

5-24-2019

Living with Water in a Modern World: an Analysis of Water Relationships in Two Globally Different Rural Areas

Haley Morris
Portland State University

Follow this and additional works at: <https://pdxscholar.library.pdx.edu/honorsthesis>

Let us know how access to this document benefits you.

Recommended Citation

Morris, Haley, "Living with Water in a Modern World: an Analysis of Water Relationships in Two Globally Different Rural Areas" (2019). *University Honors Theses*. Paper 710.
<https://doi.org/10.15760/honors.727>

This Thesis is brought to you for free and open access. It has been accepted for inclusion in University Honors Theses by an authorized administrator of PDXScholar. Please contact us if we can make this document more accessible: pdxscholar@pdx.edu.

Living with water in a modern world: An analysis of water relationships in two globally different rural areas

By

Haley Morris

An undergraduate honors thesis submitted in partial fulfillment of the

Requirements for the degree of

Bachelor of Science

in

University Honors

and

Geography

Thesis Adviser

Idowu (Jola) Ajibade

Portland State University

2019

Abstract:

This paper investigates how embodied emotions influence access, allocation, and use of water among farmers experiencing droughts. The paper engages with the hydrosocial cycle and emotional geographies to understand how power dynamics and emotions shape nature-society relations. Case studies of droughts in western Rajasthan, India and central Arizona, United States were used to highlight how social and political factors play out through embodied emotions with access, allocation, and use of water. Peer reviewed secondary materials were used for the overall qualitative literature analysis. While, a qualitative thematic analysis on existing theoretical and empirical literature was used to code how emotions influenced the way water was accessed, allocated, and used during these particular drought periods. My findings suggest that embodied emotions with water are considered more in western Rajasthan’s decision making processes than central Arizona’s. Based on this research a clear gap in the hydrosocial cycle has been identified, which outlines the missing element of embodied emotions with water. This calls for a rethinking of the hydrosocial cycle that extends beyond social and political factors but also considers embodied emotions in nature-society relations.

Table of Contents

Introduction..... 3

Methods..... 5

Theoretical Framework..... 6

Literature Review..... 8

Findings..... 21

Conclusion..... 23

Bibliography..... 25

Introduction:

Droughts are becoming increasingly prevalent in semi-arid regions, leaving farmers in water scarce situations. This is in part due to climate change impacts, such as unpredictable rainfall and depleted groundwater resources. Recent research on impacts of climate change affecting farmers in rural areas have discussed ways to adapt to vulnerabilities, and have touched on topics of adaptation, mitigation, and resilience (Nyantakyi-Frimpong and Bezner-Kerr, 2015; Haden et al., 2012). Stresses have also been placed on water resources through groundwater pumping and reallocations of water in response to rapid urbanization and land development. Neither of which consider the “emotive realities that have direct bearing on how resources are accessed, used, and fought over” (Sultana, 2011, p.163). A non-monetary valuation of water resources which views water as a living element instead of a commodity to be traded for the highest economic return.

Two regions who have faced these water scarcity challenges are western Rajasthan, India and central Arizona, United States. These rural areas have previously been known as agricultural hubs. But, with increasing populations in urban spaces, a monetary value has been placed on natural resources which has left these farmers with a lack of decision-making power. This is largely due to the privatization of regional water resources by corporate interests, which has resulted in depleted groundwater resources that farmers heavily rely on for irrigation. In this paper, I argue that an approach to addressing water scarcity in western Rajasthan and central Arizona must go beyond the narrow focus of monetary valuation, to also include embodied emotions felt by farmers when accessing, allocating, and using water.

Scholars such as Linton and Budds (2014) have identified how social and political factors shape water issues, which is modeled through the hydrosocial cycle theory. Their conceptualization of the hydrosocial cycle “offers a critical approach that prompts us to consider how water internalizes and reflects social and power relations that might otherwise remain invisible” (Linton and Budds, 2014, p. 178). While, power dynamics do in fact impact decision-making in the governance of water and creates disparities between social groups. I argue that there is an absence of how these power structures influence embodied emotions in the hydrosocial cycle. Thus, the existing hydrosocial cycle does not provide a complete analysis of emotive realities that influence how societies are affected by water scarcity challenges. This

article extends these debates by exploring the complexities of emotional geographies in the context of nature-society relations in order to shift perceptions of how and why embodied emotions affect the way rural farmers access, allocate, and use water when facing water scarcity.

Recent scholarship on emotional geography has shed light on the “emotive realities that have direct bearing on how resources are accessed, used, and fought over” (Sultana, 2011). Existing literature focused specifically on how emotions toward water affect how the resource is managed and influence disparities between different classes, genders, races, etc. These disparities between water issues show up in both the Global North and Global South. However, Sultana clarifies that “some of the issues found in the Global South versus the Global North may vary depending on context, but they are similar in that water crises produce sufferings and injustices that can be solved” (Sultana, 2018, p. 485). By taking into consideration these similarities and differences between nature-society relations in the Global North and Global South, I will lay out this research and identify the gap by detailing two case studies of specific drought periods in western Rajasthan, India and central Arizona, United States. Further, in the literature review I will explain how the different emotions were dictated by how the resource was accessed, allocated, and used among farmers.

My interest in this interaction between embodied emotions and natural resources, centered on specific drought periods between the Global North and Global South is driven by two different frameworks. First, through the lens of the hydrosocial cycle, to consider how social relations dictated environmental processes and created disparities between social power relations. Second, an emotional geography framework will be used to explore how embodied emotions dictated the way that natural resources were accessed, allocated, and used between farmers in western Rajasthan, India compared to central Arizona, United States. In particular, emotional geographies scholarship will be used to highlight a gap in the hydrosocial cycle that outlines the missing element of embodied emotion with water.

Based on the gap in existing literature, the questions driving my research are: 1) how can we determine nature-society relations and embodied emotional connections with water in two culturally and geographically different areas? 2) In what ways are government interventions helpful with combating water scarcity for farmers, if at all? 3) How do traditional farming methods elucidate positive embodied emotions with water? While, taking into consideration governance, political, economic, and gendered factors that affect farmers in these regions, I will

further argue the important role that emotions play in terms of access, allocation, and use of water.

Methods

In this study I used secondary materials for this qualitative literature analysis which were based on existing studies drawn from a variety of journals, and found using Google Scholar and JSTOR. These consisted of scholarly peer reviewed economic, political, and environmental articles related to water resources with a specific focus on groundwater and farming in western Rajasthan, India and Central Arizona. The time frame of the specific case studies ranged from 1995 to 2008.

Altogether, 22 peer reviewed articles were reviewed for the literature analysis. 6 of those articles were used to analyze how and why emotions were felt when accessing, allocating, and using water during the 2002 drought in western Rajasthan, India, one of the worst droughts in Rajasthan's history. The same number of articles were used to conduct the same analysis on the thirteen year drought in Central Arizona from 1995-2008, the longest and most impactful drought period of central Arizona's history. The remaining 10 articles were used to support the theoretical framework and the overall analysis of the research. The literature review covered both theoretical and empirical studies on the hydrosocial cycle, emotional geography, water justice, agriculture, climate change, and water governance.

A qualitative thematic analysis was used to code how and why emotions were felt when accessing, allocating, and using water based off of 6 different emotions (stress/anxiety, frustration, concern, relief, peace, and hope) experienced during the drought period in each location. The chosen emotions were extracted from emotions used in Farhana Sultana's *Suffering for water, suffering from water: Emotional geographies of resource access control and conflict*. The goal of the thematic analysis was to identify key features which were accomplished through coding the emotions. "Codes are the building blocks for themes, (larger) patterns of meaning, underpinned by a central organizing concept - a shared core idea" (Clarke, 2017, p. 297). Tied to each coded emotion was a larger theme, drawn from social and political structures which influenced that particular emotion.

For the coding process, if the article referenced privatization, re-allocations, control, technology, development or anything of the like, then the emotion was coded as frustration. This is because a means of control was inflicted upon these communities through pipelines, dams, and

canals. This frustration stemmed from state and national governments commodifying the natural resource and forced the communities to adhere to modern infrastructure created by privatization. Additionally, if climate change, vulnerability, or unsustainable water consumption were the main focus then stress/anxiety was coded. This is because climate change impacts were unpredictable which left the community stressed and anxious about the vulnerable situations they were in. Concern was coded if farmers and residents did not get a say on how to combat water scarcity. If there were conflicting views and opinions between citizens, scientists, and governments on how to combat water scarcity, then concern was the coded emotion due to the concern about the future of their groundwater resources.

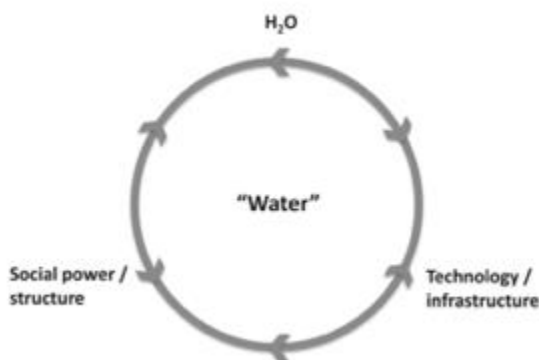
Hope was coded if privatization and infrastructure were decreasing in the future, which would lead to easier access, allocation, and use of water. If there was a positive governmental or ecological change such as minimized impacts from privatization then relief was the coded emotion. Although, if there was no concern with government intervention and residents were primarily able to use their traditional methods, then I coded that emotion as peace due to their water secure situations. By using these two case studies as a reference, this research aims to show how social and political structures influence emotions felt by farmers, which changes their nature-society relations with water.

Theoretical framework:

Close attention to the relationship between the hydrosocial cycle theory and emotional geography framework was important in identifying the absence of embodied emotions in the hydrosocial cycle. This social and political cycle has been widely studied in the scholarship of political ecology with the goal of viewing water as a nature-society relationship. Linton and Budds explain how “recent scholarship have explored how society shapes, and is shaped by, water, both materially and discursively, and how water is not external to social relations but rather embeds and expresses them” (2014, pg. 174). These social relations often include those in positions of power who privatize water resources and in turn gain capital accumulation by commodifying natural resources. While, in this case farmers, suffer from inequities and injustices resulting in water scarcity. These means of control have been widely studied and understood by theorists Karl Marx and David Harvey who view privatization as acts of enclosure and dispossession for certain parts of society.

Trevor Birkenholtz (2016) laid out Harvey's advancement of Marx's primitive accumulation, which "provides a framework within which to examine the state-led discursive and material strategies of alienating water from irrigating peasant farmers specifically as an ongoing process, pursued through extra-economic means" (Birkenholtz, 2016, p. 97). This is also known as eminent domain, meaning that water used for farming was transferred to centers of capital accumulation, and left farmers helpless, in drought ridden conditions. These farmers in both the Global North and Global South were subjected to economic coercion for accumulation of capital by the state, which is in fact an ongoing process. I argue that these acts of coercion should be analyzed not only through the hydrosocial cycle theory but also through an emotional geography lens to show how this control determined the way water was accessed, allocated, and used among farmer's and how emotions played a very vital role in that.

Emotional geography is an emerging field of study with the first works coming out in the early 2000's. Farhana Sultana (2011) explained how paying "close attention to the emotional geographies of water are important in explaining how 'feeling subjects' relate to water and how water mediates social relations of resource management" (pg. 164). Without considering how emotions influenced the way water was accessed, allocated, and used, water was seen as a commodity rather than a valuable resource that should be protected and appreciated. These two frameworks are paired together to show how different frameworks can overlap, and further explain how resource struggles are multifaceted and tap into emotions, politics, and the environment.



The Hydrosocial Cycle (Linton and Budds, 2014).

Literature Review:

Study context:

Water scarcity has affected populations at both global and local levels. Through existing literature on emotional geography scholars have identified how nature-society relationships are dictated by emotions. However, there is no existing research on how emotions fit into the hydrosocial cycle, which is a critical factor that shapes how different government, economic, and political structures affect societies. Based on existing literature, empirical evidence was gathered to show how water scarcity among drought ridden areas played out all over the world, ranging from California, Australia, Bangladesh, and Ghana. In these cases, embodied emotions with water were highlighted through issues of privatization as well as cultural, gendered, and political factors that affected nature-society relations in these areas.

Dallman et al. (2013) used an emotional geography and political ecology approach to highlight conflicts over natural resources among the Winnemem Wintu tribe in California. The Winnemem tribe is one of the last of the Wintu tribes existing in Northern California. The tribe has infused both modern and traditional ways of living to keep their culture alive, and are home to ancestral landscapes and sacred spaces along the McCloud River which was once significantly more productive before modern development.

Similar to water policies in western Rajasthan and Central Arizona, a comparable water project was implemented along the McCloud River for economic prosperity and water security, which ultimately did not come to fruition. “The Central Valley Project (CVP), authorized by the federal government in 1935 and constructed by Reclamation, consists of a series of dams, reservoirs and conveyance facilities designed to ensure a reliable water supply for agricultural irrigation in California’s Central Valley” (Dallman, 2013, p. 36). These developments have placed an economic valuation on natural resources by implementing dams and reservoirs which has reshaped communities’ nature-society relationships by not accounting for emotional and spiritual connections with water. For example, “their lands are perceived by Reclamation and others as resources or commodities, influencing resource management agencies to prioritize water supply and other economic needs above the needs of the Winnemem” (Dallman, 2013, p. 41). This research can help to address the gap of embodied emotions in the study of the hydrosocial cycle theory as it highlights how a communities’ relationship to land and natural resources are linked to embodied emotions.

Nyantakyi-Frimpong and Bezner-Kerr (2015) drew from frameworks of resilience, and vulnerability to assess impacts of climate change on smallholder farms in semi-arid northern Ghana, where more than 80% of the population is involved in agriculture. However, through development policies and abnormal weather patterns “the region has experienced severe droughts and climatic variability, with important implications for agriculture and food security” (Nyantakyi-frimpong and Bezner-Kerr, 2015, p. 41). Smallholder farmers are potentially most vulnerable to climate-change impacts, as they don't use modified seed varieties and chemicals that allow for plants to withstand droughts and other inclement weather conditions.

However, “many farmers do not worry about climate variability and change partly because traditional farming systems are set up to manage these risks on an annual basis” (Nyantakyi-frimpong and Bezner-Kerr, 2015, p. 51). These farmers can be most resilient, as they have discovered mitigation and adaptation strategies to combat impacts from climate change and other factors that negatively affected their water resources. Respondents in this study shared that drought fluctuations in this area are normal, as are droughts in Arizona and Rajasthan, however, the frequency and duration of the droughts are increasing, putting farmers in water scarce situations. This research by Nyantakyi-Frimpong and Bezner-Kerr (2015) supports my research by detailing how vulnerabilities as well as adaptation and mitigation strategies to reduce climate change impacts influences farmer's embodied emotions which dictates how and why they access, allocate, and use water the way they do.

Sultana (2011) used an emotional geography approach in her research on access, use, control, and ownership of safe drinking water in Bangladesh to explain how emotions in real life play out in many different ways, and are often dictated by different conflicts and meanings. Sultana focused on how resource struggles and conflicts towards arsenic contaminated groundwater were mediated through embodied emotions. She expressed that “paying attention to emotions also shows how people access existing water rights and maneuver to gain new access to water in order to fulfill everyday duties/tasks” (Sultana, 2011, p. 168). Sultana agrees that access is a multifaceted issue which needs to be more broadly understood. For example, “while access is often discussed in terms such as proximity, distance, time needed, and physical barriers, it is also linked to socio-cultural factors such as class barriers, power relations, gendered spaces, and emotional labor needed to negotiate water rights” (Sultana, 2011, p. 166). By paying attention to emotional geographies of water, we are better equipped to understand how people

respond to environmental changes and injustices, and how that plays out in their access, allocation, and use of water. This work by Sultana is useful in supporting my research on how resource struggles are experienced on an emotional level and among different social groups.

As previously demonstrated, emotional geography has been used in existing literature to highlight how embodied emotions influence nature-society relations. However, there is no existing research on how emotions fit into the hydrosocial cycle. This lack of overlap between the two frameworks is a testament to the gap I am identifying in order to shift perceptions of how we view water issues by accounting for how emotions shape access, allocation, and use of water.

Study Area: Rajasthan

Rajasthan, India is the largest and most stratified state of India, comprised of “low and high caste Hindus and Muslims with differential levels of education, landholdings, and access to off-farm income opportunities” (Birkenholtz, 2009). Rajasthan is primarily rural with 25% of its population living in cities, however, “it is expected to become 35% urban by 2020” (Birkenholtz, 2016, p. 98). Due to this increase in urban populations, Rajasthan’s water supply for farming has been reallocated at a rapid rate to urban spaces for drinking water and commercial uses. However, Rajasthan has faced frequent droughts which means that water scarcity is a challenge in this state. “According to the Disaster Management and Relief Department, the Western part of Rajasthan experiences drought very frequently (one in every 3-4 years)” (Dutta, 2015, p. 55). This is mainly due to the Aravalli Mountains that run between the east and west, as the summer monsoon primarily hits Eastern Rajasthan, leaving the western part in constant water scarce situations.

The monsoon season has dictated when and what farmers could plant, based off of the two main cropping seasons for farmers, winter (Rabi) and summer (Kharif). The main staples in Rajasthan are comprised of pearl millet, vegetables, melons, soybeans, maize, and gourds. “Kharif crops are dependent upon monsoonal rainfall for water and sown in June-July and harvested in the months of September and October, whereas Rabi crops are cultivated in winter season” (Dutta, 2015, p. 54). However, with increasing impacts from climate change there has been increased unpredictability in precipitation, which has affected the timing of the monsoon season. This has impacted supplemental groundwater irrigation which is undesirable as the state is predominantly reliant on groundwater for irrigation and drinking water (Birkenholtz, 2016).

The hardest hitting drought period for Rajasthan was in 2002, which left communities facing water scarcity that was hard to recover from.

In 2002 “Rajasthan had experienced one of the worst droughts during this year and it was the fifth incessant drought in the state” (Dutta, 2015, p. 57). It is important to understand the emotions that resulted from the drought as access, allocation, and use of water was more difficult than before. “Almost 40 million people and 50 million cattle were affected in the 2002 drought alone” (Dutta, 2015, p. 57). Different organizations and policies were implemented in Rajasthan with the objective to move towards water security after this drought. However, the Rajasthan State Water Policy (SWP) for example, did not necessarily support those who didn’t contribute to capital accumulation, as “the SWP invokes scarcity as a rationale to reallocate water” (Birkenholtz, 2016, p. 98). Additionally, Rajasthan’s Public Health Engineering Department (PHED) made a shift from state-centered water allocation to market environmentalism “which encouraged the involvement of the allocation of water according to market principles of economic scarcity and efficiency” (Birkenholtz, 2016, p. 98). Through increased privatization dams and pipeline projects were implemented meaning that traditional harvesting methods have decreased. Although, some villages in western Rajasthan have remained to use those practices without government intervention, making it easier to access, allocate, and use water.



Fig. 2 Drought frequency in Rajasthan (Dutta, 2015).

Study Area: Arizona

Similar to Rajasthan, India, Central Arizona is comprised of places both rural and urban including Prescott, Sedona and Camp Verde. The Salt and Verde River Watersheds as well as the Gila River are located in this region, which are also connected to the Phoenix metropolitan area. Arizona is semi-arid “receiving less than eight inches of annual precipitation” (Larson, 2009, p. 1016). In turn, with increasing urban populations water is being diverted from agriculture to industrialization by groundwater pumping, leaving farmers with an inadequate amount of water to support their agricultural practices. Unfortunately, “with a current annual growth rate of 3%, the state’s population is projected to reach 9 million by 2025, nearly doubling its current level” (Bolin, 2008, p. 1494). Water in this region is being used for land development and real-estate construction, due to the huge housing boom in the past 20 years.

Even with increasing urban populations, agriculture still remains vital to Arizona’s economy. But, with rapidly depleting groundwater levels due to climate change and capitalistic motivated management strategies, farmers are more vulnerable to water scarcity challenges. Because of this, some farmers have integrated water efficient crops such as beans and vegetables. Although, farmers are still trying to integrate crops such as cotton, citrus, wheat, and alfalfa, which were staple crops for the first settlers in this region, known as “the ancient Hohokam, who developed expansive irrigation networks, which were adopted by subsequent settlers” (Coles, 2009, p. 298). However, the creation of the Salt River Project (SRP) in the early 1900’s resulted in degradation to the Hohokam tribe’s land and natural resources through privatization.

Traditional harvesting systems used by the Hohokam for farming were not appreciated by government entities, even though they did not harm the environment like modern technologies today do. “While their construction and abandonment resulted in part from environmental constraints (hydroclimatic, tectonic, geomorphic) their control was a structural element of the organization, cooperation and urbanization of complex societies” (Purdue, 2015, p. 586). Their harvesting system allowed them to follow climatic changes and water variability in a sustainable way, unlike modern infrastructure today.

The “SRP operates seven dams, 248 groundwater wells and, 1,300 miles of canals and laterals” (Phillips, 2009, p. 110). It is important to consider how the SRP has primarily provided water to urban customers, while depleting water resources for farmers. Through the implementation of the SRP project there have been negative consequences to both the environment and farmers resulting in water scarcity. “In 2008, Arizona began its 13th year of

drought, the longest in SRP history” (Phillips, 2009, p. 116). This drought was exacerbated not only by climate change, but by water reallocations, both of which depleted the groundwater in central Arizona, significantly affecting farmers (Phillips, 2009). As a result of this drought, farmers had to face emotive realities in coming to terms with the new ways that water would be accessed, allocated, and used.



Fig. 3 Central Arizona (Phillips, 2009).

Analysis

Emotions: Rajasthan, India

Empirical evidence was gathered from 6 articles focused on water scarcity as a result of the 2002 drought period in Rajasthan, India. Each peer-reviewed article was coded by emotion based on how and why varying governmental policies and projects, as well as political, social, and cultural factors influenced embodied emotions with water. Outlined below are the embodied emotions felt during and after this historically impactful drought which influenced the way water was accessed, allocated, and used the way it was among farmers.

Stress/Anxiety

During the seasonal monsoon in Rajasthan, India there is plenty of water everywhere, flooding villages and towns, but not enough of that water soaks into the ground for agriculture throughout the year. With an increase in climate change impacts, farmers have been very stressed and anxious, as the timing of the monsoons are not as reliable as they once were. “Failure of Monsoon in this state called upon severe drought during the year 2002 causing long term

consequences of shortage of food, drinking water, fodder, and also employment opportunities” (Dutta, 2015, p. 61). This is significant as more than 68% of people in India were dependent upon agriculture in some capacity. Unpredictable rainfall has left these farmers stressed and anxious about what the future holds in terms of access, allocation, and use of water in western Rajasthan, India.

Frustration

Birkenholtz (2016) used Jaipur and Bisalpur, Rajasthan as case studies to explain how coercion through eminent domain dispossessed farmers through water-grabbing to reallocate water to urban spaces where capital could be accumulated from the natural resource. Through the development of dams in 1960, many farmers were denied access to water, which has only increased since then. “But since the liberalization of the Indian economy beginning in the early 1990s, irrigators are now being dispossessed of their irrigation water by a growing state-private coalition of industrialists who exploit obscure policy provisions to gain legal entitlement to water and effect its reallocation away from irrigating farmers” (Birkenholtz, 2016, p. 97). Considering the implementation of the pipeline in the mid 1990’s, it is highly possible that this has had a direct correlation to the 2002 drought.

According to a farmer in Bisalpur, “since PHED starting sending water to Jaipur, we are not allowed to take it until after it reached 312 m. this happens too late in the season to be useful” (Birkenholtz, 2016, p. 101). The associated emotion with this particular piece of empirical evidence is frustration, as the farmers were denied the use of anicuts, which were traditional dams used by farmers for irrigation purposes during the dry season. The farmers exerted their frustrations towards the reallocations of irrigation water through protests. One farmer stated that “the water comes right by, but still we get none. We protested this last year and will again” (Birkenholtz, 2016, p. 102). This water was just as much the farmers as it was everyone else’s, but because of the government’s economic power, the farmers were not given the right to their own resource. “As noted, the modern Indian State justifies water reallocations by using some notion of public good or by presenting them as the only desirable road to development and well-being for all” (Joy, 2014, p. 958). In this case, the wellbeing of everyone is assumed and boiled down to economic forms instead of prioritizing human rights’ needs to natural resources such as water.

Birkenholtz (2013) focused on the Marwar region of western Rajasthan where he argued that development programs unintentionally supported neoliberal policy shifts for women in the water sector which was frustrating for women. “In this way the introduction of modern technology may disempower women because it silences their productive role in water availability-rules that include their involvement in the creation of rules of behavior and social institutions of access and in the construction of physical infrastructure” (Birkenholtz, 2013, p. 357). Through the development of a canal and irrigation in 1958, colonization and sharecropping rates increased, which resulted in water logging, salinization, and declining production.

These developments frustrated women, which affected how the water was accessed, allocated, and used, as they were no longer allowed to use nadis or talabs (traditional systems for capturing water). Similar to the latter example in Jaipur, The PHED took control and implemented a piped water system to modernize the water supply in the late 1990s. A farmer in the region explained that “they [PHED] told us not to use the talab or nadi for our drinking water as this was contaminated (kharab). [They told us] we were backwards then. We were to be modern (adhunik). But [now] water does not come from the pipe and the catchment has gone bad” (Birkenholtz, 2013). Because of these women had to travel incredibly long distances to collect water, resulting in a less efficient system than they had when using the talabs and nadis.

Development planners were under the impression that new methods of water supply would displace old methods, which would be more efficient, although, that was not the outcome. One woman mentioned that “girls and women collect the water. In the kharif season period of water scarcity we have to wait for the well to fill in between filling our lota [cup used for drinking water] to fill the matka [large earthen or bronze vessel for holding water]. It takes 1-1 hours to fill the matka. We do this twice per day” (Birkenholtz, 2013, p. 365). This long and tedious process is due to the pipeline that was implemented. Alternatively, in Rajput where traditional methods are still used, they have more time for personal things, as water collection is more efficient without modern technologies. This is proof that without development projects forced upon communities, emotions associated with access, allocation, and use of water are more positive than those who are subjected to modern technologies which results in frustration.

Hope

Ward et al. (2016) studied how groundwater management contributed to the wellbeing of rural livelihoods in the Meghraj, Gujarat and Dharta, Rajasthan watersheds. In these agricultural communities' access to cheap pumps, changing crop patterns, and increasing populations were creating tensions for those reliant on groundwater. However, initiatives were set in place to improve aquifer sustainability and household wellbeing by allowing communities at the village level "to craft their own institutional arrangements to manage common aquifers by coordinating autonomously operated wells" (Ward, 2016, p. 15). These arrangements would improve family/social, economic, natural environment, and health factors, which resulted in an emotion of hope for the farmers and villagers. In this case they would be given the autonomy to manage water resources themselves instead of bringing in the state government to oversee issues. This would improve their overall wellbeing, as their needs would be prioritized. Because of this transition in control and management there is hope for better access, allocation, and use of groundwater in Dharta, Rajasthan.

Relief

Empirical evidence from Banerjee (2000) revealed that villages in the Jaipur and Alwar districts in Rajasthan were more water secure than ever, resulting in an emotion of relief. Farmers were able to grow crops that only fifteen years ago they never could have produced. The use of traditional water harvesting systems allowed the village to reach water security. "The villagers, with the help of a nongovernmental organization, have built 12 check dams and are carefully managing and developing their watershed" (Banerjee, 2000, p. 51). Johads and chaukas (traditional dams), assisted with storing monsoon water and recharged the groundwater.

The Andhra Pradesh government launched a water conservation program to implement the traditional water harvesting systems. The development of traditional harvesting systems led to relief for the village as they used to be drought ridden. This program allowed villages to solve their own problems, instead of relying on the state to assume what the village needed. In this case the government considered embodied emotions when addressing water scarcity which led to relief for the community. Forests were growing back and once-dry rivers were flowing with water again. This is evidence that when taking emotions into account it is not just the community that benefits, but the environment as well.

Peace

According to Mishra (2012) “water management in Rajasthan is a people centric activity and holds a great amount of social significance” (p. 88). Similar to the example in Dharta, water in the Thar Desert of Rajasthan is not treated as a commodity. It is instead protected and valued through the use of traditional harvesting systems, and has been that way for centuries. This created an emotion of peace for these communities as “several government initiatives have been unsuccessful, these simple yet effective systems continue to provide locals with a constant supply of water” (Mishra, 2012, p. 89). With constant, reliable sources of water all year, these communities have not had to worry about water insecurities, which has left them with a sense of peace.

The Thar Desert is home to social and religious significance of water which is expressed in different ways. One example is the stone columns throughout the village, “the columns are a means to announce to the visitors that they are approaching a water source and that they must abide by certain unwritten norms of the Thar Desert” (Mishra, 2012, p. 87). Peace is an embodied emotional response associated with this traditional wisdom, as government intervention was rejected and not needed by the people in the Thar Desert. Cultural, socio-economic, and emotional factors have been taken into account when managing this resource which has resulted in water security for the Thar Desert.

Emotions: Central Arizona

Similar to the previous case study, empirical evidence from 6 peer-reviewed articles were coded by emotion based on different political, social, and cultural factors which impacted farmers and residents’ embodied emotions with water. Outlined below are embodied emotions that influenced how and why particular emotions were felt when accessing, allocating, and using water during the 13 year drought from 1995-2008.

Stress/Anxiety

The 13-year drought was exacerbated by “changes in demand patterns as land was converted from mainly agricultural use to urban use” (Phillips, 2009, p. 112). The SRP’s Water Resource Operations staff planned to change the storage planning guidelines in 2008 to combat this drought. However, their plan to address water depletion was to rely on water from the

Central Arizona Project (CAP), which meant that the future of the Colorado River was bleak as they were reallocating water from the Colorado River to the Salt River. According to Philips (2009) the SRP felt that reallocations did not contribute to the drought, but they instead blamed it on climate change. In the SRP's eyes the groundwater pumping and reallocations did not seem to be significant contributing factors, which neglects human centric initiatives that are part and parcel of this drought. This has left residents and farmers anxious and stressed out as access, allocation, and use of the water in this area were unknown for the future.

Rural farmers in Central Arizona have experienced stress and anxiety due to their vulnerabilities from climate change impacts and an increase in populations. For example, "intensive agricultural water use, increasing demand from a rapidly growing population, and climate variability thus combine to strain groundwater supplies, leading to aquifer overdraft, changes in surface and sub-flows, and relative scarcity" (Coles, 2009, p. 301). Even through the decline of the Hohokam, agriculture is still vital to Arizona, however, farming methods as well as climate adaptations have drastically changed over time. Indigenous peoples adapted to long term climate variations. Whereas, farmers today look to short to medium range forecasts, and turn to groundwater pumping, irrigation, and other unsustainable methods to access water since it's cheaper, but could result in future overdraft. Stress/anxiety is associated due to the amount of risks they are faced with, especially since "they have ties to the land, their communities, and their identities as farmers and ranchers" (Coles, 2009, p. 306). The farmers need to possess a willingness to adapt to climate change in order to reduce vulnerabilities and combat the stress and anxiety they are facing.

Stress and anxiety are also associated with unsustainable water consumption, which is analyzed by Chhetri (2011). "While water-consumption patterns are clearly related to its supply, they are also determined by a host of other factors such as population growth, household use, landscaping preferences, availability and use of water-conserving technologies, and overall pricing" (Chhetri, 2011, p. 21). Ultimately, water is being allocated to urban areas, leaving farmers in a stressed and anxious state with uncertainty of water security. "Although agricultural water use in the Phoenix Active Management Area (AMA) will continue to decrease in the future, the urban and industrial water use will continue to grow" (Chhetri, 2011, p. 20). Farmers were left to adapt to these changing conditions that were infringed upon them, while the government controlled their water. Even through the AMA, which is aimed to adhere to water

conservation strategies, management, and supply augmentation programs, deepening wells and groundwater pumping are still happening, which is very stressful for these farmers.

Frustration

Bolin et al. (2008) explained how residents and farmers in Prescott, Arizona are primarily dependent on groundwater managed by the state. However, “as a consequence of increasing residential water demands, exacerbated by a drought now (2007) in its 12th year, groundwater levels in developing exurban areas in the state are declining” (Bolin, 2008, p. 1495). Similar to the pipeline project in Rajasthan implemented by the PHED, Prescott had planned the Big Chino Project (BCP) to import water from the Big Chino groundwater aquifer to recharge groundwater aquifers in Prescott. Citizen groups were frustrated by the idea of the BCP and they identified political objectives and strategies to rally against the project. “These included rural quality of life issues, ecosystem protection, stream and riparian area preservation, groundwater conservation, endangered species protection, and moral claims of obligations to the future” (Bolin, 2008, p. 1501). Although, these initiatives would not be enough to fare against the mining that took place in the Verde watershed which proved to be very frustrating for the citizens in this area.

One member of the Water Advisory Community expressed “*the fact is that bringing in Big Chino water will not stabilize the water situation because that water is going to be used for growth. So how the hell can it stabilize when we are already over-pumping? The other fact is that we are over-pumping our existing supply so much that if we brought all the Big Chino water in and put it into our source, it wouldn't be enough. So, we're still behind*” (Bolin, 2008, p. 1503). This emotion of frustration was aggravated by a lack of acknowledgment by the city, which resulted in depleted aquifers and tension that has resulted in a divide between the city.

Concern

Larson et al. (2009) discussed how water from the Salt and Verde River watersheds was being diverted from agricultural purposes to the development of Phoenix. For example, “overall, residential uses comprise the majority of municipal demand, which is expected to surpass agricultural uses as the dominant sector of regional demand by 2025” (Larson, 2009, p. 1016). Social surveys were administered to forty neighborhoods, to observe knowledge and concern about water scarcity where they lived. “Overall, the residents, policymakers, and scientists

expressed greater concern for region-wide drought and water use compared to local-scale risks” (Larson, 2009, p. 1017). This was worrisome as respondents perceived climate change to be the only cause of climate change, rather than considering individual contributions to excess water use which also leads to water scarcity. “Policymakers also strongly supported traditional supply-augmentation strategies for resource management, whereas scientists stressed stricter regulation of water demand” (Larson, 2009, p. 1019). The emotion here is concern, as all of the actors were unsure of whether putting prices on water or boundary organization was the best way to combat the issue. In this case, residents, policymakers, and scientists all had different perspectives on how to tackle the issue which is concerning for their future when it comes to accessing, allocating, and using water.

Relief

Traditional water systems contain cultural, political, and social meanings which was the case for the Hohokam irrigation system in Arizona. “As such, water claims are based on an unwritten but understood ownership gained through communal labour in the construction and maintenance of the system” (Rogers, 2013, p. 252). For indigenous groups water is viewed as a holistic property, with both cultural and spiritual significances. “The history of the Gila River Indian Community (GRIC) presence and irrigation activities in the Salt River Valley basin is highly relevant because the appropriation doctrine, otherwise known as “first in time first in line”, prioritizes water based on timing” (Rogers, 2013, p. 253). Meaning, whoever put water to beneficial use first, received rights to the water. However, the Hohokam were not counted as citizens, so even though they accessed the water first, they were not recognized for that. The GRIC later won a settlement which allowed the Hohokam to continue growing traditional crops with traditional methods of collecting and storing water. After winning the settlement the associated emotion would be characterized as relief, however, that does not underscore the challenges that they still face today.

Emotion	Reason for Associated Emotion	Author(s)	Area
Frustration	Reallocation of water from rural to urban. New policies restricted farmers from receiving irrigation when they need it.	Trevor Birkenholtz: (2016)	Jaipur, Rajasthan
Frustration	Water supply technologies reworking gendered socio-ecological relations.	Birkenholtz, Trevor: (2013)	Jodhpur, Rajasthan
Frustration	Pipeline projects depleting groundwater.	Bolin, Bob., Collins, Timothy., Darby, Kate	Central Highlands
Stress/Anxiety	Drought in 2002 caused by water allocations due to urbanization.	Dutta, Dipanwita., Kunda, Arnab., Patel, N.R., et al.	Rajasthan
Stress/Anxiety	Farmers experiencing vulnerability from climate change impacts and an increase in urbanization.	Coles, Ashley., Scott, Christopher	Southeastern Arizona
Stress/Anxiety	Longest drought in the SRP. Climate change projections predict a water crisis in Salt River Valley.	Phillips, Daniel., Reinink, Yvonne., Skarupa, Timothy., et al.	Salt River Valley
Stress/Anxiety	Unsustainable water consumption and impacts from climate change.	Chhetri, Netra	Central Arizona
Concern	Diverging perspectives between policy actors, residents, and scientists. Ecological concern about water shortages and scarcity.	Larson, K.L., White, D.D., Gober, P., et al.	Salt and Verde watersheds
Relief	Using traditional methods to store groundwater and the government is in support.	Banerjee, Tirtho	Jaipur Rajasthan
Relief	The government transitioned to supporting the Hohokam's water rights.	Rogers, Peter., Edmiston, Stephanie	Central Arizona (Gila River)
Hope	Subjective wellbeing, village irrigator communities, manage their own institutional arrangements.	Ward, J., Varua, M.E., Maheshwari, B., et al.	Meghraj and Dharta watersheds, Rajasthan
Peace	Used traditional wisdoms instead of government intervention, resulting in sustainable water supplies.	Mishra, Anupam	Jaisalmer, Rajasthan

Findings:

This qualitative literature review has given meaning to both the differences and similarities between the emotions felt in the Global North and Global South in terms of how social relations

of power and climate change influenced different embodied emotions. These emotions further dictated the way water was accessed, allocated, and used in both areas. Emotions coded for western Rajasthan, India consisted of frustration, hope, peace, and relief. Whereas, emotions for central Arizona, United States included stress/anxiety, frustration, concern, and relief. This roughly demonstrated that negative emotions were more prevalent in the Global North, which is cause to a lack of consideration of how embodied emotions affect the way water was accessed, allocated, and used among certain communities. Recognizing structures, conflicts, and means of control that shape each emotion is key to understanding what motivates these embodied emotions, and how they are correlated to farmer's nature-society relations with water.

It is important to consider that “the embodied emotions of water are experienced in different spaces and to varying degrees, depending on the situation on any given day, and constitute the various sufferings that people experienced with respect to water in their everyday lives” (Sultana, 2011, p. 168). This suggests that emotions are not static, which emphasizes the importance of acknowledging the varying emotions that could have shaped these communities between different time/space continuums. It is also imperative to consider inefficiencies with this thematic analysis, as farmers didn't directly state the emotion felt in that situation. Instead, emotions were coded based on nuanced criteria

The emotion of frustration for both places was influenced by reallocations of water. This was mediated through a power dynamic, where the government used means of coercion and modern infrastructure to displace water from farmers for economic benefit. In Rajasthan, farmers were denied the right to use traditional water harvesting methods by the state even though they guaranteed a reliable water supply and didn't harm the environment. Women's frustrations were also a factor in Rajasthan, whereas gender was not mentioned in regards to Arizona's water resources. In Rajasthan women had to spend hours a day collecting water instead of going to school or pursuing personal goals. This created significant barriers for women and girls in their day to day lives.

Stress and anxiety for those in Rajasthan and Arizona were due to unpredictable monsoon rains, as a result of climate change impacts and rapidly growing populations in urban spaces. Whereas, concern in central Arizona was based on conflicting views and opinions from residents, scientists, and policymakers who all had different ideas of how to combat groundwater depletion in the future.

Hope was coded for the farmers in Dharta, Rajasthan as the state government was going to give farmers the autonomy to manage their own aquifers. This gave agricultural communities a sense of hope for the sustainability of their groundwater resources, which would eventually improve how water would be accessed, allocated, and used in that village. The people of the Thar Desert in Rajasthan have continued using traditional harvesting methods for centuries without government intervention. Because of this they have not experienced water conflicts, as they have remained relatively water secure which has created a sense of peace for these areas.

Relief was felt by both regions. In Rajasthan's case farmers transitioned to traditional water harvesting systems which eventually led to water security. The government provided villages in Jaipur the support and supplies they needed, but let them take control of it on their own without government intervention. For central Arizona, the Hohokam were eventually given the right to use traditional farming methods, which resulted in relief for the community as they were given permission to reintroduce traditional water harvesting systems back into their farming practices.

These findings suggest that social and political structures modeled in the hydrosocial cycle do affect flows of water in societies. However, these different structures and means of control do in fact influence embodied emotions which are directly correlated to how farmers access, allocate, and use water the way they do. Based on this study I have identified a gap in the hydrosocial cycle which highlights how emotions did have a direct effect on the way farmers accessed, allocated, and used water during these drought periods. Through this analysis embodied emotions towards natural resources were proven to be a higher priority in Rajasthan's decision-making processes than the United States'.

Conclusion:

My goal in this paper was to engage with the hydrosocial cycle theory to contribute to emotional geography scholarship. This nuanced analysis allows for an expansion of current debates on emotional geographies to better understand how and why nature-society relations play out the way they do. Through this comparison between droughts in central Arizona, United States and western Rajasthan, India I demonstrated how embodied emotions influence how and why access, allocation, and use of water happen the way they do. Social and political relations of power, culture, economy, and gender were explored to emphasize how those subjectivities towards water affect rural farmers embodied emotions with the natural resource.

Through this paper I have identified a gap in the hydrosocial cycle that highlights the missing element of how embodied emotions influence the way water shapes societies. As analyzed through emotions of frustration, stress/anxiety, concern, relief, hope, and peace it is evident that in some areas of Rajasthan water is valued as more than a commodity. This entails that embodied emotions in association with nature-society relations are a higher priority in western Rajasthan than in central Arizona. Ultimately, this analysis enables us to better understand how and why people find meaning in natural resources. This could lead to an adjustment of how water is controlled and managed, which could contribute to an increase in sustainable access, allocation, and use of water among different societies. This realm of research in emotional geographies scholarship can contribute to a greater conceptualization of how and why certain communities undergo water conflicts and injustices, and potentially lead to a consideration of embodied emotions in future decision-making processes.

Bibliography

- Banerjee, Tirtho. (2000). Harvesting the Monsoons: Restoring Ancient Systems; to Answer Water Woes. *Hinduism Today*, 51
- Birkenholtz, Trevor. (2016). Dispossessing irrigators: Water grabbing, supply-side growth and farmer resistance in India. *Geoforum*, 69, 94-105
- Birkenholtz, Trevor. (2012). Network political ecology and theory in climate change vulnerability and adaptation research. *Progress in Human Geography*, 36(3), 295-315
- Birkenholtz, Trevor. (2013). "On the Network, off the Map": Developing Intervillage and Intragender Differentiation in Rural Water Supply. *Environment and Planning D: Society and Space*, 31(2), 354-371
- Bolin, Bob., Collins, Timothy., Darby, Kate. (2008). Fate of the Verde: Water, Environmental conflict, and the politics of scale in Arizona's central highlands. *Geoforum*, 39(3), 1494-1511
- Chhetri, Netra., B. (2011). Water-demand management: assessing impacts of climate and other changes on water usage in Central Arizona. *Journal of Water and Climate Change*, 2(4), 288-312
- Clarke, Victoria., Braun, Virginia. (2017). Thematic analysis. *The Journal of Positive Psychology*, 12(3), 297-298
- Coles, Ashley. R., Scott, Christopher. A., (2009). Vulnerability and adaptation to climate change and variability in semi-arid rural southeastern Arizona, USA. *Natural Resources Forum*, 33, 297-309
- Dallman, Suzanne., Ngo, Mary., Laris, Paul., Thien, Deborah. (2013). Political Ecology of Emotion and Sacred Space: The Winnemem wintu Struggles with California Water Policy. *Emotion, Space, and Society*, 6, 33-43
- Dutta, Dipanwita., Kundu, Arnab., Patel, N.R., Saha, S.K., Siddiqui, A.R. (2015). Assessment of agricultural drought in Rajasthan (India) using remote sensing derived Vegetation Condition Index (VCI) and Standardized Precipitation Index (SPI). *The Egyptian Journal of Remote Sensing and Space Sciences*, 18(1), 53-63
- Haden, Van R., Niles, Meredith T., Lubell, Mark., Perlman, Joshua., Jackson, Louise E. (2012). Global and local concerns: What Attitudes and Beliefs Motivate Farmers to Mitigate and Adapt to Climate Change? *PLoS ONE*, 7(12), 1-8
- Joy, K.J., Kulkarni, Seema., Roth, Dik., Zwarteveen. (2014). Re-politicising Water governance: exploring Water Re-allocations in term of Justice. *Local Environment*, 19(9), 954-973

Larson, K.L., White, D.D., Gober, P., et al. (2009). Divergent Perspectives on Water Resource Sustainability in a Public-Policy-Science Context. *Environmental Science and Policy*, 12(7), 1012-1023

Linton, Jamie., Budds, Jessica. (2014). The hydrosocial cycle: Defining and mobilizing a relational-dialectical approach to water. *Geoforum*, 57, 170-180

Mishra, Anupam. (2012). The Ancient Ingenuity of Water Harvesting Systems. *Context*, 9(1), 83-89.

Nytankakyi-Frimpong, Hanson., Bezner-Kerr, Rachel. (2015). The Relative importance of Climate Change in the Context of Multiple Stressors in Semi-Arid Ghana. *Global Environmental Change*, 32, 40-56

Phillips, Daniel., Reinink, Yvonne., Skarupa, Timothy. (2009). Water Resources Planning and Management at the Salt River Project, Arizona, USA. *Irrigation and Drainage Systems*, 23(2), 109-124.

Purdue, Louise. E., Berger, Jean Francois. (2015). An integrated socio-environmental approach to the study of ancient water systems: the case of prehistoric Hohokam. *Journal of Archeological Science*, 53, 586-603

Rogers, Peter. D., Edmiston, Stephanie. M. (2013). The Gila River Indian Community Water Rights Settlement and its impact on Water resource Management. *Water International*, 38(3), 250-262

Sultana, Farhana. (2011). Suffering *for* water, suffering *from* water: Emotional geographies of resource access, control and conflict. *Geoforum*, 42(2), 163-172.

Sultana, Farhana. (2018). Water Justice: Why it Matters and How to Achieve it. *Water International*, 43(4), 483-493.

Ward, J., Varua, M.E., Maheshwari, B., Oza, S. ; Purohit, R., Hakimuddin, S., Dave, S. (2016). Exploring the Relationship Between Subjective Wellbeing and Groundwater Attitudes and Practices of Farmers in Rural India. *Journal of Hydrology*, 540, 1-16