STEFAN DÖRING

DEVELOPMENT DISSERTATION BRIEF

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BRIDGE OVER TROUBLED WATER: CONFLICT AND COOPERATION DURING WATER SCARCITY

EBA

Bridge over Troubled Water:
Conflict and Cooperation During Water Scarcity

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Development Dissertation Brief, 2022:07
to
The Expert Group for Aid Studies (EBA)

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This report summarizes findings from the doctoral dissertation *Cooperation and Conflict amid Water Scarcity*, defended in May 2022 (Döring, 2022).

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Sammanfattning

Denna Development Dissertation Brief (DDB) bygger på en doktorsavhandling om vattenresursers betydelse för samarbete och konflikt mellan icke-statliga aktörer. Analyserna bygger på statistisk modellering och använder till stor del geografiska data för att undersöka sambandet mellan tillgång till vatten och socioekonomiska processer, såsom konflikt. Avhandlingen undersöker hur bristande tillgång till grundvatten ökar förekomsten av våld mellan icke-statliga aktörer. En analys av spridningsprocesser visar att torka inte påverkar våldet lokalt, utan genom gränsöverskridande effekter. Vad gäller potentialen för samarbete så pekar studien på hur torka kan skapa incitament för samarbete, både mellan individer och grupper. Resultaten har flera implikationer för policy och forskning. I hela avhandlingen betonas behovet av att analysera och arbeta med dessa frågor på olika gruppnivåer, eftersom både konflikt och samarbete gradvis förändras genom olika handlingsytor (individ, grupp, statlig, etc.). Jag resonerar vidare att grundvatten utgör ett viktigt skydd under torka, vilket understryker vikten av att övervaka och hantera grundvatten för att förhindra konflikter.

Abstract

This Development Dissertation Brief (DDB) builds on completed doctoral research on the role of water resources for cooperation and conflict among non-state actors. Building on statistical modeling, the analyses make extensive use of geographic information to gauge the relationship between water access and socio-economic processes, such as conflict. The work investigates how insufficient groundwater access can increase the incidence of communal violence. The analysis of spillover processes, specifically, shows that drought impacts violence not locally but through wider neighborhood effects. Shifting to the potential of cooperation between actors, the research further provides evidence of how drought could be a harbinger for cooperation, both between individuals and groups. This work has several implications for policy and research. Throughout the dissertation, I argue that analyzing and addressing different group-levels is key because conflict and cooperation dynamics transition different spheres of action (individual, group, state, etc.). I further argue that groundwater represents a vital buffer during drought. Yet, groundwater needs to be better monitored and managed in order to prevent conflicts.

1 Background and Rationale

1.1 Water is life

Safely managing water is key for livelihoods, food security, energy production, and overall socio-economic development. The good news is that most people have safe access to water. Over the last century, worldwide water use has increased sixfold, and it is estimated to increase at about 1% per year for the foreseeable future (UN Water, 2020). Yet, over two billion people remain without safe drinking water and more than four billion lack basic access to sanitation (ibid). There are about 160 million people who fetch water from a river or lake, most of them in Sub-Saharan Africa (UNICEF-WHO, 2017). An estimated 844 million people worldwide spend 30 minutes or more daily on collecting water for everyday needs. Globally, 80% of households without their own water supply rely on women and girls to fetch their water (ibid). On a large scale, we may notice great improvements in water supply. Yet, a significant amount of people across the globe continue to face serious challenges. Moreover, water supply issues are closely tied to climate change.

Climate change is known to accelerate land degradation through exceptional occurrences of precipitation, flooding, droughts, dry periods, and heat waves – all phenomena which the IPCC predicts will increase in frequency for the foreseeable future (Seneviratne et al., 2012; Shukla et al., 2019). These developments threaten livelihoods because degrading water quality and quantity further elicits severe socio-economic consequences.

This report builds on a completed doctoral research on the role of water resources (Döring, 2022). The work investigates how insufficient groundwater access increases incidences of communal violence. I further analyze the spatial spillover of conflict; specifically, the analysis shows that drought impacts

violence not locally but through wider neighborhood effects. Shifting to the potential of collaboration, the research further provides evidence of how drought could be a harbinger for cooperation, both between individuals and groups.

1.1.1 Water scarcity

The most central concept for the dissertation is water scarcity. I define water scarcity broadly as "an excess of water demand over available supply in a specific area". This definition builds on conceptual arguments in the previous literature (FAO, 2012; Ostrom, 1990; Rijsberman, 2006). We could also think about water scarcity as a deficit of available supply relative to water demand. However, I argue that it is more appropriate to take a demand-focused approach as this takes human behavior as a starting point for understanding water scarcity.

Issues arising from water scarcity relate to three main categories, namely disputes over quantity, quality, and control (Swain, 2012). For example, conflicts between herder groups might arise over how much water to share, whether the water is for animals or drinking (quality), and who controls wells or other access points. Particularly during times of armed conflict, individuals may face different types of water scarcity linked to these three domains. Furthermore, responses to water scarcity occur on different societal levels: through individual or group-specific coping strategies and through adaptation processes at the macro level (regional, state, and transboundary).

While water scarcity often refers to the absence of adequate water resources in a specific geographic area, water scarcity is always relational and thereby user dependent. Solely human relations can generate water deficiencies even if water scarcity originates through natural phenomena like geological or climatic processes (e.g., erosion, rainfall, or salination). Thus, how communities

consume water determines their desired and expressed water needs. This means that water scarcity is shaped by prevalent practices. Such norms can vary by, for instance, geography, ethnic kinship, income, age, or gender.

Established norms over water use can change, for instance through higher living standards, but also through induced shortage from other uses. Demands from increasing urbanization, agriculture as well as manufacturing industries are crucial determinants of water scarcity. These sectors can accelerate or even drive erosion, pollution, or other processes that, in turn, further exacerbate water scarcity.

Lastly, I consider groundwater a crucial buffer that helps to overcome rainfall and surface water shortages. By groundwater, I refer to water obtainable from below the land surface. In parts of the dissertation, it is assumed that access to water is more difficult where groundwater tables are deeper. Yet, depth alone is not the sole determinant of access as it does not say anything about pollution or other features of water. Furthermore, geology and contingent rock formations shape suitability for well-building. This means that using groundwater requires knowledge of the specific aquifer, know-how of abstraction, and financial means, among other things.

1.2 Research gaps

The dissertation broadly speaks to climate-conflict research, as well as more general international relations studies on water and conflict. The research also tracks the footsteps of seminal works on resources within, for instance, anthropology, economics, geography, health research, and sociology. Such work highlights, for example, cooperation issues for pasture by herder communities (Hardin, 1968), groundwater allocation (Ostrom, 1990), and

access to safe water (Duflo et al., 2015). For example, improvements in water infrastructure can decrease water-related diseases and childhood mortality (Duflo et al., 2015; Fewtrell et al., 2005; Kremer et al., 2011).

By focusing on different effects of exposure to water scarcity, the dissertation contributes to the climate-conflict literature. Extensive reviews and meta-analyses on the links between violence and climate factors have been published in recent years (e.g. Buhaug and Uexkull, 2021; Dell et al., 2014; Koubi, 2019; Seter, 2016; van Baalen and Mobjörk, 2018). This literature does not find robust evidence for links between climate-change impact and violence at the inter-state level. Instead, much more focus is placed on the role of water scarcity in relation to different types of intra-state conflict, including civil war-related violence, social unrest, and protest, and communal violence.

A recurring feature of the literature is the focus on climate-induced changes as external shocks explaining the use of violence (Miguel et al., 2004). For instance, changing rainfall patterns can create imbalances between conflict dyads or alliances (König et al., 2017), especially in connection with marginalized ethnic groups and agricultural dependence (Vesco et al., 2021; von Uexkull, 2016).

1.2.1 Communal conflict and water

During the last decade, communal conflict has received increased attention within conflict research. Nevertheless, it remains understudied within this research field in comparison with the literature on civil war. Communal conflict has generally been studied from different perspectives and within various disciplines. More qualitative studies on communal violence have been undertaken within geography whereas quantitative research on communal violence mostly has been conducted within political science and related subjects.

The role of water scarcity (and related resources) is a key feature in such studies. This relates directly to formal and informal governance, which have been argued to be key factors that mitigate communal conflicts. Studying communal disputes over water ties together issues of land tenure, climate change, and grievances. There are also theorized links to migration, an inherent feature of pastoralism. For instance, pastoralists are found to avoid land conflict and generally move to more favorable vegetation (Lenshie et al., 2020). Yet, this can create tension elsewhere.

The literature suggests that group competition over resources largely depends on the level of governance as well as socio-economic marginalization (Benjaminsen et al., 2012; Detges, 2014; Fjelde and von Uexkull, 2012; Linke and Tollefsen, 2021; Papaioannou, 2016; van Weezel, 2019; Vestby, 2019). This is also visible in the water sector, where service provision has been linked with a lowered risk of communal violence (Cao et al., 2020).

Local (and central) governance can hinder or feed into communal conflict escalation through legal systems or by fueling expressed grievances (De Juan, 2015; Eck, 2014; Wig and Tollefsen, 2016). Property rights issues are often directly associated with watershed use (Katusiime and Schütt, 2020).

Communal conflicts repeatedly relate to reforms of the legal system which may overrule existing (in)formal land use practices (Benjaminsen and Ba, 2009; Boone, 2014; Lund, 2008). This can also be linked to governments taking sides in favor of certain ethnic groups. Such biases can either aggravate or dampen existing disputes (Brosché, 2022; Elfversson, 2015; Klaus, 2017; Krause, 2018). However, there is also potential to resolve disputes through institutions. Customary governance has been identified as an important ingredient in the resolution of communal conflicts (Brosché and Elfversson, 2012; Elfversson, 2019; Greiner, 2013; Petrova, 2022; Wig and Kromrey, 2018).

Local community and religious organizations hold higher trust and are generally more successful in reaching non-violent solutions to communal disputes (Cao et al., 2018; De Juan, 2015; Krause, 2018; Mustasilta, 2018).

The issue of groundwater access has been mostly neglected by previous research on water and conflict. Sekhri (2014) finds difficult groundwater access to increase poverty and lead to disputes over well usage, e.g., surrounding irrigation vs. drinking water. For northern Kenya, Detges (2014) shows that pastoralist fighting is more likely in proximity to well sites. This is also one of a few climate-conflict studies that speak to groundwater. The findings suggest that violence is more common where access to water is scarce, yet this was not tested more explicitly regarding groundwater storage. It is crucial to understand that drought conditions do not necessarily correlate with low groundwater. Depending on the study area, such considerations can be misguided. Heavy rainfall can in some areas, following even long streaks of drought, replenish groundwater levels, enabling water use throughout the year. Yet, several other factors determine groundwater availability, and it is crucial to account for local conditions.

Overall, literature across disciplines provides enormous knowledge connecting water resources with peaceful or conflictual behavior. Some gaps remain across different aspects of the literature. Climate-conflict research emphasizes water scarcity as a potential driver of violence, but there are fewer insights into how, for example, drought could lead to more cooperative behavior. While water cooperation is extensively studied in the literature on inter-state water relations, those analyses often neglect the fact that violence can still occur among actors within hydro-basins. Lastly, very few approaches combine varying water sources, i.e., they often feature only one of the following: rainfall, surface water, or groundwater. Here, it is particularly notable that groundwater has been largely left out by a large part of the literature on drought and violent behavior.

1.3 Relation to International Development Cooperation

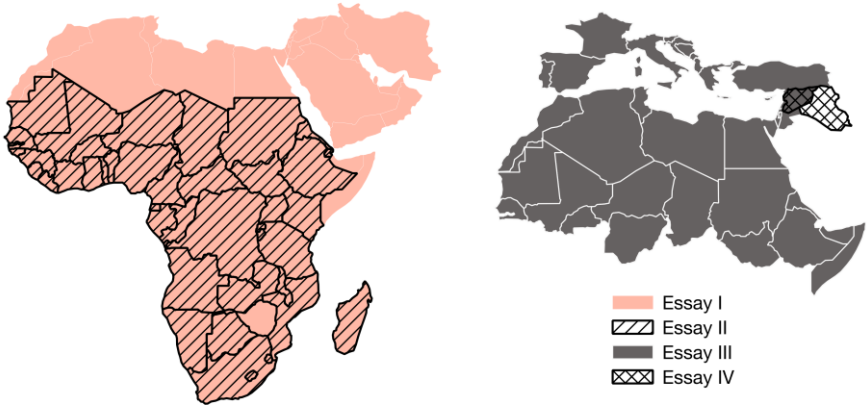
In work related to this research, my co-authors and I have argued that existing frameworks on water diplomacy can be key tools to engage local communities and policy stakeholders alike (Grech-Madin et al., 2018). Yet, much of the existing policy work on water diplomacy focuses on the country-level.

Inter-state water negotiations often display a mismatch between "state-focused" water diplomacy and local water users. This means that the ground realities can be absent from water diplomacy. These diplomatic processes and water governance in general, can be improved by synthesizing and better coordinating work at the national or river-basin level with active engagement of sub-national stakeholders and local dynamics. Better data within a state can further help policy makers, local actors, and other stakeholders to take more targeted actions. Clearly, accurate and reliable information can inform research and policymaking. Where applied, such synergies will be fruitful in enhancing evidence-based policy – a key ingredient for meaningful water diplomacy.

2 Research aims and questions

This doctoral research summarized in this brief consists of four separate studies, which can be broken down into two larger parts. First, I study water scarcity in relation to a specific type of conflict, namely communal violence. The second part deals with water scarcity as a source of cooperative behavior; this includes individual as well as group-level cooperation. I consider cooperative behavior as a key ingredient to peace. Furthermore, the second part also accounts for previous exposure to violence, thereby further linking cooperation and conflict.

Figure 1: Areas covered by the four studies/essays of the dissertation



2.1 Methods and data

All studies make use of statistical modelling using geographic information (GIS). I focus on so called grid-cell units, which allow within-country comparison of water access and climate processes. The grids can be thought of as a global fishnet with each cell measuring about 55 by 55 kilometers. The four studies (referred to as essays in the dissertation) cover different parts of Africa, Southern Europe, and the Middle East (see Figure 1).

Covering larger areas with quantitative methods allows for a more general interpretation, yet an obvious disadvantage is that the analyses can lose case-specific depth. I have tried to overcome this challenge in two ways. First, case-specific research and critical literature inform the studies both empirically and theoretically. I corroborated desk-based information through conversations with other researchers who have conducted in-person visits in the regions that are covered by the studies. I also frequently discussed my

assumptions on water access with technical experts at international conferences. This also included interviews with hydrologists, stakeholders, and experts on boreholes and well construction.

Another integral part of the research is the use of hydrological data to capture water scarcity. The research accounts for rainfall, drought, groundwater, and major surface water bodies. The different water measures primarily build on data captured through remote sensing. A disadvantage with such data can relate to validity and reliability. It is also more difficult to obtain micro-level data on water resources. I also acknowledge that norms and inter-personal differences in water use cannot be obtained through remote data collection. I have tried to address this by considering ethnographic accounts of water usage as I rely on physical measures of water scarcity. Nonetheless, using remote sensing data even at lower spatial resolutions has several advantages. It allows one to compare large geographic areas and makes data collection possible without on-site visits. Using such data also avoids the use of surveys on water scarcity reporting which has several ethical upsides.

For this research, the key dataset used for measuring violence builds on the Uppsala Conflict Data Program (UCDP). Nearly all event data is derived from news media or reports by policy actors and the literature exemplifies how reporting biases or varying coding procedures may affect the quality of events data (Croicu and Kreutz, 2017; Eck, 2012; Weidmann, 2016). Building on my experience of working within the water policy sector, I acknowledge that data on water events potentially under-report observations due to the nature of track-2 efforts or behind-the-door hydropolitics. Such topics are highly sensitive to governments as well as NGOs working on inter-community water issues (Grech-Madin, 2021). The full impact of interventions and actions is difficult to ascertain but the research aims to minimize biases through different control variables, e.g., accounting for government censorship.

3 Findings and Discussion

The dissertation consists of four separate studies, two of which have been published in academic peer-reviewed journals. Below, I discuss the combined results of the four studies along the two main themes: cooperation and conflict. The table below provides an overview of the individual studies.

Table 1: Overview of the studies

Study	Region	Main findings	Reference
1) How Access to Groundwater Affects Violence	Africa, Middle East	Low groundwater access increases violence; state presence mitigates effect of scarcity on conflict	Döring 2020a
2) Spatial Patterns of Communal Violence	Sub-Saharan Africa	Local drought increases risk of nearby conflict (not locally)	Unpublished/ under review
3) Analysis of Domestic Water Cooperation in Drought-prone Regions	Mediterranean, Sahel	Low groundwater access increases water cooperation; state-based cooperation common where previous armed conflict occurred	Döring 2020b
4) Drought Exposure and Altruism: Evidence from Surveys	Iraq, Syria	Exposure to drought decreases individual cooperative attitudes	Unpublished/ under review

Note: Unpublished manuscripts available upon request.

3.1 Conflict

The first study focuses on water scarcity as a driver of conflict. The research is published in the journal *Political Geography* (Döring, 2020a). The analysis differentiates three different types of water resources: groundwater, rainfall, and surface water. The study argues that it is crucial to analyze different water sources to explain incidences of communal violence because drought mitigation is dependent on the available resources. The main argument rests on the fact that groundwater is more readily available year-round and sometimes far away from streams and rivers. Therefore, groundwater provides a much-needed buffer to communities that suffer from water shortages. The paper also presents conditional arguments further explaining the role of groundwater in relation to population density and state presence. On the one hand, more densely populated areas are associated with a higher demand for water for agriculture, industry, and household water services. This means that the effect of dwindling groundwater access should be more pronounced in more densely populated areas. State presence, on the other hand, is crucial when mitigating the adverse effects of water shortages for communities. Similarly, inclusive property rights implemented through the state can dampen the effect of insufficient groundwater access on communal violence.

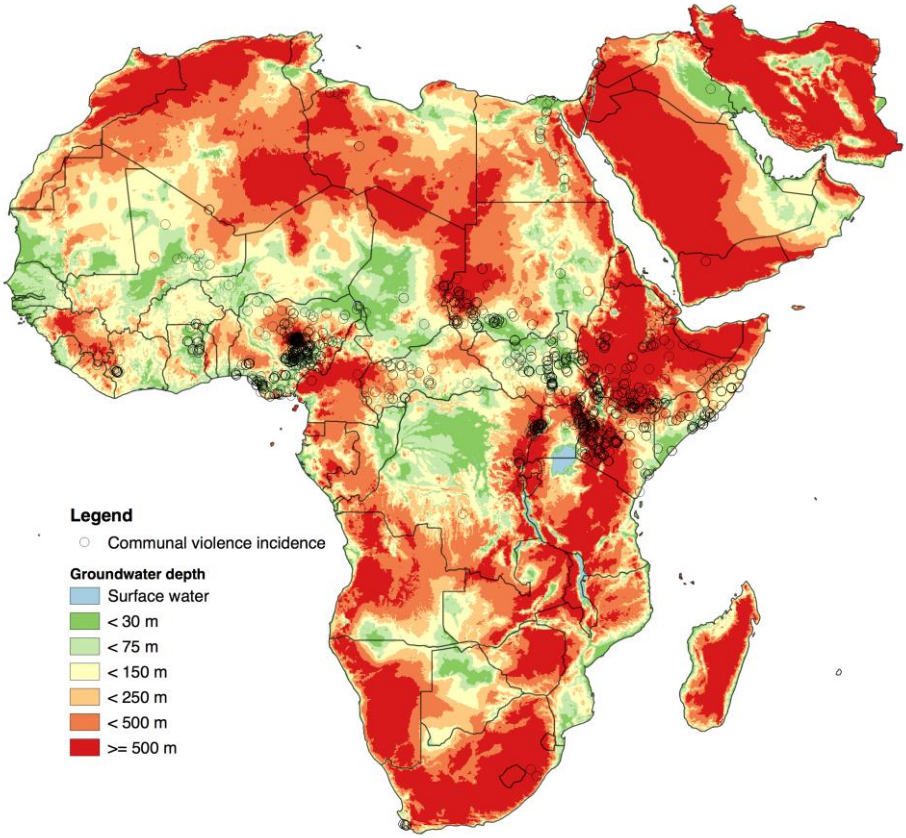
The second study focused on conflict sheds light on the spatial dynamics of communal violence and water scarcity. Focusing on drought, I argue that in order to explain communal violence, we must distinguish between local and neighborhood effects. More generally, this means that causes of disputes do not necessarily influence armed conflict locally, but rather further away. This is especially important for water shortages. As livelihoods are endangered as a consequence of drought, migration and market effects on agricultural products can lead to spillover effects in areas further away from the area affected by water scarcity.

The findings show that insufficient access to groundwater increases the risk of communal violence. For example, comparing areas with 30-meter and 55-meter average groundwater depth, I find that the odds of communal violence increase by about 36 percent in areas with 55-meter average groundwater depth. Further, the effect of groundwater access on communal violence is conditioned by precipitation levels as well as population density. The results also suggest that a higher degree of government services lowers the effect of groundwater on violence. In other words, where state presence is higher, scarce groundwater has a much smaller effect on communal conflicts.

Furthermore, the findings uncover that spillover effects from water scarcity are crucial when explaining incidences of communal disputes, namely that drought explains violence not locally but rather in the neighboring areas. The results further show that the likelihood of violence increases by almost ten percentage points if there is an incidence of communal violence nearby.

The research makes several contributions. While there are many in-depth case studies on farmer-herder conflicts, there are very few large-N studies on communal violence and water scarcity beyond meteorological drought. Moreover, no previous large-N study on armed conflict has explored the effects of groundwater access. The study is also the first to use geo-spatial data on a combination of groundwater, rivers, and precipitation. Furthermore, most climate-conflict studies have analyzed only Sub-Saharan Africa. My analysis expands to other geographic areas, where, despite being rare, communal violence is not absent.

Figure 2: Communal conflict incidence and groundwater depth in Africa and the Middle East (1990–2014)



3.2 Cooperation

The second part of the dissertation shifts the focus to cooperation. One of the studies on this topic has been published in the journal *Global Environmental Change* (Döring, 2020b). All parts of the dissertation make assumptions and arguments regarding individual behavior following exposure to water scarcity. In the last study of the research project, I specifically test the pathways of these micro-level assumptions. Shifting focus from group- to individual-level analysis, the fourth study examines the role of exposure to drought for pro-social attitudes (as a proxy for cooperative behavior).

While much of the previous literature has focused on water scarcity and violent conflict, my analyses show that water-scarce areas are also likely to witness instances of water cooperation. Everything else being equal, more difficult access to groundwater is found to increase the likelihood of water cooperation, both between non-state actors and between the government and non-state actors.

At the group level, the same pathways that can link resource scarcity to conflict may also explain how shortages can lead to cooperation. I argue that this is not puzzling per se. Upon recognizing resource shortages, communities or other actors usually begin to engage in distribution issues through explicit interventions. Such behavior can be positive, i.e., they might result in sharing agreements or other allocation mechanisms. Water scarcity can also lead to interactions that are less positive in nature, like the illegal appropriation or diversion of water resources. While the theoretical argument assumes cooperation to be the more likely result of experienced scarcity, conflict might still occur over shared resources. For government and non-state actors, violent altercations are costly and will not benefit resource allocation or sharing in the long-term. Communities should thus have a particular interest in cooperation after incidences of violence. This also dovetails with seminal work by Ostrom (1990) who argues that repeated interactions, even if conflictual, will eventually lead to more cooperation over shared resources.

The study also finds that more difficult access to groundwater increases the likelihood of water cooperation, both between non-state actors and between the government and other domestic actors. The work further shows that the relationship between water scarcity and non-state water cooperation is stronger in less democratic countries. This suggests that in less democratic countries, actors find solutions to water scarcity without help from their central government. The insights from this study link to case studies which have long suggested that water scarcity can be a driver for cooperation.

A large share of the areas included in the analysis have witnessed armed conflict. Yet, the same areas also show incidences of cooperative water events. Here, cooperative events refer to actions between at least two actors that aim to improve the access to safe water. In fact, my analysis suggests that areas that have experienced violence are substantially more likely to see cooperative events on water issues. A similar relationship is, however, not found for non-state cooperation as an outcome variable.

Examining the individual level, the fourth paper considers cooperation based on data from surveys among refugees from Syria and Iraq. The responses were matched with observational data on drought for the years respondents left their home areas. War and extended water scarcity can negatively affect personal health. Here, the research suggests that drought exposure could affect such cooperative behavior as well. Individuals are more inclined to value their own welfare over other individuals' welfare.

The findings suggest that drought exposure is associated with decreased cooperative attitudes (measured as altruism) for the survey respondents generally. For instance, survey respondents exposed to drought show a 42% decrease in altruism relative to the average sample of respondents. The research further shows key conditional effects through group affiliation. In

particular, the analysis reveals that people with higher drought exposure appear more cooperative towards members of their own group (here a highly salient ethno-religious group).

This ties together the literatures on social psychology and climate-conflict, making three important contributions. The research makes a case for why the interaction of climate and conflict are important for our understanding of the climate-security nexus. Instead of focusing solely on how climate change might cause conflict, we ought to study how behavior is shaped by both climate change and conflict in places where these factors already interact. Second, for this specific study, the results suggest that water scarcity decreases cooperative behavior, but that in- and outgroup relationships condition this relationship. While the latter finding could be specific to the studied population, this represents an important contribution to our understanding of resilience in environments hit by armed conflict and water scarcity.

4 Conclusion

Much more research has focused on conflict than on cooperation and peaceful behavior. Yet, if we only focus on understanding conflict, we overlook the determinants of and prospects for cooperation and peace. Similarly, when we focus too much on what explains cooperation, we underestimate the misery created by rare events such as armed conflicts and fail to understand their determinants. While this is not an argument for always studying both war and peace in each research project, broader research agendas in peace and conflict research should consider both sides of the coin.

Taken together, the dissertation presents four main findings:

- Groundwater is a vital buffer during drought. Yet, groundwater needs to be better monitored and managed in order to prevent conflicts.
- Assessments of climate-related water scarcity must account for actual water demands and access to various water resources, including rainfall, surface water, dams, irrigation, groundwater etc.
- There is a need to look beyond resource scarcity as solely a cause of conflict. We ought to also study the potential of peaceful resource sharing and cooperation.
- Analyses ought to differentiate actions on different actor-levels. Addressing different group levels is key because conflict and cooperation dynamics transition different spheres of action (individual, group, state, etc.)

The dissertation also offers key insights to policy makers. Climate change challenges existing water management practices, and we therefore must find more sustainable ways to use and handle this resource. The impact of extreme weather events can be mitigated by proper water management. This requires an understanding of socio-economic dynamics in relation to water scarcity across different scales and units of analysis. Providing disaggregated evidence related to factors that matter for climate resilience enables policy interventions where they are needed the most.

This research makes a special case for incorporating groundwater into our analysis of climate, conflict, and cooperation. This is by no means a call to only study groundwater. However, research on groundwater and conflict (or cooperation) is scarce, which is surprising considering the fact that groundwater represents the largest distributed store of freshwater on earth

(Taylor et al., 2012). About 32% of Africa's urban population relies on groundwater and there is a potential to use more (Chávez García Silva et al., 2020). Indeed, the quality and quantity of groundwater often remain unknown to many of its users. This is due to a lack of data collection and sharing. Ultimately, we cannot manage what we do not measure. This creates challenges for sustainable use, often resulting in overextraction and pollution. Moreover, it stresses that we need to further study the impact of groundwater on socio-economic changes, including the impact of pollution.

Furthermore, there is still a gap in knowledge when it comes to gender issues related to water and security issues. There is ample evidence of gender inequality within the WASH sector, climate resilient farming, and general water service provisions (Perez et al., 2015). Because women and girls face a disproportionate burden from water scarcity (Kadir et al., 2019), we ought to further foster insights from research on gender, water, and armed conflict.. Societal taboos have also been found to make women more reluctant to bring attention to issues related to sanitation access (Mafuta et al., 2021). Ensuring water access affects the well-being of society through different channels, particularly in regard to gender issues. This also relates to gender-based violence, for instance in cases where women fetching water are regular targets of violence. Women face a disproportionate burden from water scarcity and their voices can be further undermined when WASH services are insufficient. Here, there are several avenues for future research that could ultimately provide important information to stakeholders.

The dissertation also speaks to several UN Sustainable Development Goals (SDGs), especially considering water (SDG 6) and peace (SDG 16). Using water in a sustainable, equitable manner is one of the most crucial aspects for human development. The IPCC has presented robust evidence demonstrating that climate change will significantly decrease both renewable surface water and groundwater resources in arid regions. This dissertation shows that such

changes can explain violence between actors, but also that there is a vast potential for peaceful, cooperative actions. The impact of water scarcity on society is less severe in areas with strong democratic institutions and a higher socio-economic status. These insights are neither new nor necessarily helpful for professionals working in the water sector or with environmental issues. However, these relationships highlight the need to strengthen civil society, democratic norms, and institutions, and social justice and equity. Such actions would have an enormous impact on societies' abilities to cope with water scarcity. Ensuring water access minimizes impact of poverty, improves health and nutrition, and generally lowers potential for grievances or resources disputes. Eventually improved access to water resources can feed back into strengthening institutions and influences how societies mitigate water scarcity.

Another issue relates to the extent to which research on water reaches and informs relevant policy and practice. Scientists might lament that few of their insights are being adopted by water professionals. However, the problem does not necessarily lie within the policy sector. As researchers, we also bear responsibility to make findings visible and applicable to a range of audiences. This entails communicating knowledge in a way that is accessible to stakeholders and the wider public. This could strengthen our engagement with water issues and help in finding solutions for more sustainable water use.

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Many people worldwide face challenges in access to water, which are made more serious by climate change. This Development Dissertation Brief uses statistical modelling to show how drought can both increase violence and lead to peaceful resource sharing and cooperation. It emphasizes the role of groundwater management to prevent conflict and offers key policy recommendations.

Bristande tillgång till vatten är ett globalt problem som förvärras av klimatförändringar. Denna avhandlingssammanfattning använder statistisk modellering för att visa hur torka både kan öka förekomsten av våld och leda till fredlig resursdelning och samarbete. Studien betonar vikten av god förvaltning av grundvatten för att förhindra konflikter och ger ett antal policyrekommendationer.

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