Universitat Autònoma de Barcelona

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Cover image: Salt flats on Lake Urmia, Iran. Photograph taken in October 2016 by the author.

Summary

Large-scale anthropogenic alterations of water flows through hydraulic infrastructure are the manifestation of hydro–social imaginaries of politically and socially powerful groups and often produce a profoundly unequal distribution of burdens and benefits for different social groups or regions, reflecting their social and political power. Those that are marginalized can suffer manufactured water scarcity, which disturbs the natural, economic and socio-political order of those water users, thereby severely affecting their livelihoods. It is downstream communities that are often the ones whose socio-natural environment is most affected by alterations of water flows, while also receiving the least benefits that such projects create. Informed by the field of political ecology, this thesis builds on extensive fieldwork undertaken in the Lake Urmia basin in north-western Iran to investigate the complex relationship between water and society, focusing on the various effects of the manufactured water scarcity on the disadvantaged downstream water users. First, the thesis problematizes the unequal vulnerability of the members of different ethnic minorities facing the same environmental disaster and links this with social and political power dynamics at the state level. It identifies the key elements that lead to the enhanced vulnerability of one ethnic group versus another and traces the historical dynamics of empowerment and marginalization of the two at the state level to explore the processes that led to their current differential status. It argues that the understanding of the development of unequal power relations within a society at the macro-level is key to reducing this inequality at the micro, or household, level. Second, it uses the lens of hydro-social territories to analyze the contested nature of the reconstructions of such territories, especially through the process of governmentalization, and links this with the under-researched impacts on mental health. This is done by identifying the pathways through which manufactured water scarcity leads to psychological disorders experienced by disadvantaged water users. Finally, adopting the lens of hydro-social cycle and waterscape, the thesis explores how waterscapes are produced by advancing particular narratives of meanings, values, and roles of water employed by the dominant groups, while profoundly undermining local and traditional water practices. It further suggests how the concepts of waterscape and hydro-social cycle could inform paradigms and tools currently in use in policy-making to become more inclusive and encompass the interests of all stakeholders.

Resumen

Las alteraciones antropogénicas a gran escala de los flujos de agua a través de la infraestructura hidráulica son la manifestación de los imaginarios hidrosociales de grupos política y socialmente poderosos y, a menudo, producen distribuciones profundamente desiguales de los costes y beneficios entre diferentes grupos sociales o regiones, lo que refleja el poder social y político de estos. La localización y el acceso al agua están, por lo tanto, fuertemente influenciados por las coreografías de poder entre los diferentes grupos de usuarios de la misma. Las regiones marginadas pueden sufrir una escasez artificial de agua, alterándose así el orden natural, economico y socio-politico de los usuarios y afectando gravemente a sus medios de vida. Normalmente, las comunidades situadas en el curso bajo son aquellas cuyo entorno socio-natural se ve más afectado por las alteraciones de los flujos de agua, recibiendo a su vez la menor parte de los beneficios creados por tales proyectos. Conformada por el campo de la ecología política, esta tesis se basa en un extenso trabajo de campo realizado en la cuenca del lago Urmia, en el noroeste de Irán, con el objetivo de investigar la compleja relación entre agua y sociedad. Esta tarea se lleva a cabo a través del estudio de varios de los aspectos que los efectos de la escasez artificial de agua han ocasionado en los usuarios desfavorecidos de la zona del curso bajo. En primer lugar, la tesis problematiza la desigual vulnerabilidad que los miembros de diferentes minorías étnicas experimentan al enfrentarse al mismo desastre ambiental, vinculándola a su vez con la dinámica del poder social y político a nivel estatal. Se identifican así los elementos clave que conducen a la mayor vulnerabilidad de un grupo étnico respecto a otro, rastreando la dinámica de empoderamiento y marginación de los grupos estudiados -a nivel estatal- para explorar los procesos que condujeron a su estado actual. Se argumenta también que la comprensión, a nivel macro, del desarrollo del poder desigual de diferentes grupos dentro de una sociedad es clave para reducir esta desigualdad a nivel micro (hogares). En segundo lugar, a través del enfoque de los territorios hidrosociales, la tesis analiza la controvertida naturaleza de las reconstrucciones de dichos territorios, especialmente a través del proceso de gubernamentalización. Todo ello se relaciona con los infra-investigados impactos en la salud mental a través la identificación de las vías mediante las cuales la escasez artificial de agua conduce al desarrollo de trastornos psicológicos en los usuarios desfavorecidos. Finalmente, bajo el prisma del ciclo hidrosocial y el paisaje acuático, la tesis explora la forma en que estos paisajes acuáticos son producidos y formados por los grupos dominantes a través de narrativas específicas que incluyen tanto los significados, como los valores y roles del agua, mientras que las narrativas no reconocidas deben esforzarse para obtener ese mismo reconocimiento. Adicionalmente, la tesis sugiere la forma en que los conceptos de paisaje acuático y ciclo hidrosocial podrían informar los paradigmas y herramientas actuales a fin de ampliar su inclusividad y su capacidad de incorporar los intereses de todas las partes.

Resum

Les alteracions antropogèniques a gran escala dels fluxos d'aigua a través de la infraestructura hidràulica són la manifestació dels imaginaris hidrosociales de grups políticament i social poderosos que, sovint, produeixen distribucions profundament desiguals dels costos i beneficis entre els diferents grups socials o regions, reflectint el poder social i polític d'aquests. La localització i l'accés a l'aigua estan, per tant, fortament influenciats per les coreografies de poder entre els diferents grups d'usuaris de la mateixa. Les regions marginades poden patir una escassetat artificial d'aigua, alterant així l'ordre natural, economic i socio-polític dels usuaris i afectant greument als seus mitjans de vida. Normalment, les comunitats situades en el curs baix són aquelles on l'entorn socionatural es veu més afectat per les alteracions dels fluxos d'aigua, rebent al seu torn la menor part dels beneficis creats per tals projectes. Conformada pel camp de l'ecologia política, aquesta tesi es basa en un extens treball de camp realitzat a la conca de l'estany Urmia, al nord-oest de l'Iran, amb l'objectiu d'investigar la complexa relació entre aigua i societat. Aquesta tasca es du a terme a través de l'estudi de diversos dels aspectes que els efectes de l'escassetat artificial d'aigua han ocasionat en els usuaris desfavorits de la zona del curs baix. En primer lloc, la tesi problematitza la desigual vulnerabilitat que els membres de diferents minories ètniques experimenten a l'enfrontar-se al mateix desastre ambiental, vinculant-la a la vegada amb la dinàmica del poder social i polític a nivell estatal. S'identifiquen així els elements clau que condueixen a la major vulnerabilitat d'un grup ètnic respecte a un altre, rastrejant la dinàmica d'empoderament i marginació dels grups estudiats -a nivell estatal- per explorar els processos que han conduit al seu estat actual. S'argumenta també que la comprensió, a nivell macro, del desenvolupament del poder desigual de diferents grups dins d'una societat és clau per reduir aquesta desigualtat a nivell micro (llars). En segon lloc, a través de l'enfocament dels territoris hidrosocials, la tesi analitza la controvertida naturalesa de les reconstruccions d'aquests territoris, especialment a través de el procés de governamentalització. Tot això es relaciona amb els infra-investigats impactes en la salut mental a través la identificació de les vies mitjançant les quals l'escassetat artificial d'aigua condueix al desenvolupament de trastorns psicològics en els usuaris desfavorits. Finalment, sota el prisma de l'cicle hidrosocial i el paisatge aquàtic, la tesi explora la forma en què aquests paisatges aquàtics són produïts i formats pels grups dominants a través de narratives específiques que inclouen tant els significats, com els valors i rols de l'aigua, mentre que les narratives no reconegudes s'han d'esforçar per obtenir aquest mateix reconeixement. Addicionalment, la tesi suggereix la forma en què els conceptes de paisatge aquàtic i cicle hidrosocial podrien informar els paradigmes i eines actuals per tal d'ampliar la seva inclusivitat i la seva capacitat d'incorporar els interessos de totes les parts.

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Acknowledgments

First I would like to thank my supervisor, Professor Louis Lemkow Zetterling for giving me the opportunity to do this PhD. I am grateful to him for his kind guidance, patience and advice.

Second, I am immensely grateful to Professor Filippo Menga, who kindly accepted me as a visiting student at the University of Reading. He offered me useful guidance with an incredible patience and support. I would like to thank him for his help, encouragement and for sharing his time, advice, ideas and knowledge with me.

The institutional setting at ICTA was a very stimulating and supportive place to work, and I am grateful to everyone who made my work possible.

I would like to thank the Agencia de Gestión de Ayudas Universitarias y de Investigación for funding this research.

This research would not have been possible without the interpreter, to whom I am grateful for his excellent work and enthusiasm. The dedication, compassion and empathy he showed during the interviews with the respondents contributed enormously to the quality of the interviews.

To each respondent, I am enormously grateful for sharing their time and experience with me.

I am grateful to my friends, who patiently supported me throughout the PhD, especially to Karmen, Anja, Tanja, Vijana, Tanja, Klavdija, Tanja, Boštjan, Uroš, Aljoša, David, Robin, Sarah, Jernej, Kaja, Albert and Matic. Special thanks to Olatz for making me feel at home in Barcelona, for helping me get through a series of bureaucratic and other problems I managed to accumulate, but especially for sharing the pain of writing the PhD with me while keeping me sane with a great sense of humor.

I am grateful to my family, who supported me in every possible way. Hvala mami, ati, Urška, Blaž, Jurij in Urška!

Finally, I am grateful to Sanjin, who encouraged me to take up the challenge of a PhD. I am grateful for his love, care, patience and support.

I. INTRODUCTION

Water has a fundamental role in the development of human societies and in sustaining ecosystems. Water flows and regimes influence the organization of human societies, which in turn use, manipulate and intervene in those water flows for their benefits. However, not all of the water users sharing river basins have equal levels neither in the access to water nor in the participation in decision-making on water governance, as these are greatly determined by the power asymmetries that exist between different actors (Boelens 2014; Budds 2008; Zwarteveen & Boelens 2014). Despite access to safe water and sanitation being recognized as a human right by the United Nations General Assembly in July 2010, and the United Nations Human Rights Council in September 2010, this has proven to be difficult to put into practice, mostly due to inadequate financial investments into universal water and sewerage systems by governments. Especially in the Global South, most public and private investment into water supply infrastructure have served the needs of urban populations. Capital investments by the state have thereby been directed at a privileged segment of the population, while the poorer residents of peri-urban informal settlements and rural areas have often been left to struggle with the lack of (affordable) portable water and insufficient sanitation services (Bakker 2004). Globally, 2.2 billion people still lack access to clean drinking water (WHO 2019), and 2.3 billion lack basic sanitation services (UN 2018). According to the 2020 United Nations World Water Development Report (UNESCO 2020) by the year 2050, 40% of the global population will live in conditions of severe water stress. It has been recognized that access to water is not a function of the physical availability of water, but rather of socio-political processes that create a profoundly unequal distribution of water between countries, regions and different groups of water users. In other words, the existence of a staggering number of people suffering water scarcity is not the product of natural conditions, but of failed policies (Bakker 2004; Loftus 2009; WWAP 2018; Zwarteveen & Boelens 2014). The produced water scarcity does not only alter the access to water for the disadvantaged water users, but touches various other aspects of their lives, the exploration of which is the central theme of this work.

1.1 Situating the research

The role of political power in the distribution of resources is one of the main themes of **political ecology**, an interdisciplinary field of study which has been developing since the 1970s and the 1980s as a response to the lack of a political perspective in the explanations of environmental crises (Blaikie 1985; Peet et al. 2011; Robbins 2004; Watts 1983). In the broadest terms, the field focuses on the connection between political processes and environmental change through the exploration of the causes rather than symptoms of environmental problems. Common themes in political ecology include environmental degradation and marginalization, the socio-political implications of environmental conservation and management, environmental conflicts as a response to changes in the access to resources, identities and social movements, and the production of new natures. It is also concerned with questions of power and forms of governance, and with the production and representation of knowledge of environmental problems (Peet et al. 2011; Robbins 2004). Political ecology researchers "accept the idea that costs and benefits associated with environmental change are for the most part distributed among actors unequally" (Bryant & Bailey 1997: 28–29), leading them to explore the socio-economic asymmetries deriving from environmental changes and their political implications. Access to the environment and environmental resources of different groups has been shown to be closely related to power relations (Robbins 2012), with dominant actors appropriating, accumulating and controlling resources while simultaneously dispossessing the marginalized, often local communities of the resources vital for their livelihoods.

The **political ecology of water** is a subfield within political ecology, which "seeks to politicise the understanding of the distribution of water as a first step in an emancipatory project to ensure that all are able to live in environments free from the daily injustices of stagnant, polluted water sources" (Loftus 2009: 953-954). By showing how access to water embodies the power relations in a given setting (Bakker 2004; Boelens 2014; Budds 2004; Franco et al. 2013; Loftus 2009; Swyngedouw 2005), political ecologists of water contribute to the understanding of the production of water crises, and also to the broader political ecologies of power (Loftus 2009). Water landscapes or ‘waterscapes’ (Swyngedouw 1999) are constructed and reconstructed through the use of legal, technical and discursive means, with the key actors behind those processes most often being different types of state and capital alliances that influence reforms or different interpretations of state laws and policies, with this enabling them to accumulate or pollute the targeted resources. The dominant interest groups use discursive power to gain legitimacy for their control of water resources and to stabilize the injustices in access to it. They

commonly adopt discursive framing of water issues as being the results of natural conditions and processes in order to naturalize water scarcity and underplay its anthropogenic dimensions (Boelens et al. 2016; Franco et al. 2013; Mehta 2011). By presenting water scarcity as a natural condition without considering the resource appropriation by powerful actors and the disparities in the distribution and access to it enables the advancement of the technological and economic solutions that do not address the real causes of the problem (Mehta 2011). The subsequent water management decisions are often presented as 'efficient', 'rational' and 'objective' solutions, with such discursive framing serving to seemingly depoliticize the deeply political issues of water management in order to (re)inforce or sustain the dominant political order (Boelens 2014; Boelens et al. 2016; Budds 2009). Water knowledge is thus constructed through the use of selected languages of valuation, and dominant groups often use them to advance their hydro-social imaginaries by representing water as only a physical entity valued for its economic aspects, while neglecting its cultural, spiritual and symbolic dimensions as well as disregarding the traditional and local water use practices (Linton 2014; Mehta 2011). Knowing and representing water simply as what Linton (2014) termed 'modern water', a physical entity devoid of its local and social contexts and reduced only to its hydrological dimension, has dominated water management in the past century in industrialized countries. The control over water resources was increasingly taken over from local communities by state agencies, with water management informed by natural and technical sciences, and severely lacking a regard for the social and ecological functions of water flows (Bakker 2004; Linton 2014).

During the 20th century large-scale hydraulic infrastructures such as large dams were seen as a pathway to modernity and means to economic prosperity and increased welfare. Indeed, water held a pivotal role in the modernization processes, which severely transformed waterscapes (Linton 2014; Swyngedouw 1999). Decades of research have brought to light the human and environmental costs of large-scale hydraulic projects and alterations of water flows. The indigenous and peasant communities in particular have suffered many negative socio-economic impacts resulting from hydraulic developments, due to the insufficient representation and consideration of their interests in decision-making processes. Frequently overlapping therewith, the livelihoods of downstream communities have often been overlooked in the studies prior to the enactment of large hydraulic projects, leading to the impoverishment and hardship of millions who suffer severe socio-economic impacts without receiving the economic benefits that such infrastructure generates for privileged social groups (McCully 1996; Obertries et al. 2016;

WCD 2000). The manipulations of water flows and the resulting changes to the downstream ecosystems and water supply greatly enhance the vulnerability of the downstream water users.

The concepts of **vulnerability and risk** have been important elements of political ecology since its emergence (Wescoat 2015). The political ecology view on hazards and disasters developed as a critique of the conventional hazard research (O'Keefe et al. 1976; Wisner et al. 1976) to emphasize the importance of political economy in the production of hazards and the political and structural origins of vulnerability (Collins 2008; O'Keefe et al. 1976; Robbins 2012). Vulnerability is often defined as "… the characteristics of a person or a group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard" (Wisner et al. 2004:11) and is thus defined by context-specific political-economic and socio-cultural dynamics (Ribot 2011; Ribot 2014). The political ecology approach to vulnerability focuses on social, economic and political causes that make people vulnerable to hazardous events. It recognizes and explores the differences in the vulnerability of certain groups within a society and connects these with the asymmetric power relations between those groups. The economically and politically disadvantaged groups have fewer options to cope with a disaster, with political ecology enabling the exploration of the root causes of their marginalization (Kasperson & Kasperson 2005; Oliver-Smith & Hoffman 1999).

As vulnerability is therefore inherently linked to power relations, the dynamics of vulnerability of different groups within a society are subject to change over time through the processes of empowerment and marginalization. How those processes are reflected in the vulnerability of certain groups to environmental hazards is an underexplored topic in political ecology. Chapter II of this thesis will address this gap in the literature by examining how in periods of significant political change, certain groups within a society may achieve a certain level of empowerment, while others may become more marginalized or see their political status unchanged. This impacts their degree of vulnerability and their ability to cope with and to adapt to changes in cases of environmental hazards and disasters, as will be explored through the study of ethnically diverse downstream water users suffering severe water scarcity resulting from upstream water overuse. Despite being exposed to the same slow-onset environmental disaster, the members of the two ethnicities will be shown to have different levels of access to water resources and relief mechanisms, with the politically more powerful ethnic group having more options to adapt to and to cope with the disaster due to their socio-economic advantages, and members of the politically and socially marginalized ethnic minority experiencing greater vulnerability. The

chapter links this observed difference with the different political trajectories of the two minorities at the state level which influenced their current political power. The chapter further shows that even within relatively small communities, access to water is not equally distributed between households, but is influenced by broader political power dynamics.

The findings corroborate research done by other authors which shows that access to water for different social groups is determined by social, political and economic factors rather than mere physical water availability. This by itself demonstrates that water management has profound social implications, and the very articulation of 'modern water' is inherently social (Bakker 2004; Linton 2014; Mollinga 2014). The discursive separation of society and nature is therefore used to govern society. A tradition in political ecology rejects the artificial dualistic division of nature and society and recognizes that nature and society are in fact so deeply entwined that they do not exist separately, but instead form hybrid socionatures (Castree 2005; Swyngedouw 2007). This view informed a large body of literature within the political ecology of water and is also embedded in the perspective of **waterscapes** (for review see Karpouzoglou & Vij 2017) where it combines societal and natural dimensions of water and enables the posing of central questions of political ecology such as the power relations between different water users. It challenges the dominant position of hydrology in defining and managing water, bringing into focus the socio-political aspects of water realities. Water as a 'socionature' (Swyngedouw 1999) is the product of dynamic natural as well as political processes that continuously rework it. The acknowledgement of the intertwinement of water and society has gained dominance in the past decades, with scholars recognizing that "all water problems are fundamentally social problems, and need to be addressed as such" (Linton 2014: 114). To theorize and critically analyse the hydro-social relations, complementary to the perspective of waterscapes, political ecologists advanced the concepts of **hydro-social territories** and the **hydro-social cycle**, which examine the role of politics and power relations in water issues (Bakker 2012; Boelens et al. 2016; Budds 2008; Karpouzoglou & Vij 2017; Linton and Budds 2014; Swyngedouw 2004; Swyngedouw 2009). They acknowledge the social, political, economic, spiritual, cultural, and material dimensions of water and examine how the circulation of water is embedded within wider socio-political processes.

Hydro-social territories can be defined as "spatial configurations of people, institutions, water flows, hydraulic technology and the biophysical environment that revolve around the control of water" (Boelens et al. 2016: 1). In other words, the multi-scalar hydro-social networks are

spatially bound and they are involved in the processes of the construction and reconstruction of spaces. Territories are thus not defined by nature, but are actively constructed and reconstructed through historical processes involving the interactions of society, nature and technology (for review see Boelens et al. 2016). Different groups of water users have different imaginaries regarding the use of water flows and a differential power to materialize those imaginaries. The manifestations of powerful hydraulic imaginaries redraw the hydro-social territories, affecting the physical and social environment of different water users in distinct ways. Such alterations of hydro-social territories are therefore often contested by the disadvantaged and disempowered local water users who might experience disruptions in their access to water. The dominant actors use different approaches to try to align local water users to new hydroterritorial configurations, who in turn may undertake various forms of resistance to such impositions. An examination of hydro-social networks therefore offers a chance to connect local water struggles with broader socio-political scales (Boelens et al. 2016; Hommes et al. 2016; Hoogesteger et al. 2016; Ioris 2016). Alterations of hydro-social territories interfere with the social, symbolic, cultural and spiritual dimensions of water which are diverse, context specific and deeply embedded in the everyday lives of communities with water based livelihoods (Mehta 2011). Manufactured territorialized water scarcity profoundly impacts the lives of affected water users, and while the economic, cultural and material consequences of water scarcity have received scholarly attention (e.g. Allon & Sofoulis 2006; Browne et al. 2014; Sofoulis 2005), there is a visible lack of research on the impacts of manufactured water scarcity on the mental health of water users. Chapter III of this thesis will address this gap by outlining the connection between water availability and mental health outcomes for the population suffering severe water scarcity resulting from the reconstructions of their hydro-social territory.

While the studies adopting the lens of hydro-social territories focus more on the multi-scalar hydro-social relations and the contested nature of the hydro-social territorial reforms, the complementary concept of **hydro-social cycle** pays more attention to the social construction of water and the hydro-social change. It advances the understanding of water and society as internally related socionatural hybrids that continuously make and remake each other through historical and geographical processes. It is further concerned with how particular instances of water are produced by particular assemblages of historical, political, natural and technological circumstances, and how the produced water in turn reshapes social relations (Linton 2014; Linton & Budds 2014; Swyngedouw 2009). Unpacking those processes "offers analytical insights into the social construction and production of water, the ways by which it is made

known, and the power relations that are embedded in hydro-social change" (Linton & Budds 2014: 171). Chapter IV of this thesis will adopt this lens to examine the production of the studied waterscape and the variety of meanings, roles and values that different groups of water users ascribe to water.

There has been significant progress made over the course of the past few decades in recognizing the social and political dimensions of water and including more stakeholders in water governance decision-making process, particularly with the development of the highly influential **Integrated Water Resources Management** (IWRM) paradigm in the 1990s. The main objectives of the IWRM approach are to improve economic efficiency in water use, promote equal access to water for all water users and to manage water in a sustainable way (GWP 2000; Molle et al. 2008). There are however still many difficulties in putting it into practice (Franco et al. 2013; Linton 2014) due to its vagueness about how and by whom the aims should be implemented, and also because some of its aims – such as maximizing economic efficiency and promoting social equality - may appear antagonistic (Biswas 2004; Franco et al. 2013). It nonetheless remains a dominant paradigm in water management and its goals represent an ideal for good water management. At the core of IWRM is the consideration of both environmental and social impacts of water policies and projects. However, in many IWRM approaches social impact assessment (SIA) is treated as a secondary consideration and is often inadequately conducted or its findings not sufficiently considered in the decision-making process. Chapter IV will briefly touch upon the ways that the perspectives of waterscape and hydro-social cycle could inform more comprehensive enactments of SIA, as a way to move towards meeting the goals of IWRM. Improving the application of IWRM would be instrumental in ensuring the broader goal of enabling access to water and sanitation for all (SGD 6, UNESCO 2020).

1.2 Research aims and questions

The overarching aim of this thesis is to investigate how and in which ways the alterations of water flows impact the livelihoods of the disadvantaged water users, who are not included in the decision-making process and who experience negative impacts of the hydraulic projects without receiving any of the benefits. This is done through an engagement with the literature introduced in the previous section, which situated the research in the field of study, identified the gaps that will be addressed in the empirical chapters, and connected the main themes of the thesis. As this thesis consists of three empirical chapters which have either been published as articles or

submitted for publication, there is some overlap, especially in relation to the description of the study area and methodology.

The specific aims of the thesis are:

- to examine the differential vulnerability of different groups of water users to water scarcity, and to connect those observed disparities with the wider political power dynamics at the state level
- to link produced water scarcity resulting from the reconstructions of hydro-social territories with mental health outcomes for the marginalized water users who experience the alterations in their socio-natural environment
- to explore how waterscapes are produced through the manifestation of hydro-social imaginaries advancing certain roles and values of water, while neglecting others
- to uncover the plurality of roles, meanings and values of water for communities with water-based livelihoods through the social impacts of water scarcity
- to uncover the shortages of the applications of social impact assessment of hydraulic projects by investigating the impacts on the often overlooked downstream population and to suggest avenues to make it more inclusive.

Those aims will be addressed in the following chapters of the thesis. The specific research questions of the chapters are:

- Chapter II: How do the political dynamics at the state level influence the vulnerability of the members of different ethnic minorities in cases of environmental hazards and disasters? How and through which pathways do the state-level political power relations impact the ability to cope with and adapt to natural disasters for members of different ethnic groups?

- Chapter III: How and through which pathways do the transformations of hydro-social territories impact the mental health of the disadvantaged populations who experience produced water scarcity?

- Chapter IV.: How does the perception of roles and values of water change over time and differ between various groups of water users? What are the social impacts of the advancement of dominant hydro-social imaginaries on the disadvantaged downstream water users suffering produced water scarcity? How can the perspectives of the hydro-

social cycle and waterscapes inform a more comprehensive process of social impact assessment for hydraulic projects?

1.2.1 Outline of the thesis

Table 1: Outline of the thesis

Chapter	Research questions	Theoretical background		Methodology	Output
		Field of study	Concepts		
II.	How do the political dynamics at the state level influence the vulnerability of the members of different ethnic minorities in cases of environmental hazards and disasters? How and through which pathways do the state-level political power relations impact the ability to cope with and adapt to natural disasters for members of different ethnic groups?	Political ecology: political ecology of hazard and vulnerability	Vulnerability, adaptive capacity, social sensitivity	63 in-depth interviews conducted with small farmers from ethnically mixed villages (26 Kurdish and 37 Azeri)	Ženko M. and Uležić S. 2019. The unequal vulnerability of Kurdish and Azeri minorities in the case of the degradation of Lake Urmia, Iran. *Journal of Political Ecology* 26(1): 167-183.
III.	How and through which pathways do the transformations of hydro-social territories impact the mental health of the disadvantaged populations who experience produced water scarcity?	Political ecology: political ecology of water	Hydro-social territories, waterscapes	96 in depth interviews with farmers	Ženko M. and Menga F. 2019. Linking Water Scarcity to Mental Health: Hydro–Social Interruptions in the Lake Urmia Basin, Iran. *Water* 11: 1092.
IV.	How are waterscapes produced? What are the social impacts of the hydro-social transformations on the disadvantaged downstream water users? How can the perspectives of the hydro-social cycle and waterscapes inform a more comprehensive process of social impact assessment for hydraulic projects?	Political ecology: political ecology of water	Hydro-social cycle, waterscapes	96 in depth interviews with farmers	Article submitted for review to Society & Natural Resources

1.3 Research design and methods

The research questions were operationalized during the fieldwork phase in the selected geographical area through the use of a commonly adopted political ecology methodology with

an emphasis on ethnographic methods. This section provides the description of the contextual setting for the research undertaken in the writing of this thesis, and the methodology adopted.

1.3.1 Study area: Lake Urmia waterscape

The fieldwork was undertaken in villages in close proximity to Lake Urmia in Iran. The lake is located in the North-West of the country (Figure 1) at an altitude of 1275 meters above sea level and used to be one of the largest hypersaline endorheic lakes in the world (Ghaheri et al. 1999) and the largest lake in the Middle East (Abbaspour & Nazaridoust 2007). The surface area of the lake covered between 4750 km^2 and 6100 km^2 (Azari Takami 1987) with a maximum reported depth of 16 meters (Abazopoulos et al. 2006). The main water sources for the lake are the supplying rivers and to a smaller extent direct rainfall and groundwater springs (Hashemi, 2012). The catchment area of Lake Urmia is divided between the provinces of West Azerbaijan, East Azerbaijan and Kurdistan. The basin covers an area of 51,440 km^2 (Ghaheri et al. 1999) and contains 17 permanent rivers and 12 seasonal rivers that flow into the lake. While the basin covers 3% of the area of Iran, it contains 7% of the total available freshwater resources (Hashemi 2012). The climate is semi-arid with seasonal variation of temperatures between 0 and -20 degrees Celsius in the winter and up to 40 degrees Celsius in the summer (Ghaheri et al. 1999).

Over the course of the past two decades the surface area of the lake has been decreasing significantly (AghaKouchak et al. 2015; Garousi et al. 2013; Ghale et al. 2018; Emanifar & Mohebbi 2007; Shadkam et al. 2016; Shokoohi & Morovati 2015; Tisseuil et al. 2013). According to Tisseuil et al. (2013) the area of the lake has shrunk from 5650 km^2 in 1998 to 2005 km^2 in 2010, while a study by AghaKouchak et al. (2015) reported that the surface area of the lake has decreased by 88% since 1972. The water level has decreased by 7 meters (Garousi et al. 2013; Shadkam et al. 2016) which combined with 7 meters of salt deposits on the lakebed to reduce the maximum depth of the lake from 16 meters in 1995 to only 2 meters in 2015 (Shadkam et al. 2016). 250.000 ha of the surface of the lake have turned to salt marsh, with most of the changes occurring in the southern and eastern part of the lake (Tisseuli et al. 2013).

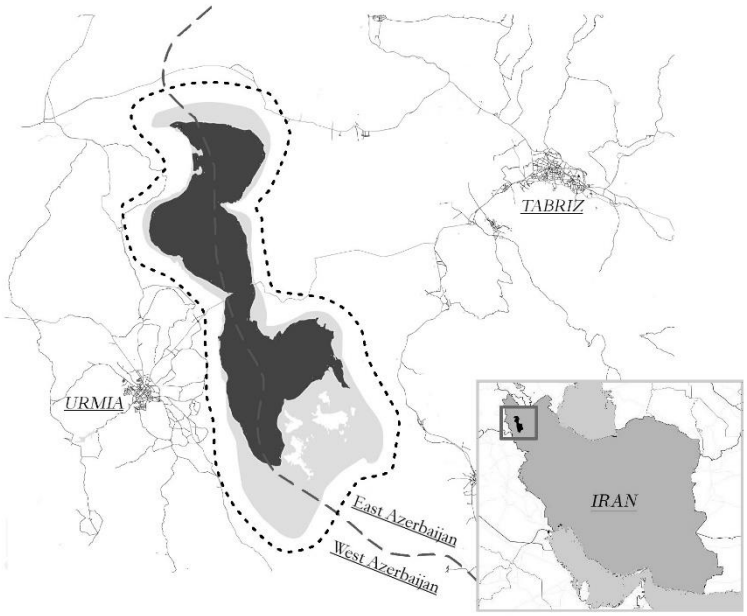

Figure 1: The location of the study site.

The dashed line running north to south across the lake denotes the border between the provinces of East and West Azerbaijan and the dotted line around the lake outline represents the area within which the fieldwork was undertaken. The precise location of the fieldwork sites is not given to maximise the anonymity of the respondents. The light grey outline represents the boundary of the lake in 2000 and the dark gray the surface of the lake in September 2018.

Several causes for this drastic reduction in the surface area of the lake have been reported, including the overuse of surface water mainly for irrigation purposes, the construction of dams on the supplying rivers and other hydraulic infrastructures in the upstream regions (Abbaspour & Nazaridoust 2007; AghaKouchak et al. 2015; Hassanzadeh et al. 2012; Hoseinpour et al. 2010), climatic changes with frequent droughts (Alipour 2006; Delju et al. 2013; Shadkam et al. 2016), and the construction of a causeway that divides the lake into two parts with an insufficient flow of water from one part to the other (Eimanifar & Mohebbi 2007; Zarghami 2011; Zarrineh & Abad 2014). The main pressures on freshwater resources in the basin are the intensive and unsustainable agricultural development (AghaKouchak et al. 2015; Madani 2014; Zarghami 2011) and population growth with rapid urbanization (Madani 2014). While there is conflicting information about the level of impact of the anthropogenic and climatic factors on the degradation of the lake, with the former frequently downplayed by governmental bodies (AghaKouchak et al. 2015; Hassanzadeh et al. 2012; Nabavi et al. 2016; Shadkam et al. 2016), multiple researchers agree that the main reason for the declining surface of the lake is the

overexploitation of surface water (AghaKouchak et al. 2015; Ghale et al. 2018; Hassanzadeh et al. 2012; Tisseuli et al. 2013). Indeed, Hassanzadeh et al. (2012) estimate that the overuse of surface water in combination with climate change is responsible for 65% of the effect, the four largest dams on inflowing rivers being responsible for 25% of the effect, and a decrease in precipitation having a 10% share on the decreasing surface of the lake. A recent study by Ghale et al. (2018) gives the anthropogenic impacts 80% of the weight for the drying of Lake Urmia, and 20% to climatic factors. Another study by Khazaei et al. (2019) shows that the dominant human driver of the desiccation of Lake Urmia is the expansion of irrigation in the basin. This is in sharp contrast to the position of Ministry of Energy, which attributes 67% of the degradation of the lake to climatic factors, 27% to other hydraulic developments and only 5% to dams (Hashemi 2012).

The agricultural demand for water represents the largest pressure on water resources (Khazeri et al. 2019) and the area of the irrigated agricultural land in the basin has been sharply increasing in the past decades (Hassanzadeh et al. 2012; Hesami & Amini 2016; Shadkam et al, 2016; Shokoohi & Morovati 2015). The irrigation efficiency in the Lake Urmia basin is low (Hashemi 2012; Hassanzadeh et al. 2012) and agriculture is based on the cultivation of water-intensive crops which reach high market values (AghaKouchak et al. 2015). There are currently 56 dams in operation in the Lake Urmia basin (Ghale et al. 2018) along with other water diversion projects on the supplying rivers (Garousi et al. 2013; Hoseinpour et al. 2010). Additionally, the largely unregulated overexploitation of groundwater in the basin lowers the amount of water reaching the lake (Garousi et al. 2013; Eamen & Dariane 2013; Hashemi 2012; Shokoohi & Morovati 2015; Zarrineh & Abad 2014).

The shrinking of the lake has had severe socio-environmental impacts. Due to the retreat of the water, vast areas of salt covered flats have been exposed to wind erosion, with wind carrying salt particles mixed with chemicals deposited on the lakebed to the surrounding areas (Hassanzadeh et al. 2012; Hoseinpour et al. 2010). The resulting salt storms have negative impacts on vegetation, soil fertility, and pose a risk to agriculture in the area causing economic losses in the region (Hosseinzadeh et al. 2012; Madani 2014; Tisseuil et al. 2013), which is expected to lead to emigration from the rural areas (Delju et al. 2013; Hesami & Amini 2016; Hosseinzadeh et al. 2012). Although several scholars have mentioned potential health impacts of the salt storms that include respiratory and eye diseases, as well as increased rates of various types of cancer (Ghalibaf & Moussavi 2014; Hesami & Amini 2016; Hoseinpour et al. 2010; Hosseinzadeh et

al. 2012), no comprehensive study of the health impacts caused by the degradation of the lake has yet been conducted.

In order to save Lake Urmia from drying the authorities have taken multiple actions. In 2010 the Integrated Management Programme for Lake Urmia Basin, prepared by the Department of Environment (DoE) in cooperation with United Nations Development Programme, and a Drought Risk Management Plan were approved by the government (ITRTDW 2014). The main aims of the Integrated Management Programme are to reduce the agricultural water demand and to secure the minimum ecological water requirement for Lake Urmia (Zarrineh & Abad 2014). In 2013 the National Committee for Saving Lake Urmia and the Regional Management Council for the management of Lake Urmia were founded (ITRTDW 2014) and the Urmia Lake Restoration Programme established. The Ministry of Energy (MoE) coordinated the execution of the program and several projects were launched aimed at securing the water requirements for Lake Urmia, raising public awareness of the problem, and encouraging public participation in the conservation of the lake, as well as promoting sustainable agriculture practices and water use. Among other actions, it was agreed that no new dam construction projects would be allowed and those in early construction phases would be stopped (ULRP 2015). In 2014 the Japanese government dedicated funds to the United Nations Development Programme Iran to contribute to the restoration of Lake Urmia by engaging local communities and introducing sustainable agriculture practices and reducing water consumption in the Lake Urmia basin. However, despite the efforts and implementation of more than 88 governmental and non-governmental projects aimed at saving Lake Urmia (ULRP 2015), the effects of the action seem to be inadequate. In spite of the decision that no new water development projects, including dams and irrigation project would be allowed, new development projects continue to be implemented and agricultural lands are still expanding in the Lake Urmia basin (ITRTDW 2014), preventing a successful restoration of the lake.

1.3.2 Community attributes

The population of the Lake Urmia basin was 6.7 million in 2010 and is expected to increase, with the majority of the people living in urban areas (Ghale et al. 2018). The largest city is Tabriz, located in East Azerbaijan, with a rapidly growing population of currently 1.6 million people. There has been a 500% increase in urban land use in the Lake Urmia ecological zone between the years 1990 and 2000. Securing the increasing urban demand for water is creating conflicts between the provinces, as urban water needs are often met through inter-provincial

water trading from rural areas, deepening the rural-urban inequality in access to water (Hashemi 2012).

The main ethnic groups in the basin are the Azeris and the Kurds, with smaller numbers of Assyrian Christians and Armenians. While the Azeris follow Shia Islam, the official religion of the Islamic Republic of Iran, there are followers of both Sunni and Shia Islam among the Kurdish population. As will be discussed in the second chapter of the thesis, different minorities have different levels of social and political power in Iran and there are significant disparities in the development as well as access to resources between the Kurdish and Azeri populated areas. Additionally, there is unequal power distribution between the provinces sharing the Lake Urmia basin, with Kurdistan being the least developed and most dependent on agriculture. The ethnic and religious heterogeneity as well as power disparities between the provinces create divergent interests and understandings regarding water resources planning (Hashemi 2012) in the Lake Urmia basin.

1.3.3 Methodology

The research for this thesis is based on data gathered from 96 in-depth interviews conducted with small farmers living and working in 21 villages and settlements with a maximum distance of 10 kilometers from the Lake Urmia lakebed. Additionally, three interviews with officials and experts were conducted. The interviews were carried out between June 2016 and August 2017 with the help of a local interpreter fluent in English and multiple local languages. The initial villages were selected by a combination of demographic data and mapping. The respondents were approached and explained the nature and purpose of the research and asked if they would be willing to participate. They were interviewed mostly individually but depending on their preference sometimes in groups of no more than four, with the latter primarily in cases when female members of households felt more comfortable being interviewed together with other family members, or when farmers were approached when working in the same field. Sometimes during an interview, the respondents would invite another person to participate and provide additional information on a discussed subject. Due to potential political sensitivity of the provided information all participants were guaranteed anonymity. Ethical considerations in conducting fieldwork as described by Wood (2006) were followed and oral informed consent was acquired before proceeding to interview the respondents. The participants were made known that they can refuse further participation at any point during the interview. To avoid posing a risk to participants no recording devices or cameras were used, but instead extensive notes were

taken in a third language in order to secure the data; however, no names of the respondents nor exact locations of the selected villages were noted. In addition, a detailed and extensive fieldwork diary was kept.

The questions that were posed to the respondents were semi-structured and open-ended, aimed at understanding how the degradation of the lake influenced their everyday lives. When respondents spontaneously mentioned additional topics they were encouraged to elaborate on them. (1) The first group of questions was focused on information about the farm size, number of family members living on the farm, irrigation and land use practices, number of livestock and sources of income. (2) The second group of questions was aimed at understanding whether the farm has experienced any consequences from the degradation of Lake Urmia in the approximate time frame of 10 years, such as changes in the water supply, salt and sand storms and changes in the quality of water and soil. If so, they were asked what changes they observed and how it impacted their irrigation and land use practices, their income, workload, their health, including mental health, their access to health care services, and access to drinking water and sanitation. They were also asked about the potential changes in the social relations at the household or community level. (3) The third group of questions was aimed at understanding whether the respondents were aware of or were included in any governmental or non-governmental projects aimed at mitigating the impacts of water shortage on local farmers.

When returning from fieldwork all interviews were typed, coded and analysed using Atlas.ti software (7.5.18, Scientific Software Development GmbH, Berlin, Germany). During the coding process, other discussed topics emerged which were not initially included in the groups of questions noted above, but were frequently brought up by the respondents. Those included the speculations about the causes of water scarcity and the degradation of the lake, historical information about the area, and the opinions about the government and governmental actions in relation to environmental policies and service provision.

The gender structure of respondents was as follows: 29 (30%) were female and 67 (70%) were male. This discrepancy is due to the cultural constrains resulting in female respondents often wishing to be interviewed together with male family members. Additionally, the majority of the farmers approached while working in the fields were male and male members of the households were most often consulted for providing information about the size of agricultural land,

workload, and financial situation, especially in terms of expenditures and the selling prices of crops.

I recognize that the lack of gender perspective is one of the shortcomings of the research. It has been acknowledged in several studies that different genders might be differently affected by the socio-economic impacts of water scarcity (McCully 1996; WCD 2000). While the initial intent of the research was to include the gender perspective, it sadly could not be done due to the above described constrains.

The age of the respondents was between 16 and 90. The table of the age distribution of the respondents in provided in Table 2 (Chapter III).

Additionally, three expert interviews were conducted, comprising of two officials from governmental organizations and one university researcher. To avoid posing risk to them, their identities are not provided.

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Photograph of Lake Urmia taken by the author, October 2016.

CHAPTER II: The unequal vulnerability of Kurdish and Azeri minorities in the case of the degradation of Lake Urmia, Iran

Abstract

This article explores the differences between the vulnerability of two ethnic minorities faced with the same environmental disaster, along with the causes of those disparities. Set in the context of the degradation of Lake Urmia in north-western Iran, the study problematizes the unequal access to political power of the Kurdish and Azeri minorities and the historical dynamics of marginalization and empowerment. It links those dynamics with the current differential vulnerability of the members of the two minorities living in proximity of the lake, who have traditionally been dependent on agriculture as a means of subsistence. The degradation of the lake has severely affected the agricultural production in the region through the salinization of irrigation water and the degradation of arable land. The study focuses on households in the proximity of the lake with the goal of exploring to what extent their ethnicity determines their vulnerability and adaptive capacity in the face of the disaster. We find that ethnic politics plays a role in the access to irrigation water and the potential for income diversification, as well as being a component of the coping capacity embedded in social networks. Additionally, we find that ethnicity is a determinant of the availability of economic resources, and strongly influences the knowledge of – and willingness to participate in – governmental and non-governmental projects to mitigate the effects of the environmental disaster.

Key words: vulnerability, ethnicity, Iran, political power, minorities, environmental degradation, Lake Urmia

1. Introduction

With environmental disasters becoming more frequent at a global scale, understanding people's vulnerability to them is becoming critical for their mitigation (IPCC 2012). In hazards and disaster literature, vulnerability is used to explain the susceptibility of a person or a group affected by a hazard. However, not all individuals and groups are equally affected by the same hazard, as people's vulnerability is greatly determined by social relations, discrimination, inequality and their access to resources (Birkmann & Wisner 2006). In turn, the vulnerability of people in the face of a hazard reflects their spatial, social, economic and political marginalization within society (Gaillard 2010; Lewis 1999; Wisner et al. 2004). Ethnic minorities are frequently among the most vulnerable groups (Clark et al. 2005; Cutter et al. 2009; Elliott & Pais 2006; Peacock et al. 1997) due to structural discrimination, which leads to their economic and geographical marginalization (Bolin & Kurtz 2018; Cutter et al. 2009; Fothergill et al. 1999). Cultural barriers (Cutter et al. 2003), as well as inadequate representation of their interests in environmental decision-making also increase their vulnerability (Dash 2013).

The dynamics of selective marginalization or empowerment of certain groups within a society over time, along with the reflection of these changes to the vulnerability of those groups to environmental hazards, are relatively underexplored topics in political ecology. Adopting analytical frameworks with a sufficient temporal scope enables the exploration of variations of political power in periods of significant political transitions, such as those following 'regime change'. This article does so by arguing that the nature of the marginalization of entities can vary over time, and in periods of significant political change a certain empowerment may be achieved. To justify this, we explore national-level political change and link the selective empowerment of one minority versus others to variance in their disaster exposure and coping. A case in Iran involves one ethnic minority, the Azeri, transitioning from a state of marginalization to a high level of representation in the political and economic elite, with this empowerment driven by alliance-building during the Islamic revolution of 1979 (Alamdari 2005). The large-scale change driving this empowerment was centered on the rapid modernization and urbanization of Iranian society, and this simultaneously structured the further marginalization of other ethnic minorities,

including the Kurds. The diverging trajectories of the two ethnic minorities under consideration are most evident in those geographic areas where the two minorities cohabit. Here, the continuously marginalized ethnic minority gains a new actor with which its members compete or are in conflict. This cleavage between ethnic minorities, with one emerging as part of the Iranian political and social elite, becomes latent in the post-revolutionary period and is central in influencing the characteristics and effectiveness of coping strategies and the degree of vulnerability when these two ethnic communities face a large-scale environmental disaster. This disaster is the degradation of Lake Urmia in north-western Iran, exacerbated by economic and social changes in the post-revolutionary period.

The article explores the effects of the degradation of the lake on communities living in its proximity. Over the course of several decades the rapid degradation of the lake, caused by a combination of environmental and human factors, created one of the largest environmental disasters in Iran, producing threatening consequences for the population in the lake basin. This population is predominantly ethnic Azeri, who regard Lake Urmia as a symbol of their identity (Mirchi et al. 2015), with the Kurds populating the area around the lake in smaller numbers.

Our primary objective is to contribute to the political ecology of vulnerability. This is done by examining the dynamics and consequences of selective empowerment of a given minority over time and by linking these changes to the varying vulnerability to environmental disasters of this minority on a household level, and to one that remained marginalized. Tracing the historical development and dynamics of marginalization and empowerment of certain groups, and recognizing the root causes of their enhanced vulnerability, can provide a more detailed understanding of marginalization and illuminate the possible political and structural interventions needed to decrease the levels of their inequality. As this study shows, significant power disparities can be observed between different minority groups, and the empowerment of one at a given time can enhance the vulnerability and diminish the adaptive capacity of the other. This article also contributes to the literature on the status of ethnic minorities in contemporary Iran, which is dominated by national-level studies (Koohi-Kamali 2003; Romano 2006: 222-247; Yildiz & Taysi 2007). The example of the manifestation of the political and social exclusion of the Kurdish minority on an individual or household level is a significant expansion of this field of research.

The second section presents the theoretical framework that informs the study. Specific developments within ethnic politics and political power in Iran are discussed in the third section, which outlines the diverging development of political power attainment between the Kurdish and Azeri ethnic minorities. The region is then contextualized, outlining the degradation of Lake Urmia and its effects. The penultimate section presents the results of the study, differentiated by observed sensitivity and adaptive elements, before concluding.

2. Vulnerability, marginalization and empowerment

In hazards and disaster literature, vulnerability is a broad theoretical approach that investigates environmental hazards in connection with social, political, and economic inequalities (Bolin & Kurtz 2018). Though there is no one definition of vulnerability, since it varies with topic and approach (Birkmann 2006; Cutter et al. 2008; Fuchs et al. 2011) a widely accepted one is that by Wisner et al. (2004: 11) who define vulnerability as "…the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard." Vulnerability is therefore a predisposition of a subject or a system to be affected by a hazard (Cardona 2003). Political ecology offers opportunities to critically examine the differences in vulnerability of certain groups within a society. Vulnerability is linked to economic and political marginalization, with this approach focusing on marginalized groups with the aim of investigating the causes and sources of their marginalization (Kasperson & Kasperson 2005; Oliver-Smith & Hoffman 1999). Vulnerability is generated by processes and social conditions that are subject to change over time. Political, demographic, and economic processes may create power asymmetries among different groups within a society impacting their vulnerability (Wisner et al. 2004).

The social vulnerability paradigm focuses on socioeconomic and demographic attributes that make some people more vulnerable to natural hazards (Cutter et al. 2009). Social vulnerability to natural events is driven by social inequality (Phillips & Fordham 2010) and is pre-existing to a natural hazard (Cutter et al. 2003). Cutter et al. (2009: 20) define it as "…those characteristics of the population that influence the capacity of the community to prepare for, respond to, and recover from hazards and disasters." It is often described using personal characteristics such as age, gender, health, income, ethnicity, employment and race. According to Fordham et al. (2013: 17) "…social vulnerability reflects the stratified conditions in which people compete for scarce, limited resources to mitigate against, respond to, and recover from disasters." Some of the factors affecting social vulnerability are a lack of access to resources, reduced political power and lower

political representation, limited social capital, and an underdeveloped infrastructure (Adger 2006; Cutter et al. 2003). Such characteristics have been observed among ethnic minorities, as have a reduced access to social services, higher unemployment rates, and lower social and financial capital to cope with disasters, all of which make them more vulnerable to hazard events (Bolin & Kurtz 2018). Indeed, ethnicity is a commonly noted factor that influences vulnerability (Cutter et al. 2003; Wisner et al. 2004), as has been observed in many studies of disasters (eg. Clark et al. 2005; Elliott & Pais 2006; Masozera et al. 2007; Peacock et al. 1997). According to Dash (2013) "…ethnicity is based on a shared culture such as language, religion, or common norms and practices." The interests of ethnic minorities are often poorly considered in environmental decision-making and policies, with environmental racism manifesting as unequal exposures to environmental hazards, health hazards, and access to health care. When analyzing ethnicity within African states, Raleigh (2010: 69) notes that groups can be characterized by their 'relevance' for national-level politics or their exclusion from that level, with consequent impacts on economic marginalization or inclusion. Sowers (2007: 37) explores the Egyptian government's curtailment of minority conservation efforts, noting that marginalized communities were even compelled to defend their own efforts against the state, regardless of any benefits for the community. Increased social vulnerability of minority groups to environmental hazards is therefore not a result of being a minority, but results from unequal social conditions created by discriminatory structures that politically and socially marginalize them (Dash 2013).

Widely contested as a concept, political power stands at the center of discussions on minority marginalization. We consider power as "…based on privileged access to valued social resources" (Van Dijk 1995: 85). Following this, a nuanced examination of the underlying mechanisms of power politics is proposed, which sees the issue of access to political power as being at the center of minority political endeavors. Indeed, access is defined by exclusionary mechanisms, intimately tied to resources based among others on relations of "…production, gender, ethnicity, status and age" (Blaikie et al. 1994: 48). With systemic exclusion defining structured ethnic inequality, access becomes the key factor in determining power, with two processes to be addressed: first, the way that this access was achieved or constructed, and second, the way that power is maintained or reproduced, primarily though organized and institutionalized means (Van Dijk 1995: 85). If in turn challenges of power are not effectively organized, they can only take the form of decentralized and smaller-scale contestations which leave the 'weaker' of the minorities still prone to vulnerability (O'Riordan & Timmerman 2001). Additionally, in contexts of centralized power where resource management policies are distant from those affected by

them, an 'environmental alienation' can emerge, leading to conflict and crisis (Johnson 2003: 82).

The marginalization of a given group may be altered. 'Empowerment' is the process of an individual or group gaining or developing the capacity to alter their surroundings or the broader society in which they are embedded (Beteille 1999; Cooke 2002). Crucially, empowerment can occur where change is large-scale, when newfound political regimes develop altered alliances and new institutional arrangements emerge that affect the balance of power. Decolonization, state fragmentation, and revolutions all represent contexts where such change can occur (Cavanagh 2018). But new power dynamics can subsequently be wielded by newfound elites to produce novel marginalizations. In their study of water reforms in Zimbabwe, Derman and Ferguson identify the social consequences of political elites claiming to reinforce empowerment. While their reforms were intended to "…increase racial equity by providing black communal area farmers with greater access to water resources", the outcome was the exclusion of the 'white population', political opponents, and "…almost anyone who disagreed with the [ruling party's] program for reelection" (Derman & Ferguson 2003: 285). This shows how political processes can be empowering for one section of society, disempowering for another, and *maintaining* the marginalization of a third. Such processes represent trajectories of 'selective empowerment.' We present the Iranian experience with selective empowerment in the following section.

3. Iranian ethnic politics in transition

As the focus of this article is on the changing nature of marginalization that brought about the current state of affairs in the country, we need to examine the transition that occurred from the political era that preceded it. The pre-revolutionary period in Iran is characterized by the dominance of the Pahlavi dynasty in two continuous periods, between 1925 and 1941, and between 1941 and the 1979 revolution. Characterized by absolute monarchism, the Pahlavi era produced significant levels of marginalization of ethnic groups not seen as representing the political base of the monarch, namely Persians. This Persian-centrism became the dominant ideological footing for the new regime, with ethnocentric policies informing the expansion of bureaucratic rule that was part of modernization drives instituted by the Shah (Grebenikov 2013). While at least one of the minorities, the Azeri, managed to achieve some level of elite integration driven primarily by their commercial endeavors (Atabaki 2005), the Persian-centric policies meant that cultural freedoms such as linguistic rights were an important marginalizing factor that

affected all ethnic minorities. This would become an important mobilizing element in the period leading up to the 1979 revolution (Kurzman 1996).

Iranian ethnic minorities are inhabitants of areas destined for peripheral status by their geographic characteristics and remoteness from historically established political and economic centers in Iran (Malm & Esmailian 2007). This trajectory of isolation is characterized by an indiscriminate marginalization of the population of these areas, most evident in the economic modernization that took hold in Iran in the 20th century. Two stages of this modernization can be identified, with one taking place before the Islamic revolution and the other following it (Adhajanian 1983; Madani 2014). While they occur under two different regimes, and within largely different contexts of the international placement of the Iranian economy, their common trait is the political centralization in the provinces populated mostly by ethnic Persians (Elling 2013: 54). The uneven geographic and ethnic distribution of projects that followed this led to large-scale industry being almost completely absent from areas populated predominantly by ethnic minorities, including those focused on in this article. Contemporary industrialization occurred in agriculture as well, but again following the centralized logic described above. Furthermore, contemporary investment continued in relatively developed regions which were seen to have a higher potential for profit because of prior investment in infrastructure and the 'modernization' linked to it (Malm & Esmailian 2007). These accumulated effects produced different paths to prosperity for the ethnic minority-dominated peripheral areas and the combined geographic, political, and economic center.

The 1979 Islamic revolution brought about diverging trajectories of inclusion into the Iranian political elite for the marginalized groups discussed above. Indeed, while one ethnic minority would achieve empowerment the other would undertake an attempt to do so, but ultimately fail. The revolution granted opportunities for different interest groups, thus motivating their support. The Kurdish and Azeri minorities both attempted to institutionalize their stated national programs (Bill 1982; Shaffer 2000). Separate from the combined effort of the revolutionary elites, the Kurds achieved autonomous territorial control of the north-western part of the country (Yildiz & Taysi 2007). A subsequent negotiation between the Kurdish Democratic Party of Iran and the new government failed to address the particular demands of the Kurds, since their desires for more autonomy were deemed incompatible with Islamic jurisprudence (*ibid.*). An open and violent conflict followed, further deteriorating relations between Kurds and the new Islamic political elites. The Iran-Iraq war was highly destructive to Kurdish areas (Saleh 2013: 69). After

the conclusion of the conflict and the death of Imam Khomeini in 1989, the militarized Kurdish areas slowly became normalized with inclusive governmental control returning, albeit largely following the same developmental exclusionism that had existed throughout the pre-revolutionary period.

A decidedly different relationship developed between the Azeri population and the regime. The Azeri are often considered as being politically the most powerful ethnic minority in Iran. This is in part due to a markedly different allegiance to the Islamic revolutionary regime, in particular, one characterized by an absence of dissent during the Iran-Iraq war (Saleh 2013). Other factors include: a shared religion with the state's Persian majority, namely Shi'i Islam; a larger population compared to the other minorities, thus representing a significant political bloc of up to 30% of the Iranian population (Elling 2013); and being the ethnic ingroup for large segments of the Islamic clerical and economic elites, including the current Supreme leader Khamenei. With Iranian society traditionally characterized by informal politics (Bill 1973; Samii 2006), such relations develop easily, and feature highly resilient informal networks of influence (Shaffer 2000). Furthermore, with the Azeri achieving significant positions in Iranian society, again driven by their favorable relationship with the regime and the Persian majority, the desire emerged to "address past injustices and gaps and to raise the issue of Iran's treatment of sub-state groups" (*ibid.*). When linked to power struggles between the minorities at the regional and local level, ingroup favoritism is an important predictive factor for determining political power. There has been growing regionalism in Iran since the enactment of local self-governance reforms in the late 1990s and early 2000s, which has indeed resulted in attempts of gaining resources for underdeveloped provinces populated in large part by ethnic minorities. However, the internal distribution of these resources is still favorable to only a sub-section of the population.

The meso- and micro-level manifestation of ethnic politics is a severely under-developed area of research in Iran, especially among Kurdish groups inside the country. We turn to the micro-dynamics of political power at the individual or household level, and the enactment of what Rosino (2016: 942) understands as 'boundaries', which "restrict groups from benefiting from the state via the construction of categories and the distribution of resources and penalties according to those categories." These boundaries are frequently reproduced at the micro and meso levels, with divided communities frequently the sites of 'localized social practices' (*ibid.*), which reproduce boundaries as extensions of political power.

Writing of the Iranian context, Wellman (2017: 513) problematizes kinship, religion, and nation-making in the reproduction of political structures and allegiances. Intermediaries in networks of power, such as village officials, maintain relations with the community and local political elites (Wellman 2017: 506). These meso-level power players develop and nurture ties with provincial-level governmental offices, with those ties facilitating the acquisition of "government funds and other assistance for village projects" (Hoogland 2009: 39). In turn, ingroup favoritism or informal politics determine not only the success of the resource-gathering campaigns but also the subsequent meso-level distribution of resources. With the Kurdish population economically more deprived in most contexts in Iran (Saleh 2013; Yildiz & Taysi 2007), we feel that Hoogland's finding (2009) that the socio-economic status of households correlates with their success in taking advantage of developmental programs instituted after the 1979 revolution should be read for its ethno-political implications. Furthermore, the Kurdish position in the labor market and their access to economic opportunities needs to be considered, also for its influence on household-level adaptive strategies (Cutter et al. 2009; Fothergill & Peek 2004). Ethnic discrimination in labor markets and other areas are extensions of the structural determinants of political power or the broader exclusion of non-Shi'i Iranians (Saleh 2013; Tohidi 2009: 302).

4. Methods

In this study a qualitative approach was used to explore experiences and coping with a slow-onset disaster. The goal of measuring and defining vulnerability is to reduce it (Green 2004) and qualitative methods are valuable in local and community scale vulnerability assessments (Birkmann 2006). They can provide additional and deepened information about peoples' perceptions (Fuchs et al. 2011; Massmann & Wehrhahn 2014) of their geographical and social environment as well as vulnerability to hazards, and their coping strategies (Wisner 2006). Local knowledge can help understand local risk. Participatory vulnerability assessments give voice to people directly affected by hazards as well as the power to address risk (IFRC 2006; Thomas et al. 2013).

In-depth semi-structured open-ended interviews were conducted with the help of an interpreter during ethnographic field work in villages and settlements around Lake Urmia between June 2016 and August 2017. Some 63 farmers were interviewed, of which 26 were Kurdish and 37 Azeri, living in areas with a mixed Azeri and Kurdish population. The main objectives were to explore the livelihood strategies of farmers affected by the degradation of Lake Urmia, the underlying factors that impacted their vulnerability to the degradation of the lake, and any coping

mechanisms that farm families employed. Only villages and settlements around the lake with a mixed population were selected, so that the physical conditions were the same for both ethnicities. Farmers were approached and the study was explained, with all agreeing to be interviewed. Additional interviews were conducted with officials from governmental and non-governmental institutions connected with the conservation of Lake Urmia. All interviews were analyzed using ATLAS.TI software. While the interviews are not generalizable to a broader population, they provide detail and insight into issues and themes for further vulnerability assessment (Thomas et al. 2013).

5. The context: Lake Urmia

Lake Urmia is located in north-western Iran (Figure 1) and is one of the largest hypersaline endorheic lakes in the world (Ghaheri et al.1999), and the largest lake in the Middle East (Abbaspour & Nazaridoust 2007). The Lake Urmia basin is divided between the provinces of West Azerbaijan, East Azerbaijan and Kurdistan. It comprises 3% of Iran's surface area and holds 7% of the total available freshwater resources (Hashemi 2012).

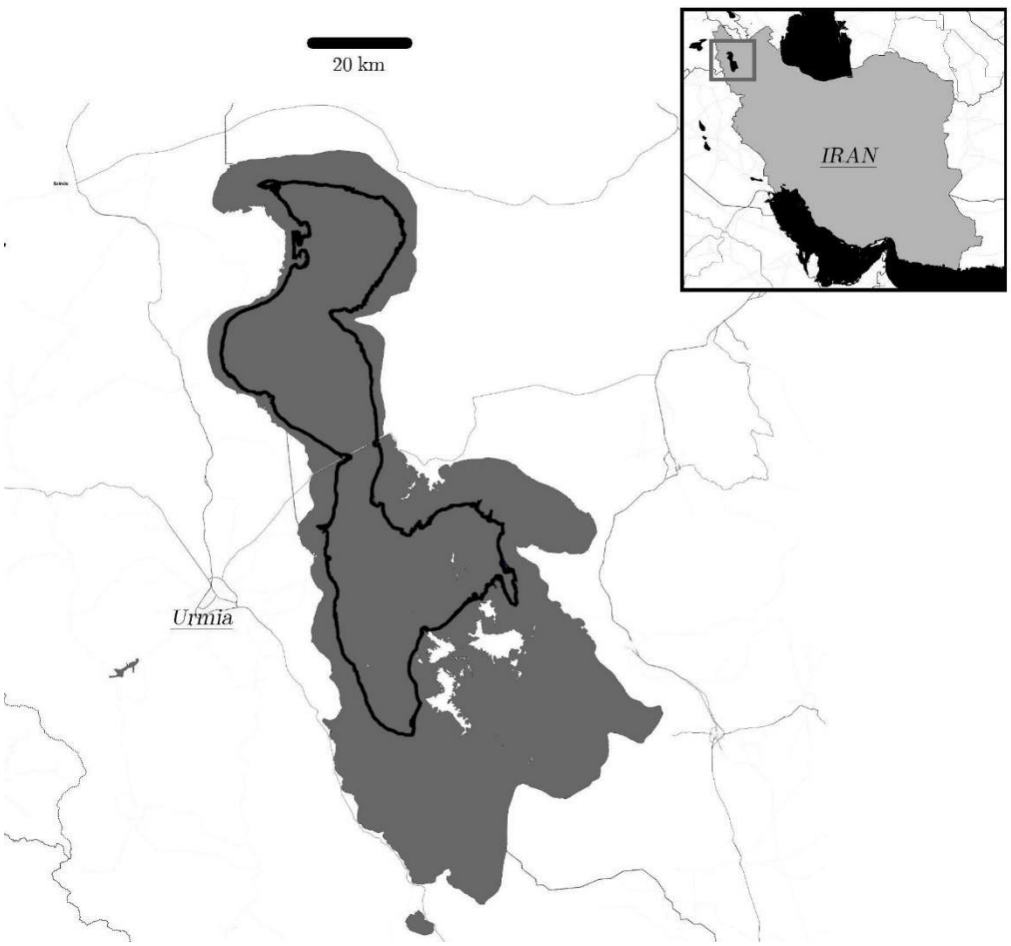

Figure 2: Location of Lake Urmia and its receding shoreline. The dark grey area shows the extent of the lake in 2000 and the black line is the boundary in 2018.

Over the last two decades the lake's surface began to decrease significantly (AghaKouchak et al. 2015; Eimanifar & Mohebbi 2007; Jalili et al. 2016; Shadkam et al. 2016; Shokoohi & Morovati 2015; Tisseuil et al. 2013). AghaKouchak et al. (2015) reported an 88% reduction of the area of the lake since 1972. There are several reasons for this drastic reduction, the most important of which are the upstream overuse of water mainly for irrigation purposes (AghaKouchak et al. 2015; Hassanzadeh et al. 2012; Tisseuli et al. 2013); the construction of dams on the tributaries and other hydro-economic developments in the upstream regions (Abbaspour & Nazaridoust 2007; AghaKouchak et al. 2015; Hassanzadeh et al. 2012; Hoseinpour et al. 2010); and the construction of a causeway that parts the lake into two arms (Eimanifar & Mohebbi 2007; Zarghami 2011; Zarrineh & Azari 2014). The demand for water has increased due to population growth (Madani 2014) and unsustainable agricultural development (AghaKouchak et al. 2015; Madani 2014; Zarghami 2011). Many researchers blame the degradation of the lake on poor

water management (AghaKouchak et al. 2015; Hesami & Amini 2016; Madani 2014; Zarghami 2011).

Water extracted in upstream rivers is mostly used for the irrigation of agricultural land (Eamen & Dariane 2013; Hashemi 2012; Yazdandoost & Moradian 2016), the area of which has been sharply increasing in the Lake Urmia basin (Hassanzadeh et al. 2012; Hesami & Amini 2016; Shadkam et al. 2016; Shokoohi & Morovati 2015). Due to low irrigation efficiency (Hashemi 2012; Hassanzadeh et al. 2012), cultivation of water intensive crops and an extensive agricultural drive, there is a high upstream demand for agricultural water (AghaKouchak et al. 2015). Despite the efforts and implementation of more than 88 projects aimed at saving Lake Urmia (ULRP 2015), the water volume in Lake Urmia is still decreasing, according to 2017 measurements (IEWW 2017).

As a result of the retreat of the lake, vast areas of salt flats have been exposed to wind erosion. The wind carries salt particles which are mixed with chemicals, pesticides, and herbicides deposited on the lakebed (Hassanzadeh et al. 2012; Hoseinpour et al. 2010). The resulting salt storms lower soil fertility, posing a risk to agriculture and driving regional economic problems (Madani 2014; Tisseuil et al. 2013). Many authors have mentioned potential health impacts of the salt storms, including respiratory and eye diseases and increased cancer risks (Ghalibaf & Moussavi 2014; Hesami & Amini 2016; Hoseinpour et al. 2010).

6. Results

The characteristics of individuals and communities that contribute to social sensitivity also influence their adaptive capacity (Marshall et al. 2010). Key sensitivity and adaptive capacity elements were identified based on their prevalence in the responses obtained. The key variables identified were access to irrigation water, income diversification, presence of social networks, and economic resources. Knowledge of and participation in governmental and non-governmental projects was identified as an important adaptive capacity element.

6.1 Access to irrigation water

Lack of irrigation water presented the main stressor for all of the respondents. The degradation of Lake Urmia severely impacted water resources in the surrounding areas. In most of the sites studied, farmers relied on water from the wells for domestic and irrigative use, however the quantity and quality of water in the wells decreased significantly. Salinization of wells occurred

in many areas and rendered wells useless for the farmers. Due to largely unregulated extractions of underground water, Iranian legislation restricts the use of wells, and even prescribes the payment of fees for their use. In order to control the use of underground water resources, legislation was adopted by an Act in 1984 that required the registration of private wells and the acquisition of permits for their use. An over-subscription of permits followed, and there are nowadays still a considerable number of unauthorized wells operating in the Lake Urmia basin (Hashemi 2012). According to the respondents, this problem is being addressed by officials by closing the unauthorized wells, and limiting the number of wells to one per farm, which is causing significant problems for these farmers.

Only some of the respondents used water from the rivers for irrigation, with most of this being unauthorized with farmers risking financial penalties. Relying on illegal water infrastructure was for many farmers the only coping mechanism they were able to adopt, however with water resources diminishing this is a short term individualistic coping solution. It additionally prevents them from obtaining help from institutional frameworks which could offer more long term solutions and enhance the adaptive capacity. According to Hashemi (2012) 27% of all water extractions from the rivers in Lake Urmia basin are informal. There is also no formal water allocation for dams in the Lake Urmia basin. A similar situation is visible at the local level, where the distribution of water from irrigation networks provided by the government is largely informal with different rules for water allocation in use in each of the studied villages. Without formal rules for water extraction, informal politics influenced the development of exclusionary practices which favored those with a particular local political influence.

As part of cooperative measures to reduce water scarcity, some of the villages had government-built irrigation networks. However, the respondents reported that the irrigation canals are mostly dry and irrigation was only possible between one and three times per month, and there was not enough water for all the farms. The mechanisms for the distribution of water from the irrigation canals differed between the case study villages. The distribution of water from the irrigation canal was officially regulated in only one of them, with farmers paying governmental organizations for the use of canal water with fees proportional to the size of their land and type of crops grown. In others the water distribution was managed on a village level by informally selected representatives, which often caused conflicts and competition for water among farmers. In all of the studied villages these representatives were Azeri farmers with good social connections. Distance of the farm from the irrigation canal played an important role in their

access to water. The construction of the canals in the villages had in the past been undertaken in such a way as to benefit those involved in their planning, thus echoing the political inequality within the communities and their governance structures. In all of the studied villages, the Kurdish population had less access to water from the canals and none of the Kurdish respondents were included in the management and distribution of water on a village level. Many did not have knowledge of how the distribution of water is managed. According to Kurdish respondents in the village that had officially managed irrigation canals, their limited use of water was the result of their inability to pay for the water or equipment (such as pumps). In the villages with informal management of irrigation water, the Kurds most often reported that they did not use the water from the canal due to the fear of being reported to the authorities for having wells without water allocation permits. The differential experience of access to water resources between an Azeri and a Kurdish farmer in the same village is illustrated in the following quotes:

"Our village has a canal that provides half of the irrigation water for our fields. We can irrigate from it about once per month, and for the rest we can irrigate from the well, so we can still survive with farming, although the income from it is now lower. One farmer in the village is responsible for the distribution of water from the canal among the farms and we have different "watering times" so everyone gets their share of water. There is good cooperation between the farmers, especially since we started sharing the water sources. " (Female, Azeri, village 1)

"There is a canal for irrigation in the village, but the water never reaches our farm. I don't know who manages the water from the canal, but the farms closer to the source use all the water so there is none left for us. We used to irrigate from the wells, but the other farmers reported on us, so the authorities closed two of our three wells, and now we cannot irrigate anymore. We get much less produce than before, and the quality of it is worse, so we can no longer export it. " (Male, Kurdish, village 1)

Access to resources is an important factor influencing vulnerability. According to Blaikie *et al.* (1994: 94) "[a]ccess involves the ability of an individual, family, group, class or community to use resources which are directly required to secure a livelihood in normal, pre-disaster times, and their ability to adapt to new and threatening situation." As Bolin and Kurtz (2018) noted, marginalized groups can have diminished access to resources in the face of disasters. Adequate access to water is determined by social factors such as ethnicity (Wisner et al. 2004). The results demonstrate that irrigation water is a critical resource that impacts vulnerability of individuals

in the case study. The Kurdish ethnic group suffers from a lack of access to water both as a result of discriminatory informal policies as well as an unfavorable political environment, as shown with the allocation of water permits. Their coping with a disaster is limited to reliance on informal and often illegal coping strategies, while the Azeri were more likely to be included in cooperative adaptation measures. Ability to mobilize resources is essential for adaptation to environmental hazards (Adger 2006).

6.2 Income diversification

Agriculture used to be the primary source of income for all of the respondents before the decline in water resources, but some farmers also had livestock, most often cattle and sheep. Often those became the main sources of income after the failure of agriculture. They do not provide much profit however, as farmers are no longer able to provide feed for the animals by themselves, but have to buy it instead. Other sources of income before the degradation of the lake included fisheries and tourism. Lake Urmia used to be a popular destination for health tourism (Zarrineh & Azari 2014), but after the retreat of the shoreline, tourist facilities closed, and fisheries were left without water, which caused significant losses of income. Diversification in terms of crop types somewhat reduced vulnerability. Farmers with several different crop types usually experienced a lower loss of income than those relying on one crop type, which was usually a water intensive one, as those reached higher market values.

As after the degradation of the lake farming did not provide sufficient income for many of the respondents, some had to find additional income sources. Kurdish respondents reported working as day laborers in construction or on other farms. Azeri respondents on the other hand most often mentioned working in the service industry (such as in retail or as taxi drivers) or as low-ranking public sector employees. A significant disparity of employment options and income provided by those jobs amongst members of the two ethnicities was observed (Table 1). The structural discrimination faced by the Kurdish population, which is in part identified by the lower representation in public sector employment, provides an explanation for the disparities observed. Such restrictions do not simply limit the capacity to respond to a crisis in a particular moment but are in fact prolonged, preventing the formation of broader individual- or household-level economic prosperity.

Diversification is considered an important vulnerability reducing measure (Agrawal 2008; Birkmann 2006; Yeh et al. 2014). However, before the degradation of the lake even those

respondents who had diversified sources of income mostly relied on economic activities related to the lake, such as farming, tourism, and fisheries. As these were all affected, diversification helped reduce vulnerability only in those cases where the sources of income were not connected to the lake.

Table 2: Distribution of employment among the Kurdish and the Azeri (percentages of the total sample size of the respective ethnic minority).

	Day labor	Public sector	Service sector	No additional employment
Azeri	1 (3%)	4 (11%)	7 (19%)	25 (67%)
Kurdish	8 (31%)	0	0	18 (69%)

6.3 Social networks

Social support networks "include a wide variety of rights and obligations between members of the same household […], with the extended family and with other wider groups with a shared identity" (Wisner et al. 2004: 104) which can help individuals claim access to resources in challenging times. Social networks and connections reduce vulnerability (Braun & Aβheuer 2011; Collins 2008; Cutter et al. 2003; Margles Weis et al. 2016). They proved to be an important sensitivity factor and increased the adaptive capacity of households. They provided monetary support, help in finding new jobs, housing for people who had to abandon their farms, and provided mental support to cope with stress, anxiety and depression which many respondents reported as a result of disaster-induced economic insecurity.

Significant differences in the use of social networks were observed between Azeri and Kurdish respondents. More Azeri reported cooperation with other villagers, especially in regards to village-level irrigation water management. Additionally, they used social networks in towns to accommodate family members who left farming to search for other income opportunities, and for help in finding work opportunities. Networks provide monetary support too, and some were receiving remittances from urban family members. In order to obtain a loan a guarantor with a steady income is required, which was more of a problem for Kurdish respondents, in turn making investments in infrastructure like water-saving irrigation systems difficult. The Kurdish farmers often used social networks for mental support, socialization and for farm labor. Some reported, however, that Azeri families found out-migration easier as their social networks were better developed:

"The Azeri families were able to move away as soon as the lack of water started. They sold the land and moved to the relatives in the city. They live good lives now. We didn't have anywhere to go, and now it is too late to sell the land as it is not worth anything. " (Male, Kurdish, village 4)

The use of urban social networks was identified as an important factor for vulnerability reduction. Azeris commonly migrate to urban areas like Tabriz and Urmia and they form a significant part of Teheran's upper middle class. The Kurds on the other hand were historically rural, with those living in urban centers resigned to low income employment (Elling 2013). According to some respondents, social networks also impacted access to institutional help:

"It is much easier for the Azeri people to obtain governmental help. They know the right people and the connections are all that matters here. They also have better access to the [institutions] such as different organizations that can provide some help. " (Male, Kurdish, village 2)

6.4 Economic resources

We evaluated the economic status of households based on non-monetary poverty indicators. Relative wealth affected sensitivity and adaptive capacity, as those farm families with greater economic assets were able to invest in drought management activities such as drip irrigation systems and the cultivation of salt tolerant crops like pistachio trees (Pistacia vera), thus securing their income. Economic status also directly determined farmer access to irrigation, where they pay for the use of irrigation water. Low income households were unable to pay for irrigation water from the canal, nor to purchase pumps and water-effective irrigation systems. Some respondents reported they did not have the money to obtain permits for their wells, which further affected their ability to obtain governmental and non-governmental aid. Many farmers did not address health problems due to a lack of financial means. While the degradation of Lake Urmia severely influenced the income from farming for both Azeri and Kurdish communities, Kurdish families were often in worse economic conditions. They were less likely to obtain financial loans, receive remittances from other family members, or to receive help from governmental and non-governmental organizations.

In general, poorer households are more vulnerable to disasters. While their economic and material losses might be smaller in monetary terms, they are greater in relative terms (Cutter et

al. 2009; Fothergill & Peek 2004). Lack of economic assets limits their ability to respond adequately to a disaster. Ethnic minorities typically experience lower socio-economic status (Masozera et al. 2007), characterized by unequal rights and obligations as determined by complex social and economic relations (Wisner et al. 2004).

6.5 Knowledge and participation in governmental and non-governmental projects

In 2013 the National Committee for Saving Lake Urmia and the Regional Management Council for management of Lake Urmia were founded (ITRTDW 2014) and a "Urmia Lake Restoration Program" established. The Ministry of Energy coordinated the execution of the program and several projects were launched aimed at securing the water requirements for Lake Urmia, raising public awareness and participation in the conservation of the lake, and promoting sustainable agriculture practices and water use (ULRP 2015). Since 2014 the Japanese government has been funding a project through the United Nations Development Programme Iran, focused on engaging local communities and introducing sustainable agriculture practices and reducing water consumption in the Lake Urmia basin (UNDP 2017). At the time of the fieldwork for this study, more than 88 projects aimed at saving Lake Urmia were implemented, many of them targeting local farmers (ULRP 2015). Many governmental and non-governmental projects are aimed at mitigating the impacts of the degradation of Lake Urmia on farmers, ranging from improving infrastructure, providing loans for the installation of water-saving irrigation systems, providing subsidies for planting certain crops and buying those crops from farmers, and providing free advice for farmers. While this shows that there has been considerable effort from governmental and non-governmental institutions to save Lake Urmia and to help the affected population, our findings indicate that alongside mechanisms of support for farmers, there are also mechanisms excluding farmers from being able to obtain that support. It has been noted in other case studies that governance institutions often help reduce vulnerability of those best placed to take advantage of them and not those who need it most (Adger et al. 2005), and this is visible around Lake Urmia as well. The marginalization of groups, manifesting in the exclusion from obtaining help, exists formally and informally. An example of the latter is the informal water distribution among farmers described in the first subsection of the results, while an example of the former is the requirement of possessing a well permit for farmers wanting to obtain help from institutional projects and participation in them. As discussed previously, social connections and financial capital play a role in obtaining such well permits, framing the vulnerability of the marginalized groups.

Among the respondents, few farmers had any knowledge of these projects and their benefits, and only three Azeri farmers benefited from such projects. A negative attitude towards governmental organizations and their actions was frequently observed among respondents. Kurdish farmers had significantly less knowledge of governmental projects and none of the interviewed Kurdish respondents were included in them. Higher levels of mistrust towards governmental and non-governmental institutions was observed among Kurdish farmers. Those who had some knowledge of the projects were reluctant to participate in them due to this mistrust, and due to a lack of necessary certificates, as was demonstrated by the following respondent:

"I have heard about such projects, but it is very risky to participate in them. If they [officials at the Agricultural organization] find out I have an illegal well, they would close it, and it is my only source of water. I would have to get the permit for the well and land ownership certificate, but I do not have the money to pay for it. " (Male, Kurdish, village 6)

Access to information and knowledge is a commonly mentioned factor affecting adaptive capacity (Cutter et al. 2003; Schneiderbauer & Ehrlich 2006). Those with better access to information have better knowledge of relief actions, which can impact their recovery quite considerably. Ethnicity frequently influences the access to information, as well as sources of information (Bolin & Bolton 1986). Minorities more often receive information from family and social networks, rather than official sources, which limits their access to accurate information. They might also not recognize official sources as trustworthy, which is often based on their previous experiences (Dash 2013). Restricted access to information can be a product of language barriers (Masozera et al. 2007), however in the cases studied this was not considered to be an important factor in reducing access to information, since the great majority of Kurds speak Persian.

7. Conclusions

Having traced the development of unequal political power between the Kurdish and Azeri minority in Iran, we argue that the increased vulnerability of the former to environmental disaster is produced by an absence of significant political power. This leads not only to unfavorable treatment in terms of any national policy of resource distribution or development but also manifests itself in discriminatory micro- and meso-level practices. Together, these contribute to a structurally embedded reproduction of the power disadvantage of the Kurdish minority. This

corresponds to a main thesis of the political ecology approach, that the function of social conditions and historical circumstances determine vulnerability.

Our findings show that ethnicity and its socio-economic and political implications affect the sensitivity and adaptive capacity of the members of the two minorities. The main sensitivity and adaptive capacity elements were identified, with these being access to irrigation water, social networks, income diversification, and economic resources. Adaptive capacity also depended on knowledge and participation in governmental and non-governmental projects aimed at mitigating the impacts of the degradation of the lake on local farmers. One of the central differences can be found in the differential access to resources between members of the two ethnic minorities, which is determined by structural inequalities. With wells representing an elusive water source, a widespread example of the disparity are farmers without water allocation permits for their wells who then cannot take part in governmental aid programs. As we have shown, a reason that Kurdish farmers are less likely to have a permit for their wells is that economic inequalities prevent financial expenditure, with their unfavorable position partly the result of discriminatory practices in employment opportunities. Another reason is a resilient mistrust of governmental institutions, arguably determined by past political and cultural oppression of the Kurdish minority in their striving for greater autonomy. Trust and reciprocity in society, participation in community-based organizations and social networks have been shown to be important factors influencing coping capacity in other case studies (eg. Birkmann & Wisner 2006; Willroth et al. 2012).

Having found that disparities in political power influence the way the two minorities are affected and are able to cope with disaster, we further propose that in the continuation of that disaster, and due to the initial inequalities, the gap between their respective adaptive capacities further increases. This is largely driven by lesser sensitivity and more resilient adaptive practices which develop within a better-placed social group as a result of better access to resources, economic conditions, social networks, and knowledge and information exchange. This gap is further influenced by a deepening conflict between members of the ethnic minorities now vying for more limited or extraction-costly resources.

This social division influences whether coping strategies will take a cooperative or individualized form, with congregating entities developing the former, and isolated entities forced to adopt the latter. Cooperative measures develop largely on the basis of informal social

connections which are determined by a shared ethnicity or political allegiance with (more) powerful actors. As such, cooperative measures may transcend the boundary between the national and the local, with these being funded, led, or at least sanctioned by the state or nationally-dominant political actors. Contrary to this, individual coping by members of the marginalized ethnic community is secluded from any favorable interaction with the state. In fact, individualized coping is frequently scrutinized or targeted by the state, as those affected first adopt measures based on the capacities immediately available to them, which can include illicit water extraction.

However, it must be stated that the situation described in this article does not lead us to conclude that social and political action is futile. One of the central obstacles to an increased equality of coping mechanisms to environmental disasters is the limited access to knowledge of inclusive public institutions among the Kurdish population. Mitigating this can be as easy as following Schneiderbauer and Ehrlich's (2006) thought that "…having access to information can be one way of decreasing vulnerability." A future increase in political participation of the Kurds in decision-making bodies would contribute to their participation in existing and future targeted programs, taking into account the cultural and developmental specificities of the social problem we have presented. This would heed Hewitt's appeal for a "protection from the social forces that create inequitable exposure to risk" (1983).

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Photograph of Lake Urmia taken by the author, June 2016.

CHAPTER III: Linking Water Scarcity to Mental Health: Hydro–Social Interruptions in the Lake Urmia Basin, Iran*

Abstract

Alterations of water flows resulting from the manifestation of powerful hydro–social imaginaries often produce an uneven distribution of burdens and benefits for different social groups or regions, reflecting their social and political power. Marginalized regions can suffer manufactured territorialized water scarcity, which disturbs the natural, economic and socio-political order of water users, and as this article shows, inevitably affects their psychological wellbeing. Set in the context of the surroundings of Lake Urmia in Iran, once one of the largest hypersaline lakes in the world and now a severely degraded ecosystem mainly as a result of water overuse in its watershed, this article explores how and through which pathways this manufactured water scarcity impacted the mental health of the water users in the region. The research findings reveal that alterations in this local hydro–social territory and the resulting biophysical, financial and social changes, as well as impacts on physical health of water users, relate to chronic psychological stress, social isolation, intra-community conflicts, despair, hopelessness, depression and anxiety.

Keywords: hydro–social territories; mental health; Lake Urmia; manufactured water scarcity; Iran

* This article has been published as: Ženko M. and Menga F. 2019. Linking Water Scarcity to Mental Health: Hydro–Social Interruptions in the Lake Urmia Basin, Iran. *Water* 11: 1092. doi:10.3390/w11051092

1. Introduction

Freshwater scarcity is becoming one of the leading global environmental issues of the 21st century (Kummu et al. 2016; Mekonnen & Hoekstra 2016; Vörösmarty et al. 2000; WEF 2015). The latest World Water Development Report released by the United Nations World Water Assessment Programme revolves around a straightforward correlation: our booming global population (particularly in low- and middle-income countries) puts a strain on global food and electricity production, which are both water-intensive. As a result, global water use is set to exponentially grow, making water increasingly scarce, and, according to the report, nature-based solutions are required to address these pressing challenges (WWAP 2018). And yet, while this argument is formally correct, it also foregrounds an ontology of water primarily informed by the natural sciences and technical assumptions about ecological scarcity, one that can downplay the social and political choreographies of power that are key in defining water use, allocation and access (Menga & Swyngedouw 2018). Research has indeed illustrated how water scarcity is often not only a result of the physical shortage of water, but rather the product of complex interactions between waterflows and socio-economic and political relations (Bakker 2003; Budds 2008; Budds & Hinojosa 2012; Ioris 2016; Kooy 2014; Swygnedouw 1999). The various actors sharing a river basin are driven by different imaginaries regarding the use of water, as well as by asymmetrical abilities to materialize those imaginaries through the use of hydraulic infrastructure (Boelens et al. 2016; Hoogesteger et al. 2016; Zwarteveen & Boelens 2014). Alterations of water flows result in the redistribution of burdens and benefits for different groups of people and impact the livelihoods of affected communities, including their social and political order, their economy, culture and health (McCully 2001; WCD 2000). This large and growing post-humanist body of literature has advanced the notion of the hydro–social cycle to denote the ways in which the materiality of water as a physical entity (H_2O) overlaps with the social and political flows of water as a resource. Research has therefore moved well beyond considering water as merely a physical substance, and acknowledged its multiple social, cultural, symbolic, political and natural dimensions (Obertreis et al. 2016). While on the one hand the seasonal flows of water in river regimes play a central role in setting the organizational rhythms of human societies (as in the case of ancient Egyptian farmers and the Nile), on the other hand humans can alter water flows (and with them the hydrological cycle) with dams and reservoirs to serve their social and economic interests (Linton 2014; Menga 2017). Yet, in spite of the considerable scholarly attention devoted to the social flows created and interrupted by H_2O, little has been written about the impacts of human-made territorialized water scarcity on the mental health of the communities directly affected by these phenomena. Mental health is an integral component

of health and is defined as “a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community” (WHO 2014:1). Even though research has recognized that environmental changes increase psychological distress and the incidence of mental health disorders (Coelho et al. 2004; Hanigan et al. 2012; Hayes et al. 2018; Speldewinde et al. 2009; Van Haaften & Van de Vijver 1996; Willox et al. 2015) the connection between mental health and water scarcity remains a largely under-researched domain.

Using the concept of hydro–social territory, which was developed by Boelens et al. (p.1) to denote the “spaces that are (re-)created through the interactions amongst human practices, water flows, hydraulic technologies, biophysical elements, socio-economic structures and cultural-political institutions”, this work explores how the reshaping of the hydro–social territory impacts the mental health of the population whose socio–natural environment is altered as a result of water management decisions that disregarded their water needs. Examining and understanding the link between mental health and water scarcity is important for at least two reasons. First, water scarcity is generally perceived as a pressing global challenge for humanity, and it will continue to be so in the near future. As the 2015 WHO report on ‘progress on sanitation and drinking water’ illustrates, by 2025, 1.8 billion people will be living in conditions of absolute water scarcity, relying on annual water supplies that will be lower than 500 cubic meters per person per year (WHO 2015). Against this backdrop, individual or communal water shortages are often produced by unequal power relations (UNDP 2006), and the experience of the dispossessed water users differs from those who are suffering physical water scarcity, because of the contested nature of their hydro–social territory and the artificial interruption of their hydro–social cycle. Communities are dispossessed of water as they are kept at the margins of the decision-making process in issues related to water governance (Franco et al. 2013). Secondly, most of those marginalized water users live in low- and middle-income countries (WWAP 2015), which are also characterized by insufficient provision of and access to mental health services, with 75% to 85% of people suffering severe mental health conditions not having access to the needed mental health treatment (WHO 2010). The health loss from diseases, injuries and risk factors is quantified by the Global Burden of Disease (GBD), which incorporates their prevalence and the relative harm they cause. Vigo et al. (2016) show that mental illnesses represent 32.4% of years lived with disability (YLDs) and 13.0% of disability adjusted years (DAYs) of the GBD. Given the current predictions of increases in water scarcity and considering the link between water scarcity and mental health, the global burden of mental illness is likely

to further increase. As Tomlinson and Lund (2012) observed, global mental health is an issue that has not yet received appropriate visibility. Yet, the fact that in 2015 the United Nations decided to include mental health in the UN Sustainable Development Goal 3 (‘good health and well-being’), suggests that more policy attention and funding is going to be devoted to this matter, thus compelling researchers to further explore its interrelation with environmental degradation in general, and water scarcity specifically.

To do so, we take as a case study the area surrounding Lake Urmia in Iran, once one of the largest hypersaline lakes in the world, and now an agonizing ecosystem reduced to 12% of its original size during the past two decades (2015), mainly due to unsustainable water use for irrigation of agricultural land in the upstream areas of the Lake Urmia basin. The diminished inflow of water to the lake from the supplying rivers and the decreasing volume and quality of groundwater in the area, created significant water shortage in the areas surrounding Lake Urmia. The wetlands once surrounding the lake have dried and the retreat of the lake exposed the salt-covered lakebed to wind erosion. The resulting salt storms along with the water shortage have lowered the agricultural potential of nearby lands and pose serious economic, social and health threats to the population living in the area.

For these reasons, the decaying Lake Urmia provides a good platform to examine how human-made water scarcity affects the mental health of local communities. Indeed, the population around the lake consists mainly of small farmers, whose livelihoods were severely altered by the reduction of available water resources and environmental changes, as well as by the subsequent increased financial pressures and socio-political changes in their communities. Data for this article is sourced from 96 interviews with farmers living and working in the villages and settlements near the Urmia lakebed. The aim of the interviews was to explore the effects of water shortage and restricted access to water on the everyday lives of respondents, including their economy, social relations and health. Hence the purpose of this article is to explore how and through which pathways changes in access to water impact the mental health of marginalized water users in hydro–social territories. We argue that manufactured water scarcity can lead to mental health impacts for the marginalized water users with additional psychological stress being caused by governmentalization and increased state regulation of the irrigation infrastructure, which creates exclusion and further marginalization of a certain part of the population who depend on illegal appropriation of water resources.

The rest of this article is structured as follows. In the next section we briefly review the literature on hydro–social territories and waterscapes, and link it to the literature on the mental health impacts of environmental degradation. The third section contextualizes this research by providing an overview of the reasons behind the desiccation of Lake Urmia. We outline the interests and actors that are responsible for water distribution on the state and local level, and the historical political strategies and decisions that led to the current, unsustainable water consumption in the Lake Urmia basin. The fourth section describes the methods used for the study. The fifth section illustrates and discusses the main pathways that led to mental health disorders and explores their impacts on local communities, while the final section concludes and identifies future research avenues to be taken as a result of our findings.

2. Hydro–Social Interruptions

In this paper we examine the spatiality of nature–society relations through the notion of 'hydro–social territories' and waterscape. While naturalistic views tend to present the management of water flows as a set of technical, objective and rational decisions that can be clearly measured and defined, the hydro–social perspective foregrounds the sometimes messy, and inherently social and political nature of water as a resource (Bakker 2010; Baller 2003; Ioris 2016; Zwarteveen & Boelens 2014), the access to and control over which is determined by broader political, economic and social conditions (Budds & Hinojosa 2012; Loftus 2007; Swyngedouw 1999; Sultana 2011). In this context, territories are not viewed as fixed spaces, but as spatially bound dynamic networks of hydro-social relations, that are constantly and interactively (re)constructed and (re)negotiated (Boelens et al. 2016; Hommes et al. 2016; Hommes et al. 2018; Hoogesteger et al. 2016). Hydraulic infrastructure, for instance, alters hydro–social territories and impacts different stakeholders in different ways, and results in changes and uneven distribution of burdens and benefits (Dajani & Mason 2018; Duarte-Abadia & Boelens 2016; McCully 2001; WCD 2000).

The advancement of the water interests of one group often comes at the detriment of other groups, and this not only impacts their biophysical environment, but also their social, cultural and political order (Dajani & Mason 2018; Duarte-Abadia & Boelens 2016; Hommes et al. 2016; Hommes et al. 2018). Governments or preeminent groups are able to utilize discursive, technical and scientific types of support (Hoogesteger et al. 2016; Zwarteveen & Boelens 2014) to reconfigure hydro–social territories according to their legitimate water knowledge, while discrediting other, often local and traditional, illegitimate forms of water knowledge (Boelens et

al. 2016). Water infrastructure projects become grounds of contestation of different knowledge regimes involving multiple actors and are often the manifestation of the epistemology of the dominant water culture (Boelens et al. 2019; Fox & Sneddon 2019). Hydro–social transformations can be at the forefront of modernization processes, and are outlined and sustained by a period-specific use of contested dominant discourses, symbols, as well as socioeconomic, political and material processes. Water infrastructure systems therefore act as symbols of modernization (Swyngedouw 2015) and are not only material structures but a combination of natural, technical, cultural, social and political components that are shaped in particular ways in the given location and time. They consist of natural and social dimensions and are also a part of broader historical, natural and social processes (Obertreis et al. 2016). Those in power can thus produce 'modern water' to offer hydrological certainty through technology, renegotiating the social relations between water users and technocrats (Linton & Delay 2018). So far, the literature on hydro–social territories have found the notion of governmentalization to be closely related to their constitution (Boelens et al. 2016; Hommes et al. 2018; Rodriguez-de-Francisco & Boelens 2016; Swyngedouw & Boelens 2018). Territorial governmentalization entails the interventions that a state makes to extend its control over a territory and implement a common governance system over diverse local socio-political arrangements. While this can enable the provision of public services in some areas, it also transforms social and political power relations in a given territory, often disregarding local political and economic interests (Bakker 2010; Boelens et al. 2016). Governmentalization can be achieved through the exercise of sovereign power, or through the use of inclusive, bottom-up power mechanisms (Seeman 2016), such as the use of dominant discourses and ideology by the ruling groups in order to alter water users' worldviews, identity, sociality, and behavior according to the dominant hierarchic system. The process aims to achieve the materialization of the dominant hydro–social territories by controlling the societal development through the transformation of water users' beliefs, sense of belonging and identification with the community, and the creation of new relationships and ways of interacting between water users themselves and between water users and water authorities in such a way, that they would accept, internalize, and reproduce the new norms of morality, water knowledge and truths imposed by the dominant system (Boelens et al. 2016; Boelens 2014; Hommes et al. 2018; Hoogesteger et al. 2016). Hommes et al. (2016), Duarte–Abadía and Boelens (2016) and Rogers et al. (2016) for example, use the concept of governmentality to show how such mechanisms are employed by the state authorities in the case of dam-building in Turkey, in territories in Colombian highlands, and water transfer in China respectively, while Ioris (2016) and Perramond (2016) apply the concept of territorialization to describe similar

processes in Lima's water management and New Mexico's state adjudication of water rights, respectively. Territorial governmentalization therefore creates spaces where dominant social, political and economic hierarchies are (re)established and (re)enforced by water governors on local water users, often eroding their local sovereignty.

Yet, multiple diverging and overlapping hydro–social territories can exist simultaneously within the same space, as informal or even illegal practices of local water management can be, to some degree, tolerated and recognized by the state to guarantee a state's stability and legitimacy (Dajani & Mason 2018; Hoogesteger et al. 2016). Under this socio–natural lens it is therefore apparent that if and when these hydro–social flows are altered or interrupted, the consequences go well beyond the so-called natural world.

Water is indeed deeply related to the everyday, and researchers have illuminated the economic, aesthetic, cultural and material value of water in the everyday life of ordinary people (Allon & Sofoulis 2006; Browne et al. 2014; Sofoulis 2005). Yet, and we might add, surprisingly, while there is abundant research exploring the cultural, economic or geopolitical consequences of water scarcity, much less is known about the link between water availability and mental health, both at the national and at the community level. Research has more generally examined the interrelation between the environment and mental health (Speldewinde et al. 2009; Stain et al. 2011), confirming that environmental degradation increases psychological distress (Berry et al. 2007; Dean & Stain 2010; Ellis & Albrecht 2017; Sartore et al. 2008; Willox et al. 2013). Slow onset disasters such as drought have been found to have a positive correlation with increases in mental disorders such as depression and anxiety (Coelho et al. 2004; Hanigan et al. 2013; Speldewinde et al. 2009; Van Haaften & Van de Vijver 1996).

Dean and Stain (2010), Berry et al. (2007), Fritze et al. (2013), Speldewinde et al. (2009), Stain et al. (2011) and Vins et al. (2015) have identified the inter-related pathways leading to mental health disorders in cases of drought and environmental degradation as i) solastalgia, ii) financial pressures, and iii) changes in social networks. First, as mental health is linked to a people's sense of place (Ogunseitan 2005) it is negatively affected by environmental degradation (Rogan et al. 2005). The relationship between mental health and environmental degradation is captured in the concept of 'solastalgia' developed by Albrecht (Albrecht 2005; Albrecht et al. 2007), which relates to the distress or pain experienced by individuals that results from the degradation of their home environment. Even relatively small changes in the environment may result in depression,

fear, anxiety, anger and sadness for people who have a close relationship with it. In the face of drought and degradation of their agricultural production systems, such feelings are often experienced by farmers, who are closely connected to their land for their livelihoods and lifestyles (Ellis & Albrecht 2017). Second, environmental degradation, drought and limited access to irrigation water are connected to increased financial pressures for small farmers, resulting from increased costs, decreased production and quality of crops, loss of livestock and increased debt (Berry et al. 2011). Economic hardship is linked to increased psychological stress and sense of helplessness, as well as insecurity and social isolation, which are strongly related to depression (Fritze et al. 2008; Vins et al. 2015). With increased economic adversity out-migration from rural areas increases, and this affects social connectedness in the communities (Berry et al. 2011; Dean & Stain 2010). Third, changes in social networks and social exclusion, including the reduced access to services, can lead to symptoms of anxiety and depression (Vins et al. 2015). Social capital is an important protective factor for mental health, and a decrease in critical social resources increases the incidence of depression and isolation. Additionally, people suffering mental health problems may experience depleted personal resources, something that decreases their ability to take part in adaptation activities (Hart et al. 2011). In this article we argue that another mechanism impacting water users' mental health through the changes in community relations is the governmentalization of contested hydro–social territories. Territorial governmentalization impacts water users' behavior and sociality through the imposition of new vertical and alteration of the existing horizontal social relationships (Boelens et al. 2016; Perramond 2016), inevitably affecting their psychological wellbeing.

Changes in the governance of water infrastructure may create further social, economic and political exclusion and marginalization of those users who lack the decision-making power in water governance and those who are, for economic or social reasons, unable to access water by officially recognized means, and thus depend on illegal irrigation practices. As we will illustrate in the following sections, interruptions of the hydro–social cycle have serious mental health impacts. Yet, before moving to the discussion, it is necessary to contextualize this research in the setting of the Lake Urmia in Iran. A multi-scalar analysis allows us to consider the state interventions on the national, basin and local levels and connect the dynamics of hydro–social territorial transformations and reconfigurations over various geographical scales.

3. The Desiccation of Lake Urmia

Lake Urmia, located in the North–West of Iran (Figure 1), used to be one of the largest hypersaline lakes in the world (Ghaheru et al. 1999). Over the last few decades the area of the lake started to decrease significantly (Eimanifar & Mohebbi 2007; Garousi et al. 2013; Jalili et al. 2016; Shokoohi & Morovati 2015; Tisseuli et al. 2013), with researchers reporting an 88% reduction in the surface of the lake (AghaKouchak et al. 2015). The overexploitation of water resources from the supplying rivers is largely believed to be the main reason for the desiccation of the lake (AghaKouchak et al. 2015; Hassanzadeh et al. 2012; Tisseuil et al. 2013). As such, the current state of the lake can be attributed to the manifestation of different imaginaries, which have been playing out in the Lake Urmia basin since the 1960s, when first large dams and irrigation networks were built. Covering 3% of the area of Iran, but containing 7% of its water resources, the Lake Urmia basin has represented an important area for the country's modernization (Hashemi 2012) with the focus of water management being the development of its agricultural potential. Since 1970, 56 dams have been built in the basin (Ghale et al. 2018), mostly for providing water for the irrigation of agricultural land (Eamen & Dariane 2013; Yazdandoost & Moradian 2016), the area of which has been sharply increasing during past decades (Hassanzadeh et al. 2012; Hesami & Amini 2016; Shokoohi & Morovati 2016). Agriculture represents the largest burden on water resources in the basin, accounting for 94% of all water demands (Hashemi 2012). This increase in agricultural land is a manifestation of decades of policies that focused on agricultural development, which considered water a limitless resource. Pahlavi's Land Reform (1962–1971), implemented during the White Revolution, greatly contributed to changes in land use. To satisfy increasing water demands, pumping technologies were introduced to extract groundwater, and deep wells largely replaced the use of traditional qanats (Madani 2014; Madani et al. 2016). After the 1979 Islamic Revolution and during the war with Iraq (1980–1988), economic sanctions made food security one of the priority issues for the government, which also hoped to increase non-oil based revenues with the expansion of agricultural production. The area of agricultural land increased further and subsidies, including subsidies for agricultural water and energy use, were offered to farmers. Rapid development and modernization in the years after the Islamic Revolution, including a hydraulic mission with large-scale dam building, were the focus of the country's development decisions. Despite economic sanctions, Iran is today one of the top dam builders in the world, with such undertakings often overlooking the impact this has on the environment (Madani 2014, Madani et al. 2016).

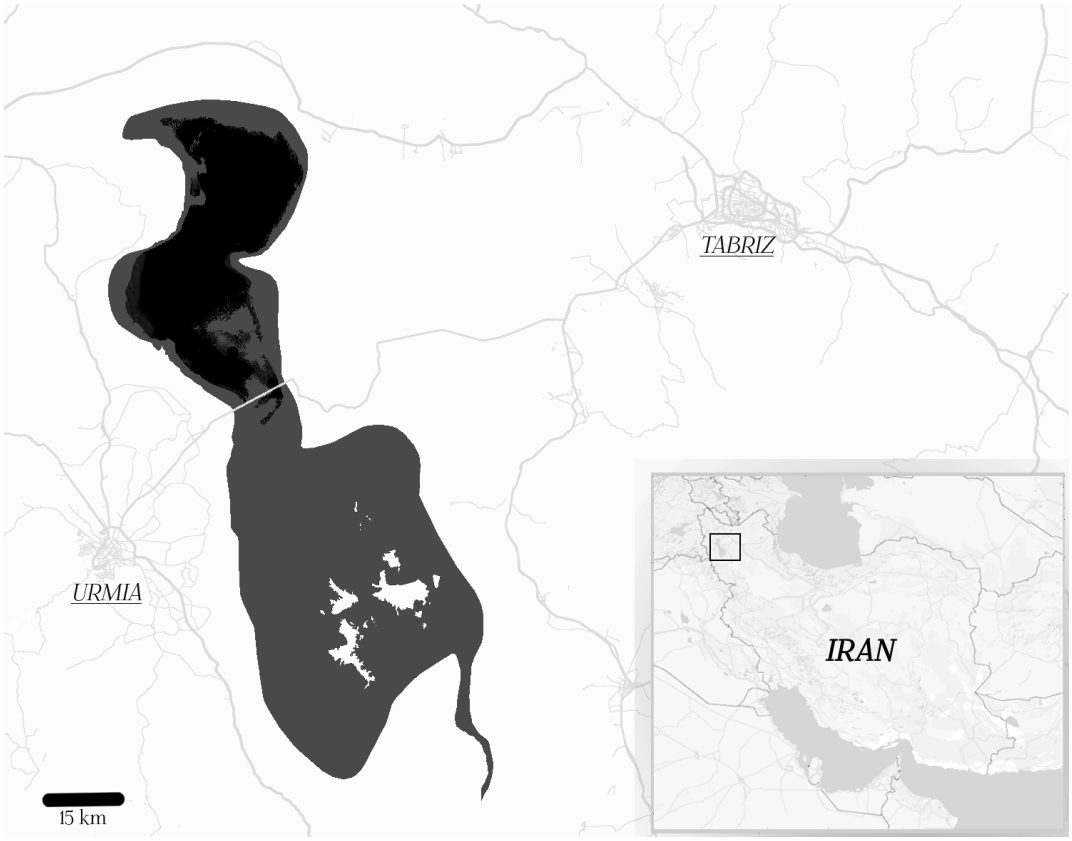

Figure 3: The location of Lake Urmia and overview of its shoreline.

The two outlines represent the area of the lake in 1995 (in grey) and in September 2015 (in black).

At the national level the key decision-maker for water allocation in Iran is the Ministry of Energy, which is responsible for the distribution of water to each sector and province of the country. The Ministry of Agricultural Jihad holds a significant influence over water allocation as well, due to agriculture being the largest water user in the country. While decisions on water allocation are made at the national level, at the provincial level regional water companies represent the Ministry of Energy. Conflict resolution for water allocation between the provinces is in the domain of the Water and Agricultural Commission and is later approved in the Provincial Planning Council (Hashemi 2012). As the Lake Urmia basin is divided between three provinces (West Azerbaijan, East Azerbaijan and Kurdistan), water management at the basin level becomes more challenging due to the administrative divisions and power disparities between the provinces competing for water (Hashemi 2012; Madani 2014; Madani et al. 2016). Smaller dam projects are funded directly from the provincial budgets and many do not have water allocation permits, making control over water allocation difficult. Another factor further complicating effective water management is that most of the irrigation water is supplied by largely unregulated exploitation of groundwater in the basin (Eamen & Dariane 2013; Garousi

et al. 2007; Shokoohi et al. 2015; Zarrineh & Abad 2014). Despite a legal Act from 1984 requiring all users to obtain a water allocation permit for the use of groundwater from private wells and qanats, most of them still operate without such permits. Unauthorized extractions of water from rivers are common as well (Hashemi 2012).

Additional pressure on water resources is posed by rapid population growth and urbanization. Between the years 1976 and 2010 the population in the Lake Urmia basin increased by 121.5%. Tabriz, the capital of East Azerbaijan and the largest urban area in the Lake Urmia basin, receives its water supply from the Zarinarud dam in West Azerbaijan, with the water largely supplied from Kurdistan province (Hashemi 2012). Urban water needs have been prioritized ahead of those of the rural downstream population, which in turn suffers from substantial water shortages. Largescale water transfers implemented to meet urban water demands often come at the expense of surrounding rural areas (Boelens et al. 2016; Hommes & Boelens 2018; Hoogendam 2018), curtailing their water security.

The rapid desiccation of the lake raised the environmental awareness of the Iranian public and put pressure on the authorities to protect the lake from drying out. The attempts to do so resulted in the Lake Urmia Restoration Program (2015), which aims to restore the ecological water level of the lake within 10 years, although such a goal is proving to be difficult to achieve (Madani et al. 2016). The mechanisms of water consumption regulation that have been put in place have so far failed to sufficiently address the upstream water overuse. These mechanisms have instead put additional pressures on small farmers around the lake, who are now facing new obstacles in the already difficult access to irrigation and domestic water, which is causing significant psychological pressures, as will be discussed in the section after the methods.

4. Methods

This study was based on 96 semi-structured in-depth interviews conducted between June 2016 and August 2017 with farmers living and working in 21 villages and settlements within 10 kilometers of the Lake Urmia lakebed. The interviews were carried out with the help of an interpreter and aimed at understanding how the water shortage and the environmental degradation impacted the everyday lives of the respondents and their families. The list of covered topics was broad and divided into three groups; the first group of questions was focused on general information about the respondents, their household and the farm; the second group of questions explored the changes that the farm has experienced due to water shortage and the

degradation of land; the last group of questions was aimed at understanding the economic and social changes experienced by the respondents, changes in workload, health and mental health, access to health services, and access to drinking water. The interviews were open-ended and when participants spontaneously mentioned additional topics they were encouraged to elaborate on them. Due to cultural constrains female respondents often wished to be interviewed together with male family members, and as most of the respondents approached while working in the fields were male, 29 (30%) of the respondents were female and 67 (70%) were male. The age distribution of the respondents is represented in Table 1. The interviews were coded and analyzed using Atlas.ti software (7.5.18, Scientific Software Development GmbH, Berlin, Germany).

Table 3: Age distribution of the respondents

Age group	Number of respondents
16–20	6
21–30	20
31–40	21
41–50	19
51–60	14
61–70	8
71–80	7
81–90	1

5. Manufactured Water Scarcity and Pathways to Mental Health Disorders

Water flows are not only a physical phenomenon that can be altered and managed by humans, but they also constitute and shape social relations (Budds & Hinojosa 2012; Linton 2010; Swyngedouw 2004). Therefore, any alterations of water flows inevitably affect the social linkages and by extension the psychological wellbeing of water users. Decisions on water distribution are usually made on a state level and may create territories of water abundance and scarcity. Territorialized water scarcity often results from agricultural development, state regulations and social relations (Ioris 2016) and it has indeed been recognized that water crises are produced by poor water management rather than physical water scarcity in a given territory (Mehta 200; WWAP 20181). The governmentalization of the hydro–social territory in the Lake Urmia basin through aggressive agricultural policies and investments into hydraulic infrastructure in the upstream areas, driven by the discourse of economic development, control over drought conditions, production of clean hydropower energy and achieving food self-

sufficiency (Hashemi 2012), resulted in territorialized water scarcity in the downstream areas and a severe degradation of the environment. When the tragedy of Lake Urmia could no longer be ignored by the authorities, the narrative of climate change-induced drought became increasingly present in the government's and water authorities' discourses to justify the implementation of water saving measures in the basin. The conflicting nature of governance interests regarding water management is evident from the continuously expanding agricultural sector and increasing area of irrigated lands and water consumption in the upstream areas (Khazaei et al. 2019), while access to water for the downstream population is increasingly restricted by the water authorities. Downstream farmers, who were already facing severe water scarcity, were thus those most affected by these water conservation measures. Based on the interviews carried out with the rural downstream population, the degradation of the lake and the surrounding areas severely impacted their psychological wellbeing. Communities who rely on local ecosystems for their livelihoods are especially vulnerable to mental health impacts caused by their degradation (Willox et al. 2013). Through an analysis of our data, we identified four main pathways that led to negative mental health impacts for the respondents: i) degradation of land and solastalgia; ii) changes in social networks and the governmentalization of local irrigation infrastructure; iii) increased financial pressures; and iv) impacts on physical health, as demonstrated in Figure 2. This corroborates research done on impacts of environmental degradation on mental health in other geographical areas (Albrecht et al. 2007; Alston & Kent 2008; Berry et al. 2011; Speldewinde et al. 2009; Willox et al. 2013).

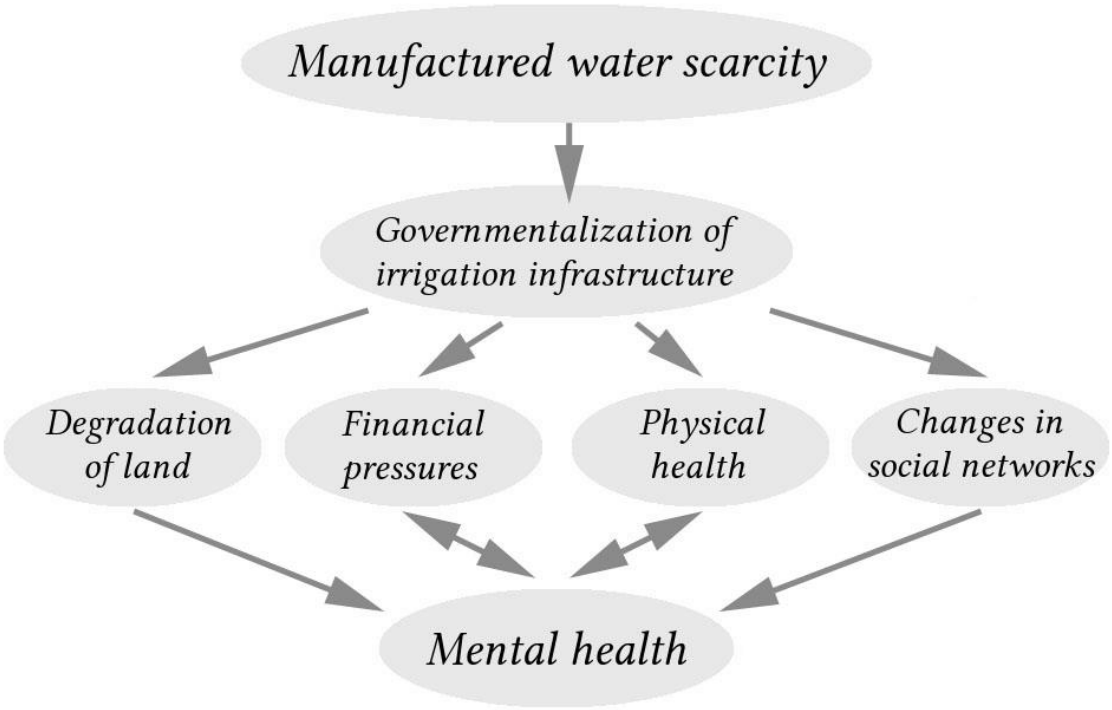

Figure 4: Manufactured water scarcity and the pathways to mental health impacts

5.1. Degradation of Land and Solastalgia

It has been recognized that people may form strong psychological connections with their local environment, which plays an important part in their sense of belonging, identity, security and offers emotional solace (Albrecht 2005; Ellis & Albrecht 2017). Environmental change may therefore produce place-based distress in people who feel powerless in the face of the change unfolding in their home environment (Albrecht et al. 2007). This change can lead to feelings of loss, trauma, depression, and anxiety. Such feelings are experienced with particular severity by those who retain a close relationship with land for their cultural, working or personal life. Hanigan et al. (2012) have for example found a clear link between drought and an increase in suicide among farmers and farm workers in Australia. In the context of the Lake Urmia basin, the reconstruction of the hydro–social territory by the upstream water overuse resulted in the diminished supply of water to the lake and the surrounding downstream areas. This led to drastic change in the environment, such as drying of the rivers, lowering levels and salinization of underground water, drying of vegetation and desertification of land, the desiccation of Lake Urmia and the resulting occurrence of sand and salt storms that carry particles from the exposed lakebed to the surrounding areas. As a result, the inhabitants are exposed to chronic environmental stressors that lead to the experience of solastalgia. Because of a strong attachment of farmers to their land, their occupation merges with their identity, and so farmers often perceive

the degradation of their home environment not only as a threat to their subsistence, but also to their self-identity (Dean & Stain 2010; Ellis & Albrecht 2017). This sentiment was described by one of the respondents:

"I have lived here my whole life. My parents were farmers, later my wife and I took over the farm and raised our children here. We have always lived off the land and we had good lives. Then the lake started disappearing and all the vegetation dried, even the trees started to die. I look around me and all our land that used to be so green and fertile is burnt. It breaks my heart. " (Male, 81)

The mental burden of environmental change and the disruption of agricultural production system was experienced and reported by all of the respondents. It was often connected to the loss of a sense of place, loss of security and loss of emotional solace. The state of the environment was commonly mentioned in connection to their own wellbeing. The majority of interviewed farmers depended solely on income from farming and felt a strong connection to their farmland, as evident from the following quote by one of the farmers*:*

"The economy collapsed and the green meadows and gardens turned into deserts. It makes me so sad to look at this place and remember how beautiful it used to be. I know that there is no future here, but I have farmed and lived here all my life and I will stay for as long as I can. " (Male, 45)

Their strong bond with nature was frequently expressed by farmers using the expression that the plants are dying ("mordan" in Farsi), rather than drying ("khoshk shodan" in Farsi). This was expressed by one of the female farmers, along with the feelings of hopelessness:

"I have been farming and living on this land for 50 years. For the past years I had been telling myself that the next year will be better. But now even the trees are dying, there is no water, just dust and salt. And now I know that I will die before it gets better. " (Female, 50)

Avoidance behaviors, such as shutting the curtains and spending more time indoors so they would not see their destroyed farmland were also frequently described by the respondents. A female farmer reported it along with the symptoms of depression experienced by her husband:

"All our vegetables have dried this year. We worked so hard for nothing. My husband has no motivation to come out of the house anymore. He stayed in the house for two months because he did not want to come out to see his fields destroyed by the drought and the winds. " (Female 42).

Feelings of sadness, despair and a sense of hopelessness were commonly mentioned by the respondents in relation to the degradation of their home environment. There are clear links between hopelessness and depression, as well as other mental health problems (Berry et al. 2011), which might result in an increased risk of suicide (Hanigan et al. 2012).

It is therefore apparent that the alterations of water flows can produce a myriad of impacts for marginalized water users. Water has many dimensions, and people shape their identity, livelihoods, culture and social order around it (Boelens et al. 2016; Duarte-Abadia & Boelens 2016; Perramond 2016). As such, when their access to water is altered, it can profoundly impact the psychological wellbeing of water users, challenging their livelihoods, identity and rituals, all of which increases their risk of developing mental health disorders.

5.2. Changes in Social Networks and the Governmentalization of Local Irrigation Infrastructure

With the increasing pressure on the government to take action and save Lake Urmia from dying, the role of the governmental institutions in water management on a local level increased. The urgency of saving Lake Urmia became a dominant discourse of the governmental institutions and media in the area, disregarding competing claims for scarce water resources by the small farmers living in the proximity of the lake. High upstream and urban demand for water in the basin which had produced and continues to maintain territorialized water scarcity in the downstream areas was not sufficiently addressed, and so the burden of saving scarce water resources for restoring Lake Urmia is disproportionately carried by the downstream farmers. The governmentalization of the local hydro–social territory in the villages encompassed in the study was articulated through the discourses of adaptation to climate change and restoring the lake, and was materialized through legal and administrative procedures and infrastructural projects. The hydro–social reconfigurations were portrayed as efficient and necessary for the restoration of the lake, and for the benefit and in the best interests of both the environment and the population of the basin, while discrediting competing claims for access to water by local small farmers. The use of such discourses of rationality and efficiency is common in the process of commoditization of water resources (Duarte-Abadia & Boelens 2016; Swyngedouw & Boelens 2018). The

imposition of water regulation in the study area included the construction of irrigation canals and in some villages the introduction of fees for the use of irrigation water, which is supplied from the dams and regulated by the water authorities.

The control of previously largely unregulated extractions of water from the rivers and from illegal wells increased, with such users facing fines and closure of their wells. A stricter application of the 1982 legal Act was undertaken, with it requiring users to obtain a water allocation permit for the use of groundwater from private wells and qanats. As obtaining such a permit and paying for water from irrigation canals represents a significant financial burden which many farmers are unable to afford, an informal and illegal hydro–social territory coexists alongside the official one. It is in part tolerated by the state due to its inability to provide irrigation and domestic water supply to all of the studied villages and settlements. As such, users with only one illegal well were reportedly not sanctioned; however, those without official water allocation permits are not allowed to take part in the governmental and non-governmental projects aimed at mitigating the impacts of water shortage on farmers, which creates a further social and economic exclusion of farmers relying on the illegal water infrastructure. Access to water is therefore characterized by the intertwinement of official and informal practices and norms, as has been observed in other geographical locations (Boelens et al. 2016; Hoogesteger et al. 2016; Dajani & Mason 2018).

The increased state control of the irrigation infrastructure reconfigured the hydro–social territory and altered socio-political relations in the area. It is considered that a degree of tolerance towards illegal water extraction practices also serves as means to control the population, as the fear of fines and possible loss of illegal sources of water are seen as the reasons why no collective resistance against the control of water resources by the state was observed in any of the studied villages. This link between the reliance on illegal water sources and chronic psychological stress and anxiety among the respondents was described by one of the female farmers:

"The canal was built by the officials and the water from it is shared between twenty to thirty farms, but it is almost always empty. We would have to pay to use the water according to the size of our land, but we cannot afford it, so we rely on two wells for irrigation […]. But God forbid they [the officials] find out that we have two wells. If they close them, we will be left completely without water and what would we do then? We have always been farmers and it is the only thing we know. " (Female, 50)

The unreliability of the water supply from the irrigation canals, as described by the respondent in the quote above, was observed in all of the studied villages with formal irrigation networks. The responsible institutions were providing irrigation water from the dams twice or less per month in insufficient quantities for all of the farms. In some of the villages the distribution of irrigation water from the state-built canals was not officially managed, which created competition and conflicts for water between the farmers and led to the creation of hydro–social hierarchy within the villages. Official irrigation infrastructures reconfigured social relationships and altered the behavior of water users and their identification with the community, something that has also been observed in the case of increased state control of water territories in other geographical settings (Perramond 2016). As King et al. (2018) note, access to water can differ significantly even within small communities. In the studied case informal networks of villagers with higher political power or political connections were formed to benefit the most from governmental water infrastructure, excluding those with less social and political power and those with illegal water infrastructure. Due to the fear of being reported to the authorities for the use of illegal sources of water, the existence of such networks was in most cases unchallenged by the marginalized water users. Feelings of injustice and social isolation, however, were commonly reported by the respondents as demonstrated by the following quote by a young male farmer:

"When we still had enough water, all the farmers in the village were in good relations and would help one another. But now there is a lot of competition for water when there is some in the canal. More powerful farmers use all the water and the others have to depend on the rain. We have illegal wells and if we tried to use some water from the canal, someone would surely report us. " (Male, 25)

The link between water shortage and increasing social isolation was further explored by one of the female farmers:

"There is so little water in the canal that it never reaches our farm, the bigger farmers use all of it. There is a lot of competition and conflicts for water in the village. Before all the women would work together and we would chat and share our worries, but now we don't socialize anymore. We all keep to ourselves. " (Female, 50)

Disruptions in social relations and loss of social capital are connected with an increased social isolation, depression and anxiety. The disputes and competition over water resources in the previously close-knit communities with a strong sense of belonging, reportedly resulted in reduced social interactions between farmers. Arguments and competition within the communities increased the psychological stress of individuals and the respondents often mentioned feelings of loneliness and sadness. Another factor impacting social cohesion and social structure is the out-migration from the study area, which has been reported in all of the studied villages, corroborating the findings from a previous study (Torabian 2014). The official data from the Statistical Center of Iran shows as much as a 31% decrease of the population for those studied villages with official population data; however, the rates observed and reported by the respondents are much higher and in some of the villages only a few households remained inhabited. The out-migration was reportedly the result of increasingly difficult financial conditions, lack of employment opportunities and lack of access to water. For the remaining villagers this increased the sense of hopelessness and many described feeling trapped because of a lack of financial resources or urban social networks that would enable them to out-migrate as well. This sentiment was described by one of the young farmers:

"There is a lot of depression and helplessness in the village. We have no income and live in poverty. I go out of the house and the village is almost empty as everyone who was able to move away has indeed left. There are no young people I could talk to or share my problems with. " (Male, 28)

Out-migration from communities suffering drought and a depleted economy reduces the support systems, services and social resources of the population that remains (Vins et al. 2015). It also alters their family and community structures. It negatively affects the psychological wellbeing of both those who leave and those who stay behind, with frequently reported symptoms of anxiety and depression among both groups (Berry et al. 2011). While out-migration can positively impact the family level income through remittances of family members who out-migrate, it also shrinks the economy on a community level through the loss of a productive workforce and a reduced economic activity resulting from fewer economic interactions. Financial pressures further negatively impact the mental health of individuals.

5.3. Financial Pressures

The reconstructions of hydro–social territories for the benefit of some groups of people may result in the marginalization of others (Swyngedouw & Boelens 2018). A socio-economically disadvantaged population has an increased risk of developing mental health problems due to higher exposure to psychosocial risk factors such as stress, social isolation, economic insecurity, reduced personal autonomy and negative self-perception (Fritze et al. 2008). Water scarcity in the study area and the degradation of agricultural land resulted in a substantial decline in income reported by all of the respondents. While 18 (19%) of the respondents found additional sources of income, mostly as day laborers or in the service sector, a vast majority depended solely on income from farming. Decreased quantity and quality of the irrigation water combined with salt and sand storms led to increased crop failure and higher expenses for fertilizers and pesticides, which left many farmers with increasing debt. This caused chronic stress, anxiety, depression and feelings of helplessness among the respondents. The unpredictability of income was the cause of significant concern for the respondents. One of the farmers reported:

"I am afraid to sow in the spring, because I never know if there will be enough water for anything to grow. We have been growing the same crops since I can remember, but in the past years we got less than a quarter of the produce than we used to because of the lack of water, and even the quality of that has decreased. This field used to support seven people, but now the three of us can hardly survive with the income from it. Four family members had to move away to search for jobs in town, because life became too hard here. There is no future here. " (Female, 67)

The contested discourse that climate change, rather than anthropogenic actions in the basin, is the main cause for the degradation of Lake Urmia and the surrounding areas, was adopted by some of the respondents. This discourse, used by the government, local authorities, and water companies (AghaKouchak et al. 2015; Hashemi 2012; Hassanzadeh et al. 2012; Madani 2014), claims that regulating water consumption in the local hydro–social territory is the most efficient and rational way of restoring the lake. Discourses are important elements of the governmentalization of hydro–social territories (Duarte-Abadia & Boelens 2016; Hashemi 2012; Hoogesteger et al. 2016) as means of creating specific truths, knowledge systems and forms of consciousness that are adopted by the water users, to align them to the dominant hierarchic system by altering their world views, beliefs, identification with the community, as well as their social relations and behavior (Boelens et al. 2016). It is interesting to note that the discourse of climate change has been used by the authorities both to justify the investments into hydraulic

infrastructure as an adaptation policy to climate change, as well as to explain the cause for the degradation of the downstream areas (Hashemi 2012), which is in fact primarily the result of poor water management decisions (Khazaei et al. 2019; Madani 2014). Presenting a disaster as the result of natural processes and climate change shifts the focus from the preventable internal causes to inevitable natural causes and to the international actors responsible for anthropogenic climate change. While the response to a natural disaster can be limited to relief measures, the response to a natural hazard turning into a disaster due to socio-political and economic factors requires deeper structural changes in the society (Dove & Khan 1995) to address the underlying causes of inequality, which makes some groups within a society more vulnerable to natural hazards than others (Birkmann & Wisner 2006; Mustafa & Wrathall 2010). We believe that the use of the discourse of climate change as the main factor in the degradation of Lake Urmia serves to shift the responsibility for the disaster from the governmental decisions on water use to unavoidable natural agency. This determined the response to the tragedy and instead of addressing the degradation of the lake as a symptom of unsustainable water use which should be tackled with profound changes in the water management on a national level, the response measures are so far limited to mitigating the impacts of the land degradation on local farmers and regulating water use in the proximity of the lake, while the water overuse on a basin level remains insufficiently addressed (Ghale et al. 2018). The dominant groups in the Lake Urmia basin justify and legitimize the materialization of the dominant hydro–social imaginaries by adopting the dominant discourse that the increasingly difficult life conditions and loss of livelihood are the result of climate change, and that there is nothing to be done to improve the situation. The sense of helplessness and depression increased among some of the respondents, as can be observed in a quote from one of the farmers whose village had no irrigation networks and the water in the wells was too salty to be used for irrigation or domestic purposes:

"The lake and the rivers have dried because of climate change. There is nothing the government can do about it. And there is nothing we can do to save our crops and our source of income. If there is no water, all we can do is sit and watch them dry. It is unbearable. " (Male, 47)

A similar sentiment was described by another farmer:

"There is no more water in the rivers and wells because of climate change and so we depend on the rain. We used to have fish farms for additional income, but of course there is no water for

them anymore. This field is our only source of income now, but there is no rain and the wells are empty. There is nothing I can do but watch the crops dry. " (Male, 35)

Such feelings of powerlessness, hopelessness and lack of control over the course of one's life increase psychological distress and can lead to depression and anxiety.

5.4. Physical Health

Some previous studies have suggested that the degradation of Lake Urmia is likely to cause various health impacts on the local population (Ghalibaf & Moussavi 2014; Hassanzadeh et al. 2012; Hesami & Amini 2016; Hoseinpour et al. 2010); however, to the best of our knowledge no comprehensive study on health impacts of the degradation of the lake has so far been done. Changes in hydro–social territories result in alterations in access to resources for different communities, and many studies have considered access to safe drinking water (Hommes et al. 2018; Ioris 2016; Loftus 2007; Swyngedouw 2004), which is one of the major public health and well-being concerns (Gimelli et al. 2018; SDSN 2014; WHO 2011). There are multifaceted interactions between physical and mental health, and it has been recognized that physical health conditions increase the risk of developing mental health disorders, with the reverse process also occurring. Such comorbidity negatively impacts the ability of individuals to use health services and to receive correct diagnosis and treatment (Prince et al. 2007).

In the studied area, the respondents considered the diminished access to safe drinking water and the occurrence of salt storms as the main threats to their physical health. Those factors cause serious health concerns for the local population, as stated by one of the respondents:

"We get water from another village that has a pipeline for drinking water, but the taste of the water has changed over the years. I store it in a reservoir and after a while I noticed that there are a lot of sediments that are deposited at the bottom of the reservoir. Many people got kidney stones and cancer in the past years and I think it is from the water that we drink, but we have no alternative. I am afraid to drink this water and I worry about me and my family getting sick from it, but there is nothing we can do. " (Male, 45)

Respondents most often reported the increased rate of different types of cancer, kidney stones, respiratory problems such as asthma and problems with eyes, with the latter two resulting from

the salt storms. Those physical health problems experienced by the respondents or their family members were often mentioned to be a cause of concern, chronic stress and depression.

"Everyone in this village is sick now, the young and the old. We call it 'the lake disease'. When a salt storm comes we cannot see anything, our eyes become sore and it is hard to breathe. We have to hide inside. The salt does not affect only the respiratory system, all the vegetables and the fruits that we eat make us sick. All the food is poisoned by the lake. There is a lot of cancer in the village. My wife is sick, and lately I have started to wake up at night and cough and I cannot breathe. Then I lie awake and I worry about my wife and about getting sick myself, because I need to take care of her and work in the fields. " (Male, 42)

The described health and mental health problems were reportedly rarely addressed due to the lack of financial means and health facilities in the area.

Despite neuropsychiatric disorders contributing a significant percentage of the global burden of disease (Vigo et al. 2016) mental health is a low priority in most countries. Mental health disorders contribute to mortality and affect the rate of other health conditions, as well as severely impact the quality of life for those suffering from them (Prince et al. 2007). There is evidence associating environmental degradation with increases in mental health disorders (Coelho et al. 2004; Hanigan et al. 2012; Speldewinde et al. 2009; Van Haaften & Van de Vijver 1996; Willox et al. 2013). Most of the environmental degradation caused by climate change and human development is occurring and expected to further intensify in low-income countries (IPCC 2014), which have low investments in mental health care (Prince et al. 2007), contributing to the urgency of the problem.

Due to expected increases in relative water demand and absolute water scarcity in many parts of the world, substantial challenges to water infrastructure and water supply are expected to occur (Vörösmarty et al. 2000), which will reconfigure hydro–social territories and may increase the incidence of mental health disorders.

6. Conclusions

In this work we explored how and through which pathways the reconstruction of the hydro–social territory in the Lake Urmia basin impacted the mental health of marginalized water users. This study provides an example of how alterations of water flows as manifestations of politics

focused on economic growth—without considering the cost to the environment and water needs of all—may lead to territorialized water scarcity and marginalization of some water users, which can severely impact their mental health. The governmentalization of the hydro–social territory in the studied basin during the last decades was driven by strong discourses of economic development, adaptation to climate change, production of clean hydropower and achievement of food self-sufficiency. This enabled large scale investments into hydraulic infrastructure and the expansion of irrigated agriculture in the basin, as well as water transfers from rural to urban areas, thus prioritizing urban water needs before those of the rural population. The created territorialized water scarcity in the downstream areas resulted in a severe degradation of the environment, including the desiccation of once the second-largest hypersaline lake in the world, as well as profound economic and social changes for the population in the area. When the tragedy of the lake could no longer be ignored by the authorities, the role of governmental institutions in water management increased, which further reconfigured the local hydro–social territory. The discourse of climate change was widely used by the government to avoid the responsibility for the desiccation of the lake, and shift the attention to the inevitable natural causes. Justified through the discourse of environmental conservation and restoration of Lake Urmia, as well as adaptation to climate change, a regulation of irrigation water and the charging of fees for its use was introduced in some of the studied villages. Additionally, the control of illegal extractions of water from rivers and wells increased with such users facing financial penalties. As all water users cannot access water through legal means, an illegal hydro–social territory coexists with the legally recognized one. Reconfiguration and governmentalization of hydro–social territories create new hierarchical relationships between water governors and water users, and disrupt the relationships between the water users themselves, changing their very identity, sociality, worldviews and behavior (Boelens et al. 2016; Hommes & Boelens 2018; Perramond 2016; Swyngedouw & Boelens 2018). As has been shown, all of these changes are closely linked to the mental health of water users. This article therefore contributes to the literature on hydro–social territories by adding another important dimension to the studies of the hydro–social interruptions, namely the mental health and the psychological wellbeing of water users. Mental health is an integral component of health and should be considered when assessing impacts of hydro–social alterations.

The concepts of hydro–social territory and waterscape allow us to view the Lake Urmia disaster through the lens of water dynamics in relation to social and political conditions. The hydro–social alterations in the studied territory greatly impacted the natural, economic and socio-

political order of the local rural population. The study area is populated mainly by small farmers, most of whom depend on farming as their only economic activity, and form strong connections with their environment. As a result of water scarcity their home environment was degraded, which led to the experiences of psychological distress, loss of emotional solace and feelings of helplessness. Additionally, they experienced significant decreases in income, increased competition over scarce water resources, and physical health problems resulting from decreased quality of drinking water and the occurrence of salt storms. Those four factors, namely the degradation of environment, social changes, economic hardship and physical health problems were identified as the interrelated pathways that led to the mental health problems among the respondents. The most often reported mental health impacts were chronic psychological stress, social isolation, intra-community conflicts, despair, feelings of sadness and hopelessness, and symptoms of depression and anxiety. While it has been shown in other studies that different subgroups within a society might be differentially affected by the factors leading to mental health impacts (Alston & Kent 2008; Hanigan et al. 2012; Ženko & Uležić 2019), this has not been studied in the present research due to a limited number of respondents of different subgroups.

Understanding the inter-related pathways through which territorialized water scarcity impacts the mental health of the affected population may not only help recognize the most vulnerable groups of people and improve their access to mental health services, but may primarily serve to address the underlying causes of their mental health problems. Many of these are not solely the results of the impacts of physical water scarcity, but of policies and development plans that increase inequality among water users and solidify exclusion and marginalization of some groups, who become more vulnerable to mental health disorders. Mental health impacts should therefore be separately assessed before the implementation of hydraulic infrastructure developments, rather than being assessed among other health impacts, and therefore often neglected. In the allocation of funding, issues relating to mental health should be among the deciding criteria for funding agencies. With mental health disorders already representing a significant portion of the global burden of disease (WHO 2014) and severely impacting the well-being of the affected individuals, prevention of mental health problems is one of the most important ways of decreasing this burden (WHO 2004).

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Photograph of Lake Urmia taken by the author, June 2016.

CHAPTER IV: The production of the Lake Urmia waterscape and the social implications for the downstream communities

Abstract

The increasing global demand for water is impacting the disparities in access to it and bringing into focus its social and political dimensions, challenging decades of water management that considered water as solely a physical resource that could be endlessly exploited, managed and manipulated for economic benefits. Such a perception of water was driven by the discourse of economic prosperity and modernity and was manifested through the construction of hydraulic projects that created areas of water abundance and scarcity. This asymmetry alters the socio-natural relations within the waterscapes and severely impacts the livelihoods of the disadvantaged water users, with downstream areas often those that experience the most significant effects. The present article examines the historical production of the Lake Urmia waterscape, which is characterized by one of the greatest socio-environmental disasters in Iran, the desiccation of that lake. It explores the alterations in the hydro-social relations and the different roles and values of water through the myriad social impacts experienced by the downstream farmers living in the proximity of the lake. Despite being disproportionately affected by the hydro-developments in the basin, the downstream communities are rarely included in the decision-making in the planning phases of the development of hydraulic infrastructures. This article suggests how the literature on hydro-social cycle and waterscape could inform a more comprehensive and inclusive social impact assessment of hydraulic projects to mitigate this absence.

Keywords: downstream communities; hydro-social cycle; Integrated Water Resources Management; Lake Urmia; social impacts

1. Introduction

For decades, water management has considered water as solely a physical resource which could be endlessly exploited, controlled, and manipulated through the use of hydraulic infrastructure for economic benefits. Such an understanding of water has led to the creation of great inequalities in the access to it, with powerful stakeholders situated outside project areas often benefiting the most from them, to the disadvantage of the vulnerable local water users in the river basins. Global water crisis has slowly begun influencing the changing of these perceptions. Due to the increasing recognition of the role of social and power relations in the production of water, the water-society relationships have gained significant attention in recent years (Linton & Budds 2014; Mehta 2011) and several scholars have stressed that in order to address the water crisis, water management should move beyond its understanding of water only as a physical entity. One prominent concept that features this emphasis is that of the hydro-social cycle, which advances the relational understanding of water, as simultaneously social and natural, material and discursive. Water management is therefore not only a technical matter, but also a social and political one, as any transformations within the hydro-social cycle are political and economic in nature (Loftus 2007). While the adoption of this shift has been limited, with the reductionist view still dominating the field, there have been some significant efforts to implement it, such as the increasingly recognized paradigm of Integrated Water Resources Management (IWRM) (Linton 2014). IWRM commonly addresses the social dimensions of water through the process of Social Impact Assessment (SIA), which is aimed at "identifying and managing the social issues of project development, and includes the effective engagement of affected communities in participatory processes of identification, assessment and management of social impacts" (Vanclay et al. 2015: p: iv). While this is a very important step to including all stakeholders into water management and recognizing the various roles, values and meanings of water for different groups of water users, the actual application and execution of SIA frequently faces many obstacles due to a lack of a systematic approach. One of the most important shortcomings in the application of SIA in water development projects is the limited spatial scope of such assessments, which most often focuses on the resettlement area and overlooks the downstream communities (Kirchherr et al. 2016).

Drawing from the literatures on the hydro-social cycle and waterscape, this article explores the historical production of waterscapes as shaped by the dominant actors, which often profoundly undermine local and traditional livelihoods. It further examines the neglected roles, meanings and values of water and the social impacts that the communities deprived of it experience. This

is done through an illustrative example of the historical production of the Lake Urmia waterscape in north-western Iran. After centuries of sustainable water management, the past few decades have seen water policies driven by the ideas of the Green revolution and the discourse of modernity and prosperity, that were materialized through hydraulic projects and infrastructures. These have shaped a waterscape characterized by one of the largest socio-environmental disasters in Iran, the desiccation of Lake Urmia. This article explores the social impacts along with the roles and values attributed to water by the downstream farmers, who value it not only for its economic potential, but also for its religious, cultural and social significance. The article further suggests how the perspectives of hydro-social cycle and waterscape could inform a more holistic and comprehensive social impact assessment of hydraulic infrastructure, as a way to expand the assessment process to include a wider assemblage of stakeholders.

This study is based on 96 semi-structured open-ended in-depth interviews that were conducted with small-scale farmers (those with 0.5 – 6 ha of land), living in 21 villages and settlements no more than 10 kilometers from the Lake Urmia lakebed. The interviews were conducted between June 2016 and August 2017 with the help of a local interpreter. The aim of the interviews was to explore the impact of the water shortage on the lives of the respondents including on their work practices, social and familial relations, their economy, health, workload, access to services and access to water. The interviews were coded and analyzed using Atlas.ti software (7.5.18, Scientific Software Development GmbH, Berlin, Germany).

This article has the following structure: this introduction is followed by a brief literature review of the concepts of hydro-social cycle, waterscape, IMWR, and SIA. The third section provides a historical and socio-political context of water management in Iran and in the Lake Urmia basin, showing how this transformed the Lake Urmia waterscape. This is followed by the exploration of the hydro-social changes and social impacts experienced by the downstream water users, with the work rounded off by the conclusion.

2. Theoretical background

Over the last decades the contributions to the field of political ecology of water have expanded with authors exploring the intertwinement of water with social, political and economic processes, with power the key determinant in the distribution and access to water (Bakker 2003; Boelens 2013; Budds 2008; Kaika 2006; Loftus 2009; Swyngedouw 2009; Swyngedouw 2004). Stemming from this tradition, the concept of hydro-social cycle addresses water-society relations

and can be defined as a "socio-natural process by which water and society make and remake each other over space and time" (Linton & Budds 2014: p6). The hydro-social cycle is viewed as a complex time- and space-specific process that produces particular kinds of socionatures (Boelens 2013). This notion was developed as a response to the modernist dualism of nature and society as captured in the hydrologic cycle, which is based on the conceptualization of nature and society as two separate entities and represents the circulation of water as a natural process independent of human involvement and water as solely a physical entity devoid of its social dimensions. The hydrologic cycle was developed during the twentieth century and served as the basis for water management, which focused on modifying the hydrologic cycle through hydraulic engineering in a way to best exploit water resources. Hydrology was established as a purely natural science and water was represented as a 'resource' to be managed and controlled by the state (Linton & Budds 2014; Linton 2014). Such a representation of water is not politically neutral (Bakker 2000; Budds 2009; Swyngedouw 1995), but is embedded in a specific historical and social context and constructed in a way that creates and supports particular truths and knowledges that serve particular political interests of dominant groups, while ignoring others (Krueger et al. 2016; Linton 2004). Presenting water in a way that attributes value only to its potential for economic development and agricultural production, and managing it through hydraulic infrastructure is by itself an enactment of power, as it intervenes with other meanings and values of water in order to advance particular political and economic interests (Mollinga 2014).

The link between water, infrastructure and social power was first explored by Wittfogel (1957) in his work on 'hydraulic societies', in which he described how political power can be established through the construction and control of hydraulic infrastructure. He claims that in arid and semi-arid environments the need for large-scale centralized irrigation systems gave rise to coercive authoritarian political regimes. While authors have pointed out many shortcomings of Wittfogel's work including its environmental and technological determinism (Obertreis et al. 2016; Ostrom 1992), it represents an important contribution to the research of hydro-social relations. Swyngedouw (2004) transcends the idea that water and society are related only externally by showing water as so deeply embedded into social, political, economic and cultural processes and power relations, that water and society are related internally and thus constitute a socionatural hybrid which embodies material, discursive and symbolic processes. The social and political dimensions of water are thus addressed in the concept of the hydro-social cycle as inseparable from the material form of water (Boelens 2014; Linton & Budds 2014; McDonnell

2013; Swyngedouw 2004). The concept recognizes water as both an object of politics and also as an active agent that shapes and reshapes social relations (Linton & Budds 2014). This view has been further developed by some of the proponents of the hydro-social cycle who show how water and society co-evolve, shape and reshape each other and how social relations are internalized, embedded and expressed in water and its circulation. Water and society are also related through various ideas, discourses, and meanings attached to water. The hydro-social cycle therefore internally relates social power, infrastructure, technologies, policies, governance structures and physical water, with hydraulic processes representing both the flows of water and the agents of social change and organization (Bakker 2012; Boelens 2013; Budds & Hinojosa 2012, Linton 2010; Linton 2014; Loftus 2009). Any transformations of and within the hydro-social cycle therefore affect the power relations (Swyngedouw 2009).

Complementary to the concept of hydro-social cycle, the perspective of waterscape recognizes the deep intertwinement of society and nature (Karpouzoglou & Vij 2017; Swyngedouw 1999) and is used in a variety of political ecology studies aiming to understand the complex socio-natural dynamics of water over spatial and temporal scales, which is important in researching many pressing water challenges (Budds & Hinojosa 2012). Waterscapes are "the geographical temporary outcomes" of hydro-social processes (Bouleau 2014: 249), and Karpouzoglou and Vij (2017: 4) consider the strength this perspective in "expressing water–society relations according to their different geographies". It interrelates different dimensions of water which impact its circulation and many studies adopting this perspective bring into focus how political economy and social power relations manifest themselves in the access to and control over water (e.g. Bakker 2003; Budds & Hinojosa 2012; Loftus 2007; Sultana 2011; Swyngedouw 1999). This approach is useful for the understanding of how state policies shape water flows and how such changes affect the everyday lives of water users, including their economy, health, and social relations.

The social and political nature of water is no longer only the subject of critical water scholars, but is increasingly being acknowledged within the field of water management and governance. This can be traced back to the development of Integrated Water Resources Management (IWRM) in the 1990s, which has become the main paradigm for water management (Linton 2014; Linton & Budds 2014). It is defined as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital

ecosystems" (GWP 2000: 22). This approach therefore aims to integrate social, ecological and economic dimensions of water with its hydrological dimension. It also intends to operationalize the principles of water as a public good that holds social and economic value, which should be managed holistically with the involvement of water users in decision-making at all levels (Butterworth et al. 2010; Lenton & Muller 2009; Molle et al. 2008). Despite recent efforts for the application of the IWRM, there have proven to be many obstacles in overcoming the cultural and political difference over water through the technical and scientific problem-solving and negotiations between stakeholders (Linton 2014; Linton & Budds 2014). One of the main criticisms of the concept has been its vagueness and a lack of clarity over how to implement it (Butterworth et al. 2010; Franco et al. 2013). Political ecologists have also uncovered that while promoting democracy and equality, the process is in fact often used by powerful players to mask the dispossession and exclusion of less powerful stakeholders (Franco et al. 2013; Zwarteveen & Boelens 2014).

One of the main principles of IWRM is the promotion of social equity and justice, as these determine access to water and water services for water users. Assessment of the social impacts of the interventions into the hydraulic cycle should be an integral part of water management to ensure public health and safety, equal access to water, and community goodwill (Grigg 2016). One method for doing so is the Social Impact Assessment (SIA), which is a process of identifying and managing the social issues that derive from project development (Esteves et al. 2012; Grigg 2016; Vanclay et al. 2015). It is also a methodological framework (Esteves et al. 2012) that uses a variety of methods ranging from technical to political approaches (Asselin & Parkins 2009) and can be applied to a wide variety of developments as well as natural disasters (Wong & Ho 2015). Even though the social impacts of hydraulic infrastructures have been studied since the 1960s, several scholars have stressed the gaps that remain in the research (e.g. Kirchherr et al. 2016; Vanclay et al. 2015). One of the key issues with the enactment of SIA is the limited spatial perspective of the social impacts of hydrological infrastructures. Those are spatially among the largest of all infrastructure projects and reach far beyond the construction site. Despite this, most studies of social impacts of dams focus on a single dam and consider the social impacts only in the resettlement area (Kirchherr et al. 2016), with downstream populations being largely under-researched and overlooked (Beck et al. 2012; Cernea 2004; Kirchherr et al. 2016; McCully 1996; Richter et al. 2010). This issue remains unaddressed in the key frameworks used for the SIA of dams and other hydrological structures. Without considering downstream populations when

performing SIA, it is impossible to implement sustainable project management (Kirchherr et al. 2016).

The next section will introduce the contextual setting of the research and briefly overview the changing historical narratives of water management in Iran, as well as describe the key actors in water governance in the Lake Urmia basin.

3. The production of the Lake Urmia waterscape

Lake Urmia is a shallow, terminal salt-lake in the north-west of Iran and was once one of the largest salt lakes in the world with a surface area of over 6000 km^2 (Ghale et al. 2018). Over the past several decades the area of the lake has decreased by 88% and the recorded volume of the lake in 2014 was only 20% of that in 1972 (AghaKouchak et al. 2015). The main driver of the desiccation of the lake is the aggressive hydraulic development on the rivers supplying it, mainly to support water-intensive agriculture in the upstream regions of its basin (AghaKouchak et al. 2015; Ghale et al. 2018; Hassanzadeh et al. 2012). The drive to maximize the economic potential of the water resources in the basin can be traced back to the 1960s, when the first development plans for dam- and irrigation network-building were undertaken. As one of the water-rich areas of Iran, the Lake Urmia basin was considered an important area for the agricultural modernization in the country. The area of agricultural land has been rapidly expanding in the past decades (Hassanzadeh et al. 2012; Hesami & Amini 2016; Shokoohi & Morovati 2015) and irrigation water now represents 94% of total water demands in the basin (Hashemi 2012). Policy-makers have perceived the expansion of irrigated agricultural lands to achieve food self-sufficiency and economic prosperity as a purely technical challenge, without considering water as a limited resource (Madani et al 2016). Water was understood as what Linton (2010) called 'modern water', devoid of its social, local and historical dimensions and reduced to merely a physical resource to be exploited, managed and controlled in order to achieve the developmental goals set by the state. This is in sharp contrast with the preceding centuries of sustainable water management in Iran which recognized the cultural, religious and social meanings of water.

Since ancient Iranian history water had been managed through a combination of water technologies such as *qantas* and ethical, social and cultural systems that effectively regulated the use of water while recognizing the water rights of all, humans, animals and nature alike (Madani et al. 2016). Water had an important role in the Zoroastrian religion, the predominant religion of ancient Iran. According to the sacred text of Avesta, water had to be kept pure and clean and was

celebrated by recitations of invocations from the Avesta and commemorated in rituals. While Zoroastrians today represent only a small religious minority in Iran, water still holds an important religious significance and ancient festivals celebrating water from the *qanats* continue to be practiced in some parts of the country. After the Islamization of Iran in the 7th century, the Islamic meaning of water gained dominance. With Islam's origins in an arid area, sustainable and equitable water management holds a very important place in its tradition and the importance of water is often referenced in the Qur'an as an origin of life and a gift from God. Not sharing water with those who need it, and the wasteful use of water are forbidden. Water is an important part of religious rituals and has a great religious significance for purification. Islamic ethics is based on the notion of community and social justice, and water is regarded as communal property. Classical Islamic jurisprudence grants unpolluted water rights to all who need it, including humans, animals and nature, and protects water bodies and ecological zones surrounding them (Foltz 2002). According to Wilkinson (1990) it also protects water rights of downstream water users by regulating the amount of water that can be used upstream for irrigation.

For centuries local water governance in Iran had been the responsibility of a *Buneh*, a collective of several farm families that balanced the agricultural water distribution with the available water resources. Their main goal was the efficient and sustainable use of water and agricultural land, while respecting its social and religious dimensions and rights to water. *Bunehs* were part of a wider water governance network that included landlords, experts in the water technology of the time as well as service providers. Such organizations developed over centuries and were based on complex socio-natural interactions which existed in similar forms across Iran until the Land Reform in 1962. They were characterized by efficient water management and a strong reliance on religious principles of water-sharing (Hooglund 1982; Yazdanpanah et al. 2013).

A profound change in water management with large-scale dam building and the construction of irrigation networks and water supply schemes began during the Pahlavi dynasty (1925-1979) when development plans based on Western development models were initiated. These focused on industrialization, urbanization and intensive agricultural modernization, part of which was a hydraulic mission. In this period, water management became a solely technical domain with technologies borrowed from the West to enable the industrialization of arid regions. The Independent Irrigation Agency was established in 1943 in order to centralize water and land management, and control the surface water provision. In the 1940s deep wells were introduced to replace traditional underground aqueducts for a more effective extraction of groundwater. In

the following decades the area of agricultural land expanded, the use of fertilizers and pesticides increased, and irrigation intensified, putting a severe pressure on water resources. The centralized and technocratic approach to water management saw the value of water solely in its economic purposes and neglected its social dimensions (Foltz 2002; Hashemi 2012; Yazdanpanah et al. 2013). The Land Reform (1962-1971) saw the land redistributed to the peasants, which severely altered the agricultural systems and decreased the role of water management at the village level. Poverty and water shortages due to poor water governance and underdeveloped water infrastructure caused the migration of the rural population to urban centers, resulting in economic imbalances (Hashemi 2012). After the 1979 Islamic Revolution, the 1980-1988 war with Iraq halted intensive agricultural development, but the period saw the passage of the most important water law, the 1982 Fair Water Distribution Act, which officially controls the extractions of groundwater by private well owners. These need to obtain Water Allocation Permits for the use of their well, with this disrupting their traditional water rights. The agricultural development continued after the war when the reconstruction program was undertaken and the water management was brought from the regional to the provincial level. This period was characterized by a big number of development projects, which severely lacked an integrated approach to water management at the level of river basins. The drive for development continued into the 2000s and Iran now ranks as one of the top dam builders in the world (Hashemi 2012). The expansion of hydraulic infrastructure is supported by the discourse of adaptation to drought and climate change, the need for the production of 'clean' hydropower energy and the achievement of food self-sufficiency.

Indeed, the intensive hydraulic development of the past decades has not come without human and environmental costs. It deepened the inequality with particularly the areas predominantly inhabited by ethnic minorities lagging behind in development projects (Elling 2013). Water demands that are higher than the natural water supply have created serious environmental problems, such as the drying of lakes, a diminishing groundwater supply, desertification, and the degradation of water quality, all of which are evident in the Lake Urmia basin. Dams and water diversions from the supplying rivers to support intensive irrigated agriculture have shifted power geometries between the upstream and downstream areas. Downstream users suffer significant water shortages which severely affect their livelihoods. The dynamics between upstream and downstream areas in the Lake Urmia basin cannot be explained solely by hydrologic connections, with this instead requiring an understanding of the hydro-social relationships. The Lake Urmia basin is divided between three provinces: West Azerbaijan, East Azerbaijan and

Kurdistan. As the water management jurisdiction is based on political boundaries rather than on watersheds, the distribution of water between the provinces competing for water is heavily influenced by power disparities between them. Smaller hydraulic projects are funded directly by provinces and most operate without water allocation permits, which creates additional inequalities in their shares of water. Most of the irrigation water in the basin is still supplied by largely unregulated extractions of groundwater based on traditional water rights, which poses further challenges to formal water management (Eamen & Dariane 2013, Garousi et al. 2013, Shokoohi & Morovati 2015).

At the time of the fieldwork, there was no effective mechanism for controlling the groundwater allocation in the region. Water distribution is characterized by upstream water overuse for agricultural purposes and the prioritization of urban water needs before those of the rural downstream population (Hashemi 2011; Madani et al 2016, Madani 2014). Only 25% of the rural population has access to safe drinking water, compared with 99% in urban areas (Hashemi 2012). Ethnic politics also play an important role in water distribution, with areas populated by dominant ethnic groups appropriating more water (Khalyani et al 2014; Ženko and Uležić 2019). For example, the reduced quantity of water in one of the main rivers supplying the lake, the Zarrineh, is partially the result of water transfers from the Kurdish part of the river to the city of Tabriz, an important economic center populated predominantly by Azeris, which are one of the most politically influential minorities in Iran (Khalyani et al. 2014). This transfer enables the supply of high quality drinking water for the urban population, while significantly reducing the quality and quantity of water available to the ethnically diverse downstream population.

Today, water management at the national level is in the domain of the Ministry of Energy; however, as 92% of water demands come from agriculture, the Ministry of Agriculture plays a major role in water distribution as it manages the agricultural water sector and irrigation networks. The Department of Environment has held an increasingly important role since the introduction of 1974 Environment Protection Act and the 1998 Environment Impact Assessment (EIA) Act, which requires EIA for all bigger projects (Hashemi 2012). However, the actual power of the Department of Environment is still limited due to the lack of regulatory capacity to prevent damage to the environment (Madani et al. 2016). Even though the need for IWRM in Iran has been a subject of public policy debate since the 1990s, and was officially adopted in 2003, the actual implementation of its principles has been almost absent, with one of the main obstacles to implementing it being the lack of institutional capacity development (Hashemi

2012). While EIA is required for larger agricultural development projects and should include SIA, due to legal and institutional constrains an effective SIA is rarely undertaken and often lacks in quality (Ahmadvand et al. 2009). This uncoordinated, sectoral and reductionist approach to water management in Iran has led to some severe socio-environmental problems.

Water management at the local level is in the domain of Regional Water Authorities, which represent the Ministry of Energy. The resolution of conflicts regarding water distribution between the provinces is managed by the Water and Agricultural Commission and has to be confirmed by the Provincial Planning Council (Hashemi 2012). Regional Water Authorities are responsible for the management of water infrastructure, the control of water provision from the dams to the irrigation networks and the control of illegal water extractions. Another actor in water management in the basin is the Lake Urmia Restoration Project (ULRP), which was established in 2013 as a response to the increasing pressure from the public to save the lake from drying. ULRP is responsible for the restoration of the lake through sustainable water management in the basin. The national office coordinates the interests of different stakeholders and manages the programs aimed at the restoration of the lake and the empowerment of local communities, while the responsibility of the regional offices is to execute the programs in coordination with different non-governmental organizations. ULRP works in coordination with the Regional Water Authorities (URLP 2015). The IWRM for the Lake Urmia project was introduced in 1998 and in 2005 a Conservation of Iranian Wetlands project was launched, both of which focus on ecosystem management within the basin and encourage participation of stakeholders from the three provinces which share it. However, regional water companies work in favor of the provincial interests, which is preventing successful integrated water resources planning (Hashemi 2012).

Despite the efforts undertaken for the restoration of Lake Urmia and the attempts to mitigate the impacts of water scarcity for the local farmers, real results are yet to be seen. Water management seems unable to manage the three elements that are the increasing demand for water from the agricultural sector (Hashemi 2012), the ecological needs of the lake and the surrounding ecosystems, and the water needs of the downstream population. As such, water remains to be managed through technical and legislative means and a reductionist perception of water still dominates water governance. Such valuation and representation of water shapes not only the approach to water management, but also the water rights of different water users (Hommes et al. 2018). The hydro-social dynamics and the alterations of informal and formal water rights in the

surroundings of Lake Urmia will be discussed in the following section through the experience of the population living in the study area.

4. The transformation of the hydro-social relationships in the downstream area of the Lake Urmia basin

The unequal distribution of water and struggles for it are a reflection of how different groups of actors perceive the role and value of water. As Palomino-Schalscha et al. (2016: 884) note, "claims over natural resources always involve issues of power, control and representations of those resources". The studied area surrounding the Lake Urmia lakebed is populated mainly by small farmers who depend on water for their livelihoods. Water developments in the upstream areas have disrupted the local socio-political relations and patterns of unequal water distribution observed at the basin level are also reproduced at the local scale (Ženko & Uležić 2019). In the following section, I first explore the socio-natural transformation in the studied area, which is followed by the exploration of different meanings, roles, and values of water through the myriad of social impacts that the communities deprived of it experienced.

4.1 Transformations of water management and access to water at the local level

As already noted, the hydraulic developments in the Lake Urmia basin are managed at the state level and are driven by the promise of economic prosperity, protection from conditions of drought and increased social welfare. While the agricultural sector in the basin is continuously expanding (Ghale et al. 2018), and urban areas are enjoying improved water provision, the population in the downstream regions is experiencing severe socio-ecological transformation. Such selective developmentalism creates and stabilizes water injustices by shaping territories of water abundance and capital accumulation and territories of water scarcity and struggle for the rural population (Hommes et al. 2018). The insufficient supply of water to sustain fragile ecological systems around Lake Urmia resulted in the drying of rivers and streams, the decline in groundwater quantity and quality, an increased salinity of the lake water and the groundwater, and a desertification of the land. The transformation of the waterscape also altered local socio-political relations. With increasing water scarcity in the area and the calls for action to save Lake Urmia, the role of official institutions especially the Regional Water Companies and the regional ULRP in water management increased, with the aim of securing enough inflowing water to the lake while mitigating the impacts of water scarcity for the local farmers. Permanent irrigation canals were constructed in some of the villages, with Regional Water Companies controlling the amount of water that is released to the canals from the dams, with the water thus becoming the

property of the state. The control over illegal extractions of surface and groundwater increased, with users without Water Allocation Permits facing fines, closures of the wells and confiscation of pumping devices. In an attempt to regulate the amount of extracted underground water in one of the villages encompassed in the study a volumetric device was installed by the Regional Water Company on a well shared by several farmers. The farmers were issued cards for the use of the well that would limit the hours that they are allowed to use it; however, there was an insufficient amount of water in the well to enable the farmers to use it for the assigned time. Indeed, due to the general inability of official institutions to provide (affordable) water for all of the users, the interviews reveal a strong presence of informal rules and traditional water rights that coexist with the formal ones. The majority of the respondents obtained water from private non-registered wells for irrigation and domestic use, and often for drinking purposes despite its decreasing quality.

In villages with formal irrigation canals the farmers complained that there is not enough water in the canals for all of the water users, and in most, the water was available only a few times per month. The rules for the distribution of the water from the canals varied in different villages. In some, users had to pay for the use of irrigation water according to the size of their land, while in the others, informal networks of farmers who controlled the distribution of water had been formed, which transformed power dynamics within the communities. The distance of the farm from the canal was an important factor determining the share of water, with political connections reportedly influencing the construction of irrigation canals in such a way to benefit the most powerful farmers.

Water scarcity and the increasing presence of formal water governance, which disrupted the customary water rights, resulted in the transformation of the hydro-social territory, reshaped hydro-social relations and created the conditions of unequal access to water, deepening the socio-economic inequality among water users. The water needs of the non-registered water users were overlooked by both the Regional Water Authority and the ULRP, as the dominant hydro-social order does not acknowledge the water rights of informal water users, resulting in their increased hardship.

4.2 Social impacts of waterscape transformations for the downstream farmers

Water plays a central role in the lives of the small farmers who live in the study area. It is intertwined with their identities and embedded in their cultural, religious, spiritual, social and

economic practices, and thus the meanings and values that they attribute to water differ significantly from those assigned to water by the state institutions that manage it. The disruption in their access to water impacts all aspects of their lives and causes significant social impacts. While SIA is often used to predict the social impacts prior to the project implementation, it is equally important as a mechanism to inform the management of social issues throughout project development (Vanclay et al. 2015). This section will describe some of the most frequently mentioned impacts experienced by the respondents.

The economy of the small farmers in the study area had been based on irrigated agriculture, with supplementary income from fish farms and hospitality from the now-extinct tourism sector. According to the respondents, the manufactured water scarcity in the past years led to crop failure, the inability to cultivate land due to the lack of irrigation water, and the decrease in quality and yields of the crops. The failure of fish-farms, lower price of crops in the market, increased expenses for pesticides and fertilizers and a lack of alternative income sources left many farmers in precarious economic conditions which severely impacted their livelihoods. As two of the respondents reported:

"All the wells in this village are salty. All of the farmers in the village now share water from a small creek for irrigation, but there is not even enough water to irrigate a quarter of our fields. If we cannot irrigate, our crops dry, and the salt storms make the situation worse. The salt covers the crops and they cannot ripe. We do not work in the fields for income anymore, but just to survive." (Female, 45)

"We have not watered our fields in 45 days. There is only 7 cm of water the well. The peppers and tomatoes that we planted have dried. There was nothing we could do but watch. It is not worth picking them, no one will buy them, so we let the sheep graze on them. 17 people depend on this field. I do not know how we will survive." (Male 55)

Apart from its value for economic activities, water also holds an important social and religious significance in the predominantly Muslim communities. It is used in ritual purification before prayer and after sexual acts, and the purity and quality of water is of special importance.

Water has an important role for the communities' self-organization and social cohesion and the lack of it contributed to the dissolution of once closely-knit community ties (Ženko & Menga

2019). Water management practices were based on informal traditional water rights, which have been in place for generations (Hashemi 2012) and guaranteed water rights of all. Community ties were built and sustained though shared farm labor, cooperative irrigation water management and through shared cultural and religious rituals, many of which involved water.

In recent years with water becoming scarce, many farms lost individual sources of it and subsequently started using communal wells or irrigation canals. As noted in the section on water management transformations, the distribution of water had to be reorganized according to the dominant order imposed by formal institutions which now coexists with the traditional system of water rights, altering the social role of water. Indeed, as noted by Boelens (2014), irrigation infrastructure is much more than objects directing water flows, as it also embeds social and political relations, traditional knowledge and practices, norms and values. In the lake Urmia basin, the described changes disrupted the community dynamics and changed social relations, as illustrated by one of the farmers:

"Since I was young, the farmers would always help one another and we were always in good relations with other villagers. I used to look forward to bigger works, like the annual building of irrigation canals, because the farmers would come together and I would work and socialize with other women. But since the water shortage started, the farmers started competing over their shares of water. Everyone thinks the others are stealing their water. We have an illegal well and we are afraid that someone would report us to the authorities." (Female, 45)

Another important value that the respondents attributed to water was related to health. The water and the mud from the lake were believed to have therapeutic properties, especially for diseases such as arthritis, which attracted health tourists to the area. The vegetation around the lake used to be lush, with wetlands, freshwater springs and ponds characteristic of the landscape, all of which the respondents associated with good health, as was noted by one of them:

"When the nature was healthy, so were we. Now all the plants here are dying and everyone in the village is sick." (Male, 46)

The respondents claimed that the groundwater and water from the streams used to be clean and healthy and most previously used water from the wells for drinking purposes. The farmers also attributed the good quality of vegetables and fruits to the water in the area. As the water crisis

escalated, the groundwater and the water in Lake Urmia deteriorated in quality and became associated with ill health, as exemplified by the following quote:

"The lake makes us sick. I feel generally unwell. The water we drink and the food we eat are poisoned by the lake. Even the air we breathe is full of salt and dust from the lake. I am always coughing and my eyes sting when I come outside." (Male 50)

The changing symbolic meaning of water is represented by the transition from the perception of clean water as being associated with life, health and prosperity to the perception of an altered, deteriorated water as being increasingly associated with disease and even death. Indeed, while no comprehensive study of health impacts of the desiccation of the lake has yet been carried out, respondents reported various health impacts deriving from salt storms and decreased quality of drinking water, ranging from eye and respiratory diseases to increased rates of cancer and kidney diseases.

Overall, the profound socio-natural changes that the downstream population experiences interfere with various meanings, roles and values of water in their lives. All of the changes mentioned above, those relating to their way of life, their culture, economy, community dynamics, environment, health, and access to resources, are elements that constitute social impacts and should be considered in the process of SIA (Vanclay et al. 2015). However, despite these various social impacts of hydraulic infrastructures experienced by the downstream population, this population is rarely considered in SIA (Kirchherr et al. 2016). While the Iranian legislation only requires SIA to be carried out for larger objects (more than 15 meters in height and for larger irrigation networks), this is rarely adequately performed (Ahmadvand et al. 2009). Furthermore, cumulative effects of several smaller elements of water infrastructure, which can be greater than those of a single large dam and most severely affect the downstream users, are not considered in SIA.

While SIA is often presented as a politically neutral and objective process, its execution is shaped by and in turn shapes the contextual socio-political relations. Additionally, the very semantics of classifying the impacts as 'social' presumes and reproduces the dualistic understanding of nature and society as two separate entities. Considering social impacts as deriving from hydraulic interventions creates an *a priori* distinction between the hydraulic and the social, as only externally related. One of the main constrains of such reasoning in the conceptual framework of

SIA is a lack of the cyclical perspective, which is captured in the hydro-social cycle. Indeed, one of the main advances of the hydro-social cycle apart from transcending the society-nature dualism is the emphasis on the process of the production of socionatures in which hybrid objects take part as both products and agents of discursive, physical and cultural practices (Swyngedouw 2004; Linton & Budds 2014; Linton 2010). By presenting the relationship between hydraulic infrastructures and social impacts as external and linear, SIA misses the opportunity to critically examine the social processes and social power dynamics that are embedded and materialized in hydraulic structures such as dams. The manipulation of water flows through hydraulic infrastructure in turn impacts the social organization and shifts social power geometries, with the produced water being the object and the agent of social and political change. SIA oversimplifies this relationship and fails to place the hydraulic infrastructures within the hydro-social cycle. As any changes in the water flows within the hydro-social cycle have the potential to alter the whole hydro-social assemblage (Linton & Budds 2014) an often applied spatial limitation of SIA only to the construction site is a serious limitation to performing a comprehensive assessment, as has been stressed by other authors (e.g. Kirchherr et al. 2016). Indeed, scale holds an important place in the political ecology research, with scholars challenging the traditional divisions of space such as 'local' or 'national', and argue that rather than by geographical boundaries, scale is defined by complex and dynamic political and economic processes (Budds 2008). Hydraulic projects are always political in nature and alter power dynamics within the waterscape, and therefore affect a far wider population than only that in their immediate surroundings. Without recognizing the stakeholders outside the preset scales, it is impossible to meet the main goals of IWRM, namely those of promoting wide participation in decision-making and considering the water rights of all.

5. Conclusions

This article adopts the perspectives of hydro-social cycle and waterscape to explore how the historical, social and political processes transformed the Lake Urmia waterscape and created one of the biggest environmental catastrophes in Iran, the desiccation of that lake. In the last decades the technical view of water as 'modern water' (Linton 2014), a resource to be controlled and exploited through hydraulic infrastructure for economic benefit, has dominated Iranian water management. Such a view of water is not politically neutral, but is shaped in a way to serve the interests of the dominant social and political groups (Boelens et al. 2016) while disregarding all other complex values and meanings of water such as its social, spiritual, ecological and cultural functions, which have informed Iranian water management for centuries. The intensive hydraulic

development which was focused on economic growth and driven by the promise of economic prosperity, control over climatic conditions and food self-sufficiency, was not limited to producing only the desired outcomes. The over-appropriation of water in the upstream regions created a territorialized water scarcity in the downstream areas, a degradation of ecosystems and restructured socio-political relations in the regions. Unequal water distribution shifted the power dynamics between water users, deepened social inequality and created patterns of inclusion and exclusion in the access to water. The water rights of informal water users have been overlooked in water management schemes, which has had severe impacts on their livelihoods. As this article shows, the waterscape transformation has disrupted the social and political relations in the downstream region of the basin and impacted biophysical, cultural, social, health-related and economic conditions of the water users.

With SIA being the most important tool in Iranian legislation that addresses the social dimensions of hydraulic projects, this article suggests that the perspectives of hydro-social cycle and waterscape could help inform a more holistic and comprehensive social impact assessment. They could also offer a chance to explore the motives and narratives behind hydraulic constructions and an analysis of who will benefit and who will lose from them on a wider scale. Indeed, the literature on the hydro-social cycle suggests that any intervention into the hydro-social cycle may alter the social and power assemblage within the whole cycle (Swyngedouw 2004). Hydraulic infrastructures should therefore not be seen only as technical objects that enable the most rational and efficient use of water resources, but as products of distinct historical narratives and social processes holding particular symbolic values and serving to advance particular political interests. The social impacts are not spatially limited to the immediate surroundings of infrastructure projects (Kirchherr et al. 2016), but resonate throughout the waterscape, and should therefore be assessed on a wider scale. Another omission in the evaluation of social impacts is that they are often required only for larger objects; however, many other objects have a potential to create considerable social impacts. As SIA is performed for individual projects, their cumulative impacts on downstream communities are not assessed, even though they might be significant, as is explored in this article on the case of the downstream communities around Lake Urmia. Although IMRW which has been formally adopted in Iranian legislation in 2003 stresses the participation of all stakeholders in water management, downstream communities remain overlooked. A more critical and comprehensive evaluation of the social impacts of hydraulic developments could help reduce social inequality often exacerbated by such projects and give voice to the marginalized water users.

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CONCLUSIONS

This thesis explored different impacts of the anthropogenic alterations of water flows on the disadvantaged downstream communities who suffer produced water scarcity, which disrupts their socio-natural environment and interferes with their way of life and with the various roles and values of water. With a renewed world-wide surge in the construction of dams, which is driven by the discourse of sustainable and renewable hydropower (Zarfl et al. 2015), research into various negative impacts of hydraulic infrastructure is as relevant as ever. This final chapter presents the main findings of the thesis and their contribution to the literature, and outlines ideas for future research.

Informed by the broader field of political ecology this thesis used the case study of the dessication of Lake Urmia to investigate the unequal access to water between different groups of water users and linked this to political power dynamics. Further, it explored the impacts of the poduced water scarcity on the lives of disadvantaged water users. While outlining the historical production of the Lake Urmia waterscape and the macro-level power dynamics of different groups, the main focus of this thesis were the local communities in the immediate surroundings of the Lake Urmia lakebed. Those communities experience the most profound changes to their water-based livelihoods, with these resulting not only from the water shortage, but also from the changing socio-political circumstances at the micro-level.

This research has shown that when faced with the same environmental disaster, there can be significant disparities in the vulnerability and adaptive capacity between different groups of people even in relatively small communities. This is closely related to the broader socio-political power dynamic. Interacting with different concepts from the political ecology of water such as waterscape, hydro-social territories and hydro-social cycle, this work investigated how waterscapes are constructed and reconstructed, highlighting the contested nature of the alterations of hydro-social territories. It analyzed various consequences this has for the

marginalized water users, with a specific focus on the under-researched impacts on their mental health. By exploring the various roles and values of water through the social impacts experienced by the disadvantaged downstream water users the thesis also exposed some of the shortcomings in the application of the main paradigm in water governance which fails to reduce the inequalities illuminated in the thesis. The research was based on ethnographic fieldwork during which interviews were conducted with local farmers, government officials and experts.

1. Main contributions

- *To the political ecology of vulnerability*

Chapter II of the thesis showed that despite all downstream water users in the studied area suffering from water scarcity and environmental degradation, major differences exist in the vulnerability and adaptive capacity between the members of different minorities. This differential vulnerability is a reflection of their political power at the state level, which is the result of the historical dynamics of marginalization and empowerment. One of the main contributions of the chapter is to establish the link between the vulnerability to environmental disasters at the micro-level and the dynamics of marginalization and empowerment at the macro-level, which allows for the understanding of the causes of marginalization and subsequent enhanced vulnerability of certain groups. We argue that understanding those processes by adopting the analytic framework with sufficient temporal scope is the key to decreasing the observed levels of inequality. The chapter also shows that the empowerment of one group might increase the marginalization of the other, which is most visible in the cases when the two compete for the same resources. This also determines whether coping mechanisms to environmental disaster will take predominantly individual or collective form.

- *To the state of minorities in contemporary Iran*

Another significant contribution of this chapter is to the scarce literature on the status of the Kurdish and Azeri minorities in Iran, particularly as it shows the differential treatment of different minorities in Iran since the Islamic Revolution (1979). While a limited number of national-level studies offer some insight into the political status of minorities on the state level (e.g. Yildiz & Taysi, Romano 2006), there is a gap in research on how and through which pathways the state-level disparities in access to political power extend to the household and

individual level. This chapter contributes to the especially scarce literature on the state of Iranian Kurds.

- *Establishing the link between produced water scarcity and mental health*

Chapter III of the thesis adopted the conceptual framework of hydro-social territories to analyze the governmentalization of hydro-social territories in the Lake Urmia basin at the local level. It investigated how and through which pathways this impacted the mental health of the disadvantaged water users suffering severe manufactured water scarcity, which is a highly under-researched domain. It brought to light the contested nature of the alterations and governmentalization of hydro-social territories, the unequal power relations between different groups of water users, the intertwinement of legal and illegal hydro-social territories and exposed the psychological burdens experienced by the marginalized water users.

The main contribution of this chapter is to establish the link between the produced water scarcity and mental health, while acknowledging the various dimensions of water and the political and social forces shaping its flows. While the connection between environmental degradation and psychological distress has been established by other researchers (Coelho et al. 2004; Hanigan et al. 2012; Hayes et al. 2018; Speldewinde et al. 2009; Willox et al. 2015), it has so far overlooked the function of the asymmetric power relations in the decision-making process and the availability of resources for different groups of people. This is especially important because different groups of water users can experience water scarcity very differently. The focus on mental health is vital, as it has long not received adequate attention and remains a neglected area of healthcare in most of the world. More than three-quarters of people suffering severe mental health conditions in low- and middle-income countries do not receive the needed treatment (WHO 2010). With those countries expected to be the hardest hit by water scarcity, which is expected to lead to 1.8 billion people experiencing absolute water scarcity (the availability of less than 500 cubic meters of water per person per year) by 2025 (WHO 2015), the burden on mental health is likely to further increase in the future. Understanding the pathways between water scarcity and mental health is important for recognizing the urgent need for improved provision of and access to mental health services for the vulnerable population. Even more importantly, this chapter shows the need for addressing the underlying causes that make certain parts of the population more vulnerable to psychological disorders, with these being the exclusionary policies and development plans that deepen inequalities between water users.

- *To the understanding of the production of waterscapes and the limitations of SIA in evaluating the social impacts of hydro-social transformations*

Finally, **Chapter IV** of the thesis investigates the changings narratives in water governance in Iran and the historical production of the Lake Urmia waterscape. It explores the various roles, meanings and values of water for the downstream users who experience extreme water scarcity mainly as the result of intensive hydraulic development in the upstream regions. It critically evaluates the dominant frameworks and tools adopted by the Iranian legislation that inform water governance. The main contribution of the chapter is to explore the various dimensions of water in the lives of disadvantaged water users, and thereby expose the shortcomings of the application of Integrated Water Resources Management (IWRM) and in particular Social Impact Assessment (SIA) that fail to consider them. SIA is often inadequately executed, overlooking the downstream communities, which are frequently the ones suffering the most from upstream hydro-developments, with the assessment thus failing to meet some of the integral aims of IWRM, those of considering all stakeholders in the decision-making process and to promote social equity and justice. The chapter suggests that the perspectives of hydro-social cycle and waterscape could inform a more comprehensive and inclusive SIA. Adopting the cyclical perspective of the hydro-social cycle would enable a more critical analysis of the narratives and power relations that produce and are embedded in hydraulic infrastructures and the alterations within the hydro-social assemblages such projects create. This could uncover a wide range of stakeholders who lose and benefit from those projects, with this helping to determine the scope of necessary evaluation of the social impacts. SIA is often performed only with a limited spatial scope in the surroundings of the hydraulic projects, which is a serious limitation to capturing the real extent of the social impacts that the hydraulic infrastructures create.

2. Outlook for future research

During the research several other ideas and questions emerged that could not be included in this thesis, but could provide avenues for future research.

The first relates to one of the limitations of this research, namely the absence of a gender perspective. Other researchers have established that different genders are differently affected by water scarcity (e.g. McCully 1996; WCD 2000) and experience different levels of vulnerability. Further research into the vulnerability, coping mechanisms, social impacts and mental health impacts on water users of different genders in this area could provide a better insight into their differential experience of water scarcity. Identifying the most vulnerable groups within a society

is especially important in order to ensure that suitable relief mechanisms which address their needs are available and accessible to them. Inequality can only be decreased by recognizing and addressing the differential vulnerability of different groups.

Second, to gain a better understanding of mental health impacts of water scarcity, an inclusion of mental health professionals into the research would be necessary. While in-depth interviews offered some insights into the psychological problems that the respondents were experiencing, this does not allow for the diagnosis of mental health conditions. Diagnosing the type and severity of psychological disorders would require the use of expert mental health screening and psychodiagnostic assessment tools by trained psychologists or psychiatrists. The changes in the incidence of mental health disorders as the water scarcity progresses could be evaluated by the analysis of medical records, when available and accessible to researchers. Awareness of the groups of people that might be excluded (such as those most vulnerable with a limited access to healthcare) is especially important in such analysis. A stronger understanding of the pathways linking water scarcity and environmental degradation to mental health as well as better knowledge of the incidence and types of mental health disorders is crucial for building a strong platform of action.

Third, while most of the respondents mentioned serious health impacts they believe result from the poor quality of drinking water and the salt storms, no comprehensive study of the health effects of the desiccation of Lake Urmia has to my best knowledge been conducted so far. The shrinking of Lake Urmia resembles the Aral Sea catastrophe, where the desiccation of that salt-lake caused severe health impacts for the population living in its proximity. The documented health impacts included anaemia, kidney and liver diseases, respiratory diseases, increased rates of different types of cancer and increased rate of tuberculosis. There has also been a dramatic decrease of average life expectancy and an increase in infant mortality. Researches have established the connection between those diseases and exposure to pesticides and other chemicals used in agriculture in the basin which accumulated in the lakebed and polluted the soil and water supplies in the region (Austin Wæhler & Sveberg Dietrichs 2017; Crighton et al. 2011). Many of the health impacts researched in the Aral Sea region were also described by the population in the surroundings of Lake Urmia. Urgent need therefore exists for a comprehensive assessment of the health status of the population and the provision of accessible healthcare services.

And lastly, Iran and the Lake Urmia basin in particular represent a good platform for investigating the relationship between water flows, hydraulic infrastructure and political rule. The 'hydraulic mission' (Allan 2006) with extensive dam building in Iran started before the regime change in 1979, and while the political change was radical, the dam building mission continued. The analysis of the discursive power strategies legitimizing extensive dam building used by the two regimes, and the changing symbolic value of dams would make for pertinent research. At the local level, the Lake Urmia basin represents a case study where formal state, provincial and local water governance coexists alongside the informal, traditional one. This has been touched upon in chapters III and IV of the thesis describing the intertwinement of legal and illegal hydro-social territories, and could be researched further. A study of the changing dynamics of the power of formal and informal water institutions as water scarcity intensifies would be relevant for understanding water use and governance in many areas threatened by water crisis.

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