company (co) shaped access to water and the struggles among farmers and bottled-water companies to access water. My departure point for this research was to analyze how bottled-water companies were enclosing water sources by applying the concept of 'infrastructural violence' (Rodgers & O'Neill, 2012). After investigating the strategies of both new and existing bottled-water companies, I recognized that bottled-water companies managed to grab water and conceal the scale of grabbing through not only infrastructures but also institutions. Therefore, I combined insights from the concept of 'infrastructural violence' (Rodgers and O'Neill, 2012) with the idea of 'accumulation by dispossession' (D. Harvey, 2003) to investigate the mechanisms employed by bottled-water companies to control and commodify water sources which caused the dispossession of local farmers from the water sources they have used for centuries. My findings revealed two main insights. First, bottled-water companies grabbed water by bending the rules, institutions of clientelism, and ambiguities in legislation. Second, bottled-water companies used infrastructures, such as fencing the water sources, building

concrete huts around springs and the imposition of water-saving agricultural technologies, to gain control of water. The bottled-water companies were the main actor who benefited from accessing water and the farmers in Ağlasun were left with less water, which caused conflicts between farmers and local authorities.

6.2. Theoretical contributions of the thesis

To answer the main research question of this thesis, I engaged with diverse theoretical frameworks. By introducing and applying a 'socio-material approach', the central theoretical contribution of this thesis is to show how different theories that prioritize either the 'social' or the 'material' perspective in critical water studies can interact with each other. In this thesis, neither the 'social' nor the 'material' perspective was my priority. I combined insights from different theories to reveal their potential in explaining how water is managed, distributed, and used by whom, when, and under what conditions, and why there are inequalities in access to water. I decided to combine insights from different specific theories after looking into several 'grand' theoretical frameworks which connect water, infrastructure, and power. Theories such as the hydrosocial cycle (Linton & Budds, 2014) and hydrosocial territories (Boelens et al., 2016) have a wider span, offering insights on the cultural, institutional, political, and material elements embedded in water governance. They combine concepts that are essential for my research. However, these theoretical frameworks are often too general to explain the overdetermined contingencies of local and temporally specific situations in the studied case. Therefore, I found it more useful to tinker the 'bricolage' of various theoretical frameworks to explain the specific reasons of inequalities in access to water. I followed a flexible, case-oriented approach and combined existing theoretical frameworks, depending on the problem at hand.

In this thesis, I synthesized insights from various theoretical perspectives to conduct this research from three different angles: actors, institutions, and infrastructures. While focusing on the role of actors, institutions, and infrastructures in co-shaping access to water, my thesis contributes to the literature on CPR theory, critical institutionalism, and water grabbing.

6.2.1. Contributions to CPR theory

In chapter 3, I combined CPR theory with the theory of access to explain the role of authority and institutions in access to water. I specifically focused on the significance of the social relations and the conditions to bend the rules regarding access to water which are less explored in CPR theory.

As the literature on CPR governance has evolved since the 1980s, it has been subject to many critiques. Although CPR theory absorbed the majority of critiques it received, the lack of attention to structural inequalities in resource access remains one of the most persistent critiques (Quintana & Campbell, 2019). Moreover, critical CPR scholars argue that evaluating

the sustainability of resource governance without assessing winners and losers remains incomplete (Agrawal, 2014; Robbins, 2011). In CPR theory, the inequalities in access to irrigation water are often explained by spatial "head-ender/tail-ender" distinctions that are determined by the distance of the recipient to the water source. However, I showed that inequalities in access to irrigation water are also created by social relations and social institutions. In chapter 3, by introducing and applying the concept of "social head-enders", I expand the analysis of power offered in the theory of access. I examined how social head-ender farmers, although being spatially far away from the water source, managed to access water illicitly through their relations with authorities. Therefore, I demonstrated that, just like the spatial distance to a water source, social distance to authorities also influences access to water. In conclusion, I showed how the 'social' (rules and social relations) intertwine with the 'material' (spatial distance to a water source).

6.2.2. Contributions to critical institutionalism literature

With its attention to the interaction between institutions, infrastructures and actors, this thesis also contributes to critical institutionalism literature which emerged to understand how institutions function in practice and why some actors benefit while others are excluded (Cleaver, 2012). Despite its ability to contribute significantly to institutional analysis, the 'material' dimension is insufficiently prioritized in critical institutionalist approaches. Therefore, I combined insights from critical institutionalism with the socio-technical approach to explain the role of both material infrastructures and institutions in access to water in chapter 4.

Critical institutionalism scholars working on natural resources management explain the role of institutions in both limiting and enabling human agency through the concept of institutional bricolage (Cleaver, 2002; de Koning, 2011). The role of material infrastructures in co-shaping institutions and the behaviour of actors in institutional analysis is less explored. Cleaver asserts that "an understanding of the ways in which social arrangements also manifest physically (through labour, infrastructure and resource use practices) would significantly strengthen institutional analysis" (2012, p. 20). Building on the attention to the agency of material artefacts in Actor-Network Theory (ANT) and Science and Technology Studies (Latour, 1987, 2005; Law, 1992; Winner, 1986) and the understanding of how institutional arrangements and actors' practices co-shape each other in critical institutionalism (Cleaver, 2012; Cleaver & de Koning, 2015), I answered the call of Cleaver by proposing the concept of socio-material bricolage in chapter 4. With this concept, I aimed to understand how material infrastructures and institutions are mutually shaped by individual and collective agency. In chapter 4, I showed how actors, institutions, and material infrastructures are interdependent and they are mutually co-shaping each other. I argued that not only institutions, but also material infrastructures play a key role in both limiting and enabling human actions. Therefore, I showed the significance of analyzing both institutions

and infrastructures in irrigation systems. I argued that the analysis of water access in irrigation governance will be incomplete if either one is missing. In conclusion, I demonstrated how the 'material' (drip irrigation technology) intertwines with the 'social' (locally embedded and newly introduced institutions).

6.2.3. Contributions to the water grabbing literature

In chapter 5, I combined the concepts of 'infrastructural violence' (Rodgers and O'Neill, 2012) and 'accumulation by dispossession' (D. Harvey, 2003) to analyze the strategies implemented by private bottled-water companies not only to grab water but also to *conceal* the scale of the grabbing. The role of the water infrastructures' materiality receives less attention in water grabbing literature and I aimed to contribute to filling that gap.

The literature on water grabbing highlights how powerful actors are able to reallocate or control water resources to their benefit, even though these resources were in use by local communities or were necessary to feed aquatic ecosystems upon which these communities depend for their livelihoods (Franco et al., 2013; Mehta et al., 2012; Veldwisch et al., 2018).

Birkenholtz (2016) suggests advancing the water grabbing literature by engaging with research on the political ecology of water, which examines social power and water technology from a critical perspective. By doing so, Birkenholtz (2016) argues that there is a need to focus on the water infrastructures' materiality, from the conditions of design to the expectations of delivery and the possible shortcomings. In chapter 5, I answered this call by combining the concept of 'infrastructural violence' (Rodgers and O'Neill, 2012) with the idea of 'accumulation by dispossession' (D. Harvey, 2003) to analyze various water infrastructures and institutions and how they were used not only to grab water but also to *conceal* the scale of the grabbing. Infrastructural violence and accumulation by dispossession brought two essential insights to light in my research. First, the literature on 'infrastructural violence' helped reveal how bottled-water companies gained control of water through various infrastructures, such as constructing fences and concrete huts around water sources and imposing water-saving agricultural technologies, i.e., drip irrigation technology. Second, bottled-water companies were able to grab water through different strategies, such as bending the rules, institutions of clientelism, and ambiguities in legislation. In conclusion, I demonstrated how the 'social' (bending the rules and institutions of clientelism) intertwines with the 'material' (fencing the water sources and the imposition of water-saving agricultural technologies).

6.3. Solidarity recommendations for smallholder farmers

After reflecting on the entire PhD thesis, I decided to write solidarity recommendations for smallholder farmers rather than policy recommendations for policymakers. Since policymakers are mostly aware of the gap between the policies they write on paper and how they are (not) implemented in the field, I find it more useful to provide solidarity recommendations for smallholder farmers on how they can fight the injustices they face on a daily basis.

In this research, I gained insights into how changes in institutions, infrastructures, and actors increased conflicts over access to water. These changes have privileged some actors and excluded others.

In Chapter 4, I examined how the introduction of drip irrigation technology changed the rules on access to water. The municipal government in Ağlasun used drip irrigation technology to privilege relatively rich farmers. Although the number of farmers who were unable to invest in drip irrigation infrastructure was much higher than those who could switch to drip, farmers could not prevent this privilege because of the lack of collective action. In Chapter 5, I showed how the arrival of the new bottled-water company caused the dispossession of local farmers from the water sources they had used for centuries because the farmers could not build strong resistance against the bottled-water company.

In Chapter 4, I also demonstrated the significance of locally embedded institutions in the studied case. Farmers were collectively responsible for irrigation canal cleaning until one of the candidates running for the mayor made a political campaign promising to make the municipal government fully responsible for canal cleaning. The farmers accepted the transfer of cleaning of irrigation canals to the municipal government to decrease their workload. However, the workers from the municipal government did not clean as precisely as the farmers did, and the farmers lost one of their most significant locally embedded institutions.

My findings demonstrate the crucial role of locally embedded institutions and collective action. Such institutions strengthen collective rulemaking, which increases the potential of smallholder farmers to oppose and counteract external institutions introduced by powerful actors. Therefore, my solidarity recommendations for smallholder farmers are to find ways to defend and strengthen local collective action and solidarity-based institutions, such as collective canal cleaning and the örüm system, related to specific infrastructures and institutions. Although giving up these institutions may look beneficial for farmers in the short term, preserving them can enhance the capacity of farmers to fight injustices to access water in the long term.

6.4. Directions for future research

In terms of future research, I identify four main directions, which respectively address the research on resistance, the relationship between water and land grabbing, fusing various theoretical concepts into each other and reflecting on how the changes in Ağlasun can inform us about the past and the future of the region.

First, future research may focus on the reasons of the lack of resistance when there is inequality in access to resources. Political ecology scholars have conducted immense research to explain how actors build resistance to protect their access to natural resources. However, the reasons why there is no resistance, even if severe injustice exists in access to water, are underexplored. In Chapter 3, I examined the interaction between access and authority to explain how the authorities' capacity to bend the rules strengthens, rather than undermines, the legitimacy of authorities. The relationship between authority and resistance plays a significant role in access to natural resources. Therefore, future research might examine the reasons why resistance is not an option for the actors (farmers in this research) to access natural resources (irrigation water in this research) and try to understand why farmers do not prefer to use their 'weapons' of resistance (Scott, 1985) against authorities.

Second, future research may examine the cases where water grabbing does not lead to land grabbing. The literature on land grabbing shows that it is linked to a substantial decrease in the availability of freshwater resources which includes rain and irrigation water (Rulli et al., 2013) and it is not easy to grab land without also grabbing water, and vice versa (Rulli et al., 2013; Woodhouse, 2012). This thesis reveals preliminary insights into the role of infrastructure in relation to land and water grabbing. However, in the studied case, the water grabbing hasn't led to land grabbing. Conducting future studies might reveal the reasons why water grabbing hasn't caused land grabbing in the studied case. One of the attempts which may help to find the answers to the relations between water grabbing and land grabbing in the studied case is the recent interdisciplinary project at KU Leuven, which is about the sustainability of urbanization in times of accelerated growth.

Third, future research may explore how critical water literatures can be in conversation with each other better. Combining insights from different theoretical concepts was useful for understanding and explaining the relationships between actors, institutions, and infrastructures. Based on my experiences of fusing various theoretical concepts into each other, I believe that more interdisciplinary and inter-theoretical research is needed for critical water governance studies. Since water governance systems are complex and multi-factor issues, we need a more holistic perspective to understand the complexity of water governance. Therefore, future research will be valuable to understand how different schools of thought and theoretical concepts can be in conversation with each other in critical water studies. In conclusion, I invite the scholars of critical water research to create dialogues that allow them to combine different theories depending on the problem at hand.

Finally, future research may investigate how the recent changes in Ağlasun, the successor of the ancient city of Sagalassos, can inform us about the past and the future of the region. Looking at the trajectory of the Sagalassos/ Ağlasun study in the long term, it can be seen that it has always been a predominantly agrarian society where access to equitable water was very significant. Irrigation systems have remained in place for long periods and are socio-material, which makes them suitable for the longue durée analysis of society-environment interactions in archaeological research (Kaptijn 2018), investigating past societies through material residues. In this research, the data I collected allowed me to go back in time around 100 years, which could be considered a small timescale for archaeologists. However, my findings clearly established relationships between institutions and infrastructures, showing how changes in the infrastructures of irrigation systems lead to changes in irrigation institutions and vice versa. Those changes also created winners and losers in access to water. Future research, combining insights from historical political ecology and archaeology, may use the remains of ancient infrastructures to speculate on how locally embedded institutions of water governance in Ağlasun are rooted in the practices of the past societies of the Sagalassos region. There is a path dependency and continuity in every change: infrastructures and institutions play a stabilizing role. Therefore, understanding the practices of past societies can provide significant information for the reasons why contemporary Ağlasun society is not able to build collective action and why they are unable to create strong institutions to protect their access to water. Departing from the practices of past societies in the Sagalassos region and the practices of contemporary Ağlasun society, possible scenarios on water governance can be suggested for the future of the region.

6.5. References

Agrawal, A. (2014). Studying the commons, governing common-pool resource outcomes: Some concluding thoughts. *Environmental Science & Policy*, *36*, 86–91. https://doi.org/10.1016/j.envsci.2013.08.012

Birkenholtz, T. (2016). Dispossessing irrigators: Water grabbing, supply-side growth and farmer resistance in India. *Geoforum*, *69*, 94–105. https://doi.org/10.1016/j.geoforum.2015.12.014

Boelens, R., Hoogesteger, J., Swyngedouw, E., Vos, J., & Wester, P. (2016). Hydrosocial territories: A political ecology perspective. *Water International*, *41*(1), 1–14. https://doi.org/10.1080/02508060.2016.1134898

Cleaver, F. (2002). Reinventing Institutions: Bricolage and the Social Embeddedness of Natural Resource Management. *The European Journal of Development Research*, *14*(2), 11–30. https://doi.org/10.1080/714000425

Cleaver, F. (2012). *Development through bricolage: Rethinking institutions for natural resource management*. Routledge.

Cleaver, F., & de Koning, J. (2015). Furthering critical institutionalism. *International Journal of the Commons*, *9*(1), Article 1. https://doi.org/10.18352/ijc.605

de Koning, J. (2011). *Reshaping institutions: Bricolage processes in smallholder forestry in the Amazon*. Wageningen University and Research.

Franco, J., Mehta, L., & Veldwisch, G. J. (2013). The Global Politics of Water Grabbing. *Third World Quarterly*, *34*(9), 1651–1675. https://doi.org/10.1080/01436597.2013.843852

Harvey, D. (2003). *The new imperialism*. Oxford University Press.

Kaptijn, E. (2018). Learning from ancient water management: Archeology's role in modern-day climate change adaptations. *WIREs Water*, *5*(1). https://doi.org/10.1002/wat2.1256

Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through Society*. Harvard University Press.

Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory.* Oxford University Press.

Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy, and heterogeneity. *Systems Practice*, *5*(4), 379–393. https://doi.org/10.1007/BF01059830

Linton, J., & Budds, J. (2014). The hydrosocial cycle: Defining and mobilizing a relational-dialectical approach to water. *Geoforum*, *57*, 170–180. https://doi.org/10.1016/j.geoforum.2013.10.008

Mehta, L., Veldwisch, G. J., & Franco, J. (2012). *Introduction to the Special Issue: Water Grabbing? Focus on the (Re)appropriation of Finite Water Resources*. *5*(2).

Quintana, A., & Campbell, L. M. (2019). Critical Commons Scholarship: A Typology. *International Journal of the Commons*, *13*(2), 1112–1127. https://doi.org/10.5334/ijc.925

Robbins, P. (2011). *Political Ecology: A Critical Introduction*. John Wiley & Sons.

Rodgers, D., & O'Neill, B. (2012). Infrastructural violence: Introduction to the special issue. *Ethnography*, *13*(4), 401–412. https://doi.org/10.1177/1466138111435738

Rulli, M. C., Saviori, A., & D'Odorico, P. (2013). Global land and water grabbing. *Proceedings of the National Academy of Sciences*, *110*(3), 892–897. https://doi.org/10.1073/pnas.1213163110

Scott, J. C. (1985). *Weapons of the weak: Everyday forms of peasant resistance*. yale university Press.

Veldwisch, G. J., Franco, J., & Mehta, L. (2018). Water Grabbing: Practices of Contestation and Appropriation of Water Resources in the Context of Expanding Global Capital. In R. Boelens, T. Perreault, & J. Vos (Eds.), *Water Justice* (1st ed., pp. 59–70). Cambridge University Press. https://doi.org/10.1017/9781316831847.004

Winner, L. (1986). *The Whale and the Reactor*. The University of Chicago Press.

Woodhouse, P. (2012). New investment, old challenges. Land deals and the water constraint in African agriculture. *The Journal of Peasant Studies*, *39*(3–4), 777–794. https://doi.org/10.1080/03066150.2012.660481

7. ANNEXES

Annex 1 - Questions for Interviews with Farmers

(Drip) Irrigation

- How does irrigation management work now?
- Which irrigation method do you use?
- Do you use drip irrigation? If yes, since when and how did you decide to use drip irrigation? If not, do you plan to switch to drip irrigation? Why?
- What are the reasons to use/not to use drip irrigation?
- Would you switch to drip irrigation if municipality built main pipe?
- Do you think that drip irrigation is efficient? Do you know how drip irrigation system work?
- In general, what types of changes might drip irrigation bring to your village? Crop choice, irrigation time, efficiency, etc.
- What is the effect of drip irrigation on your collaboration in the irrigation network, with the water guards and the other farmers?
- Do you know water guard in person? Is he your relative/close friends?
- What do you do when you have a problem with irrigation? for example, when there is not enough water in the canal, when the canals are broken or clogged.

Water Pond

- Do you have water pond in your land? If yes, when did you build it? Why did you build it? Where did you take the machine for digging hole? Do you have your own water?

Neighbors

- Do you generally talk with your up/down neighbors? Do you ask advice from them? Anything you learnt from them, or you showed to them?
- Do your neighbors use drip irrigation? If yes, have you spoken with them about drip irrigation?
- Do you know every neighbor surrounding your land? Can you map them?

Ranking/Waiting Time

- How are irrigation rankings determined? How do you get informed about the ranking?

- How many times do you irrigate your crops before irrigation season and during irrigation season?
- How many days do you need to wait for second round of irrigation?
- What kind of problems do you face at the beginning and at the end of irrigation season?
- How many farmers use water from your irrigation canal? >>ask names to check.
- How many of them do you know? What is your relationship with them?
- Pease indicate your plots on the map. Please indicate which piece of land is irrigated and which one is not.
- Which crops have you cultivated this year on each plot of land? Was it profitable?
- What did you cultivate last year and previous years? which year was most profitable and least profitable?

Crop Choice

- How do you decide what to cultivate?
- Is there any effect of neighbor choice on your crop choice?
- Is there any effect of water pricing on crop choice?
- Is there any effect of water availability on crop choice?
- Is there any change in crop choice after you shared your land with relatives?
- Assume that your land is accessible for tractor, would it effect your crop choice?
- Where do you sell your products?
- Have you shared your land between family members? If yes, how many? Is the size of the land sufficient for each member?
- Have you been cultivating the same field? If yes, for how long? If no, how did you decide to cultivate different fields?
- Is the size of the land you own/rent smaller or larger than the land owned/rented by other farmers in your village?

Water Fee

- What do you think about water fee policy?
- How are the irrigation fees determined? Who decides on the amount of the fee and payment method? Why the fee has been changed?
- What happens if you do not pay irrigation fees? Do all farmers pay the irrigation fee regularly? Are there any incentives to pay or not to pay regularly?

Infrastructure

- Are there any problems with the infrastructure? Is there enough maintenance?
- Who is responsible for the operation and maintenance of the infrastructure? Who made this decision? How?
- What happens if someone takes water when it's not that person's turn (e.g. leaving the sluice halfway open) or damages the canal to make it leak?

Other Questions

- Are you satisfied with water guard system? If not, what kind of problems you have with water guards?
- Are you satisfied with state agricultural policies? What kind of subsidizes would you prefer to have?
- Have you taken part in a meeting related to irrigation? When? How?
- Who should manage the irrigation system according to you?

Annex 2 - Questions for Interviews with Water Guards and Water Chiefs

- How many years are you working as a water guard/water chief? How were you assigned to this job?
- What is your typical daily and weekly job?
- What are your authorities and responsibilities as a water guard/water chief?
- To whom do you report? Do you speak to water chief every day?
- How do you coordinate between farmers? How do you inform them? Are you always visiting field, or do you visit field when there is a problem?
- What is your role in resolving the conflicts among the farmers?
- When you recognize a leakage, what are you doing with it?
- What happens if a farmer wants water for a very long time?
- What do you do when there is a problem that you cannot solve?
- Do you irrigate any land instead of farmers?

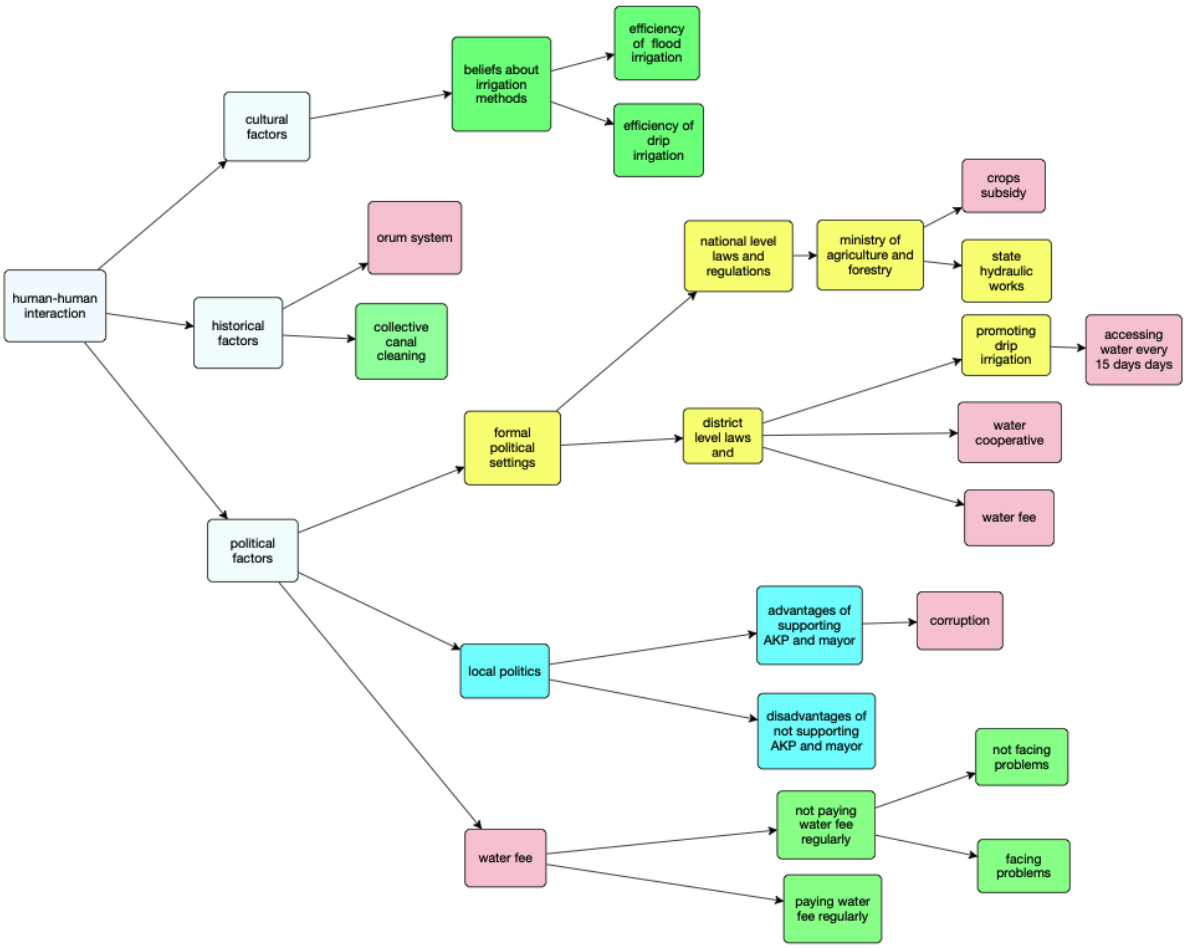
- How do you decide to start distributing water either from head-ender or tail-ender for each sub-canal?
- Are you going to water source every day? How do you decide to visit source?
- How many farmers have drip irrigation at the canal that you are working? Can you locate them on the map? (In order to understand the relationship of tail-enders and head-enders)
- If you compare head-ender and tail-ender farmers, which group is using more water? How do you monitor their water use? If yes, what are the average levels? Do the farmers know how much water they use?
- If you compare head-ender and tail-ender farmers, which group has more ponds at their lands? How many ponds are there? Do you monitor the water collected in ponds? If yes, what is the total amount and how much does it add to total water availability?
- What happens when there is an infrastructure problem? Who is responsible to solve it?
- What are the most important 'problems/issues' that you have to deal with? Let's assume this happening….

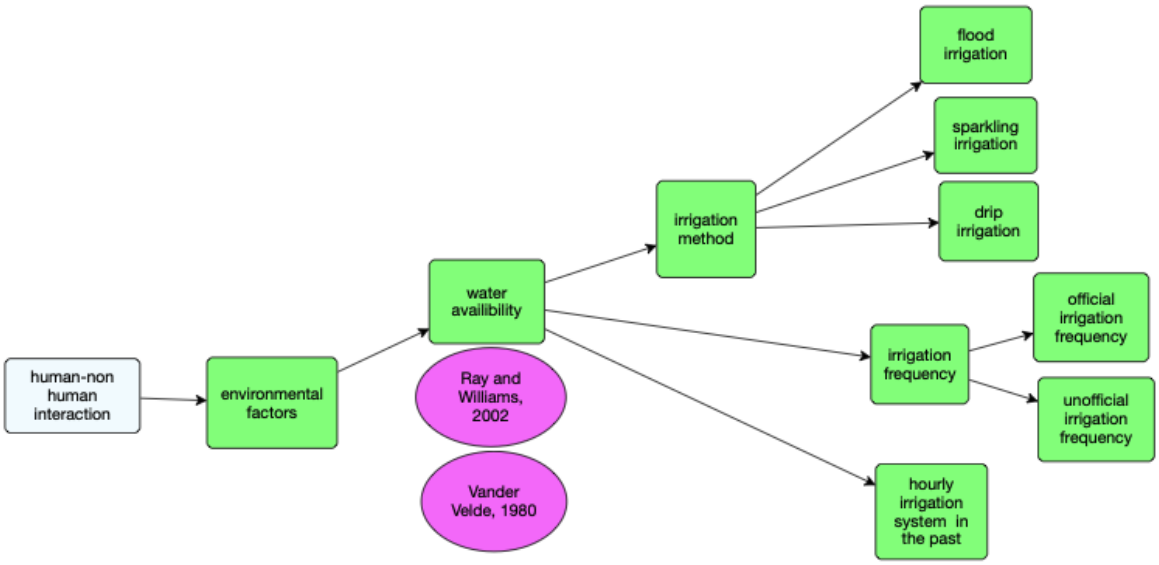
Annex 3 - Questions for Interviews with Old Farmers

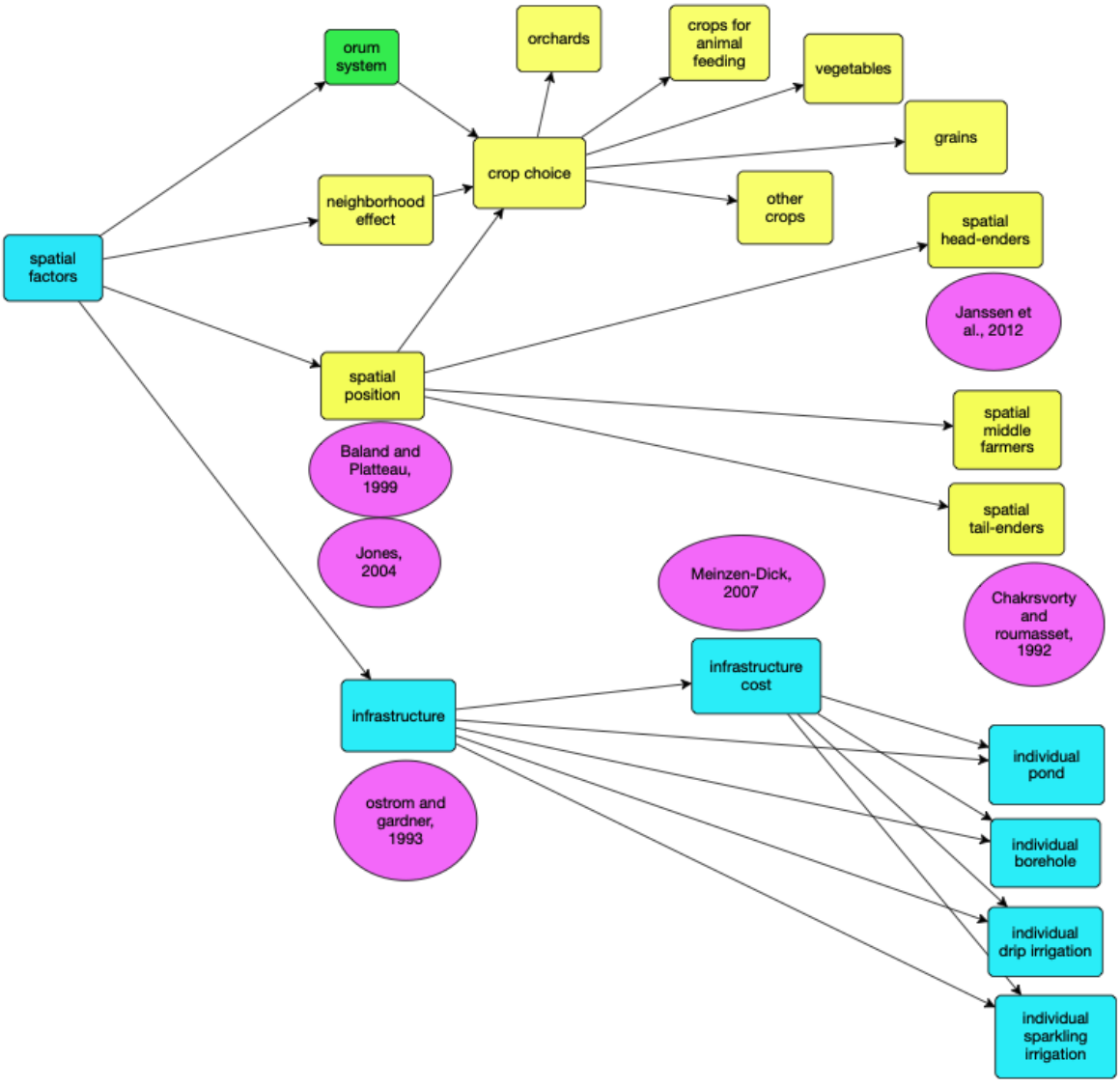
- How was the irrigation system in the past?
- How were you sharing water?
- Were all farmers benefit equally from water?
- How was the performance of irrigation management? Were you satisfied with performance?
- Were you paying fees for water use? Do you know whether other farmers were paying?
- How was the fee determined? What do you think about the increase in fee throughout years?
- When was hourly system started? In which mayor period? Why was there switch to hourly system?
- How many times did you irrigate during one season? Was it sufficient?
- When did you have concrete canal system? Who built it? Who was responsible for operations, maintenance, and repair?
- How was cleaning of canals in the past?
- What were your crops? How did you decide what to cultivate?
- How was the örüm system in the past?
- What do you think about reasons of decrease in amount of water?
- What type of subsidies were available from government in past? (Crop subsidies, fuel subsidy, subsidy for fertilizers and agro-chemicals, subsidy for soil analysis)

Annex 4 – Code Tree

I prepared the below code tree after the first fieldwork to explore the potential of the data I collected. It was part of the first cycle coding with the aim of connecting the codes with the research questions and the literature I have read on water access. My departure point was 'access' and I broadly grouped access-related factors as human-human interaction and human-nonhuman interaction. Then, I used different colours for different factors that affect access. Also, I used circular shapes with the purple colour next to some of the categories to show the relevant literature to these categories. Some of the examples are shown below. It was not possible to put the whole code tree as an annex, since it was too large. In case you are curious about the complete version, you can email me at adnanmirhanoglu@gmail.com. I will be happy to share the NVIVO version of the code tree.

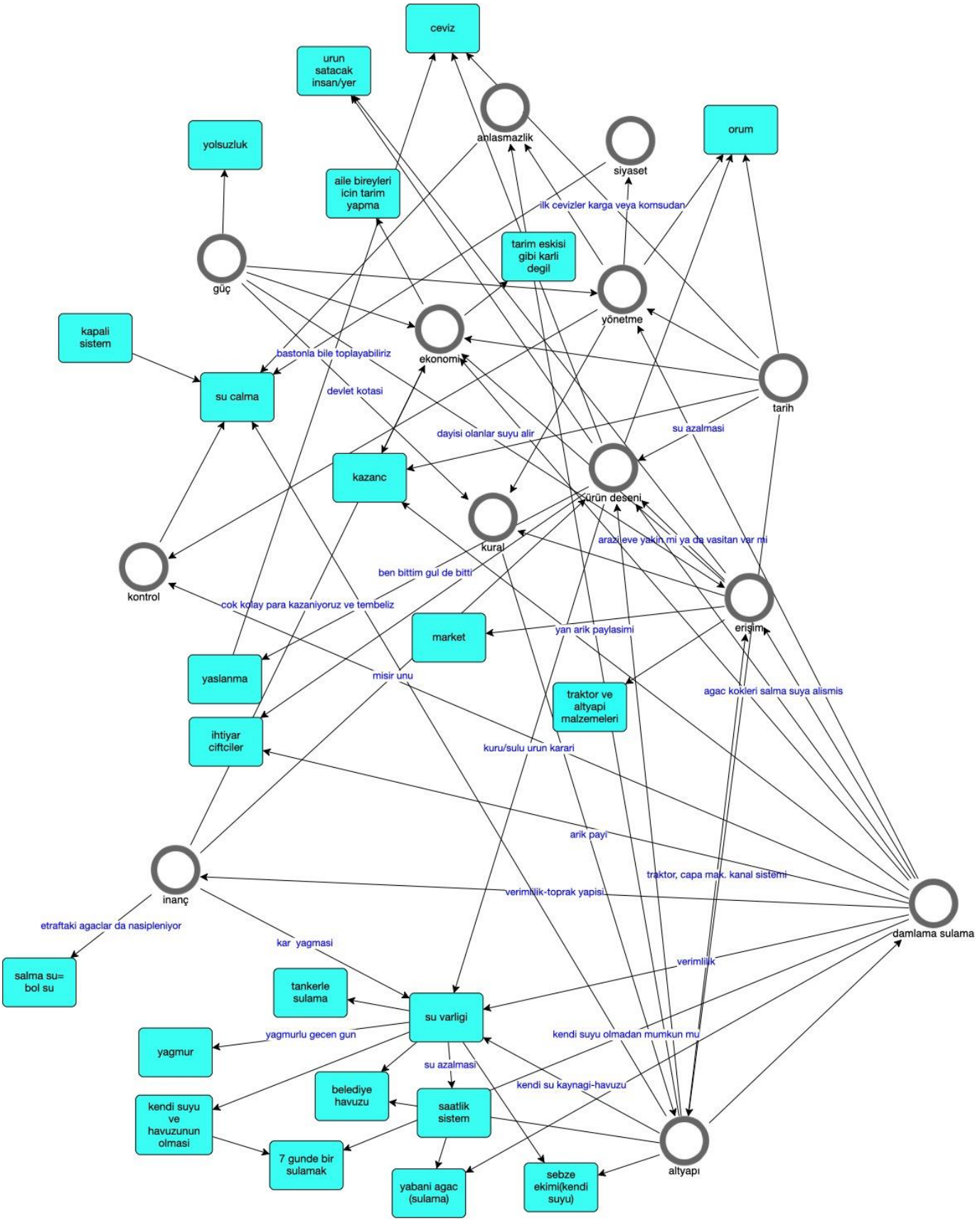



human-non human interaction
environmental factors
water availibility
Ray and Williams, 2002
Vander Velde, 1980
irrigation method
flood irrigation
sparkling irrigation
drip irrigation
irrigation frequency
official irrigation frequency
unofficial irrigation frequency
hourly irrigation system in the past


spatial factors
orum system
neighborhood effect
crop choice
orchards
crops for animal feeding
vegetables
grains
other crops
spatial position
Baland and Platteau, 1999
Jones, 2004
spatial head-enders
Janssen et al., 2012
spatial middle farmers
spatial tail-enders
Meinzen-Dick, 2007
Chakrsvorty and roumasset, 1992
infrastructure
ostrom and gardner, 1993
infrastructure cost
individual pond
individual borehole
individual drip irrigation
individual sparkling irrigation

Annex 5 – The Concept Map in NVIVO

I prepared the concept map below during the final stage of the analysis of the data. The main purpose of the concept map was to show the relationships between the codes while further analysing the data and to explain how these codes relate to each other. While I was rereading the transcriptions, I was checking the concept map each time to see whether the data I was reading was connecting any codes. If so, I was drawing between these two codes and writing how these two codes were connected to each other. There were also some concepts which were related to many codes. I put them in a rectangular shape and drew the arrows from these concepts to the related codes. The concept map is in Turkish since the transcriptions were in Turkish. The below concept map is the simplified version, since the original version was too large and not easily readable in one document. In case you are curious about the original version, you can email me at adnanmirhanoglu@gmail.com. I will be happy to share the NVIVO version of the concept map.


ceviz
urun satacak insan/yer
anlasmazlik
orum
yolsuzluk
siyaset
aile bireyleri icin tarim yapma
ilk cevizler karga veya komsudan
tarim eskisi gibi karli degil
güç
yönetme
kapali sistem
ekonomi
bastonla bile toplayabiliriz
su calma
devlet kotasi
tarih
dayisi olanlar suyu alir
su azalmasi
kazanc
ürün deseni
kural
arazi eve yakin mi ya da vasitan var mi
kontrol
ben bittim gul de bitti
cok kolay para kazaniyoruz ve tembeliz
erişim
market
yan arik paylasimi
yaslanma
misir unu
traktor ve altyapi malzemeleri
agac kokleri salma suya alismis
ihtiyar ciftciler
kuru/sulu urun karari
arik payi
traktor, capa mak. kanal sistemi
inanç
verimlilik-toprak yapisi
damlama sulama
etraftaki agaclar da nasipleniyor
kar yagmasi
verimlilik
salma su= bol su
tankerle sulama
su varligi
yagmurlu gecen gun
kendi suyu olmadan mumkun mu
yagmur
su azalmasi
kendi su kaynagi-havuzu
belediye havuzu
kendi suyu ve havuzunun olmasi
saatlik sistem
altyapı
7 gunde bir sulamak
yabani agac (sulama)
sebze ekimi(kendi suyu)

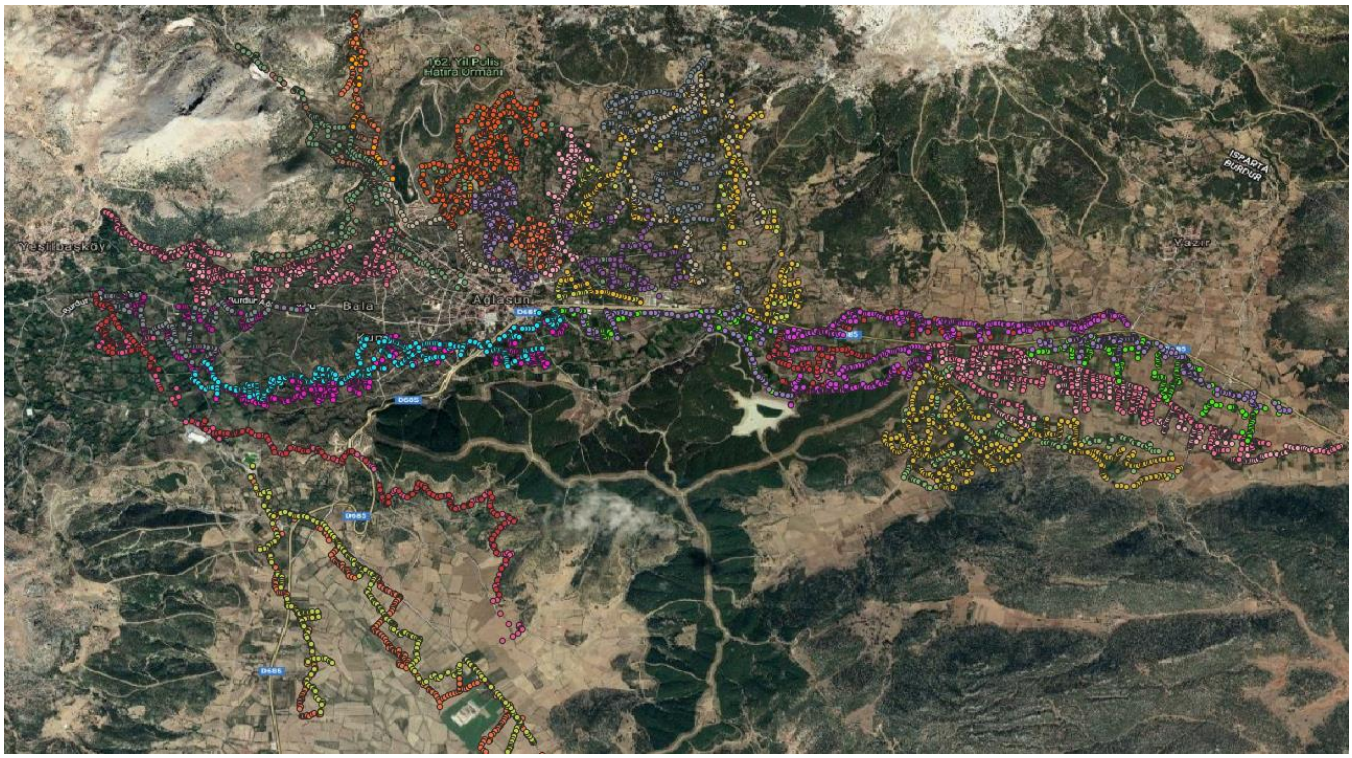
Annex 6 - The symbols Used During Collecting GPS Points for Crops and Infrastructure

CHARACTER	CROP TYPE	TYPE	MATERIAL
C	Walnut	Canal	Concrete
P		Pond	Plastic
S	Vegetable		soil
U		Underground	
Y	Clover		
D	Tomato	Drip irigaration	
W		Well (bore hole)	
F	Bean		
M	Corn		
K	Cherry		
G	Rose		
B	Wheat		
E	Apple		
T		Tab	
I		Intersection	

Canal System	
Combination	Definition
CC	Canal Concrete
CP	Canal Plastic
CS	Canal Soil
TC	Tap Concrete
TP	Tab Plastic
TS	Tab Soil
PC	Pond Concrete
PP	Pond Plastic
PS	Pond Soil
IC	Intersection Concrete
IP	Intersection Plastic
IS	Intersection soil
UC	Underground Concrete
UP	Underground Plastic
US	Underground Soil

Crop Type	
Combination	Definition
C	Walnut
Y	Clover
CY	Walnut and Clover
KY	Cherry and Clover
KS	Cheryy and Vegetable
MC	Corn and Walnuut
EY	Apple and Clover
FC	Bean and Walnut

Annex 7- The general Layout of GPS Waypoints



8. ABOUT THE AUTHOR



Adnan Mirhanoğlu was born between two rivers, the Tigris and Euphrates, known as ancient Mesopotamia. He prefers the borders of rivers to any nation-state border.

He came from a working-class family, where all of his family members worked in agriculture to ensure basic food requirements. He is also the first generation to have the opportunity to pursue education.

He received a bachelor's degree in chemical engineering. He convinced himself that the majority of problems in the world are "technical" problems and, as an engineer, he would help to solve some problems in the world. However, his life was not that linear, and he became an environmental activist and highly politicized while studying chemical engineering. Therefore, he decided not to work as a chemical engineer, and he started a master's degree in environmental sciences and worked on a socio-ecological model for sustainable groundwater governance in northern Mesopotamia. After completing his master's degree, he started working as a PhD researcher at KU Leuven. He is currently working as a researcher and lecturer at the Division of Geography and Tourism at KU Leuven, and he will start working as a postdoctoral researcher at the University of Hamburg (Germany) in January 2024.

FACULTY OF SCIENCE
DEPARTMENT OF EARTH AND ENVIRONMENNTAL SCIENCES
GEOGRAPHY AND TOURISM DIVISION
Celestijnenlaan 200E box 2409
B-3001 HEVERLEE, BELGIUM
adnanmirhanoglu@gmail.com
https://ees.kuleuven.be

