

THE PENNSYLVANIA STATE UNIVERSITY  
SCHREYER HONORS COLLEGE

DEPARTMENT OF POLITICAL SCIENCE

POWER PARITY AND TRANSBOUNDARY FRESHWATER AGREEMENTS

KRISTIAN SOLTES

SPRING 2010

A thesis  
submitted in partial fulfillment  
of the requirements  
for baccalaureate degrees  
in International Politics and International Studies  
with honors in International Politics

Reviewed and approved\* by the following:

Douglas Lemke  
Associate Professor of Political Science  
Thesis Supervisor

Michael B. Berkman  
Professor of Political Science  
Honors Adviser

\*Signatures are on file in the Schreyer Honors College.

## ABSTRACT

The decreasing global supply of freshwater and the rapidly increasing demand associated with population growth and industrialization have catapulted the global freshwater crisis into the political spotlight. Research regarding transboundary freshwater scarcity and its relationship with conflict and cooperation is a relatively recent focus of political science yet has been studied from many angles. However, the nature of the agreements drafted between states sharing the scarce water is understudied, especially when viewed from the lens of power parity. I explore the effects of power parity on the fairness of the agreements drafted between nations. More specifically, since a relatively powerful nation can have considerable leverage during the agreement process, I expect that a large power differential leads to unfair agreements that favor the more powerful country. I look at two cases, the USA-Mexico border consisting of the Rio Grande and Colorado basins, and the Nile Basin. Intervening variables are also analyzed. My results indicate that agreements are generally fair regardless of the factors, but the tendency to pursue unilateral actions is affected. These results have far-reaching implications on international policy and administration, and they offer insights to help guide future research concerning this contemporary issue.

## TABLE OF CONTENTS

<b>Introduction</b> .....	<b>1</b>
Preface .....	1
Theoretical Context .....	2
The Role of Power Parity .....	3
<b>Related Research and Literature</b> .....	<b>5</b>
Freshwater Scarcity and Conflict/Cooperation .....	5
Power Parity and Agreements .....	6
The Case Studies .....	7
<b>Methodology and Framework</b> .....	<b>9</b>
List of Hypotheses .....	9
Variables and Definitions .....	10
<b>CASE 1: USA-MEXICO</b> .....	<b>15</b>
<b>Background</b> .....	<b>15</b>
Early History .....	15
Water Treaty of 1944 and the IBWC.....	16

<b>Results</b> .....	<b>17</b>
Power Parity .....	17
Agreements .....	18
Intervening Variables .....	19
<b>CASE 2: THE NILE BASIN</b> .....	<b>22</b>
<b>Background</b> .....	<b>22</b>
Early History .....	22
Post-Colonialism and the Nile Waters Treaty .....	23
Subsequent Events and the NBI .....	24
<b>Results</b> .....	<b>25</b>
Power Parity .....	25
Agreements .....	27
Intervening Variables .....	28
<b>The Big Picture</b> .....	<b>32</b>
Discussion of Results .....	32
Notable Differences .....	35
<b>Concluding Thoughts</b> .....	<b>37</b>
Appendices .....	39
References .....	42

## INTRODUCTION

### *Preface*

On March 22, 2010, less than one month ago, the world observed the United Nation's annual World Water Day. This year, the UN-chosen theme was "Clean Water for a Healthy World." The words were chosen carefully, because the U.N. wants to convey the understanding that the issues surrounding water are deeper than mere scarcity. As populations grow and countries industrialize, matters of the environment, pollution, politics, globalization, conflict, and health all converge around water. In other words, the world cannot afford to look at contemporary issues individually because they are all interrelated. The pressing issues facing the world today must be combated in tandem.

Freshwater scarcity is undeniably a worldwide issue (see Appendix A), a problem that has been taken with utmost seriousness in the past decade. The reason for this sudden attention is two-fold: On one side, countries in critical watershed regions are currently coping with water scarcity, in varying degrees of extreme scarcity. These geographic regions tend to encompass countries that are already unstable and poor, which means that millions of people are suffering and dying from lack of freshwater. For instance, Lake Chad is no longer able to sustain its dependent population: twenty million people in four surrounding countries. Once among the largest lakes in Africa, Lake Chad has shrunk to less than 5% of its size in 1960 (Mayell, 2001). Drought among these nations is expected to worsen as the demand-supply gap grows.

On the other side, wealthy countries are beginning to feel the preliminary effects of freshwater scarcity, and the resulting tension has pushed the issue into the international spotlight. The United States is no exception. Lake Lanier, provider of freshwater to Atlanta and its five

million inhabitants, is at historic lows, no longer able to sustain fully both the city and the surrounding ecosystems (Jarvie, 2007). The Ogallala Aquifer, one of the world's largest underground sources of water, irrigates one-third of American corn crops and provides drinking water to eight states. Overuse has lowered the water table significantly, and hydrologists estimate that in many places, the aquifer will be exhausted within 25 years ("World's largest aquifer," 2006). The recent increase in freshwater scarcity in industrialized countries has resulted in a sudden seriousness regarding this issue as well as much-deserved global attention.

It is crucial for the world to use this chance to battle this threat before it becomes unmanageable. However, it is equally crucial to follow the right policies because a failed policy can be even more damaging than no policy. Thankfully, scholars and officials are working together to study these issues and lead the world on the right track. Academia must continue to play its role to uncover the right path and lead the world towards sustainability.

### *Theoretical Context*

Freshwater is vital to life, yet the fact remains that it is a scarce resource. As a result, competition over the scarce resource occurs, and in the case of transboundary freshwater, the contention that may occur is interstate. In the past, freshwater disputes between states have occurred, and in light of the trend of increasing freshwater shortage and increasing freshwater demand, the number of freshwater disputes may increase. Hence, it is becoming increasingly important to examine how states react to the issue of shared freshwater scarcity, and perhaps even more importantly, to develop the theory necessary to predict how states will react to these issues.

When a dispute arises between or amongst states over shared freshwater, the states have the option to cooperate and find a solution, or defect and engage in conflict with the competing state(s). The preferred option, not surprisingly, is to cooperate and maintain peaceful relations with neighbor states. States frequently cooperate over shared freshwater resources, often by drafting treaties or establishing commissions that share authority over the water resources. While this cooperative approach is clearly preferred to conflict, the specific terms of the agreements determine the utility each party gets from cooperating, and therefore these agreements deserve further attention.

The terms of the agreements may not necessarily serve the interests of all parties equally. Indeed, it is plausible for the interests of one party to be favored over those of another. The specifics of an agreement are important to analyze because if one party is heavily disfavored it may be in its best interest to defect. In applicable terms, a state that feels disfavored by the terms of an agreement over a shared river may suddenly choose to defect, thereby derailing the agreement process and potentially destabilizing the region. Alternatively, a state may find itself in a weak position where it feels disfavored but cannot defect because if it does, the resulting conflict will further disfavor the weak state relative to a stronger state. The end result is that the weak state is forced to cooperate and agree to the resolutions despite disadvantageous terms; the weak state is coerced into agreement.

### *The Role of Power Parity*

As outlined above, the situation under which a state is coerced into an unfavorable agreement is likely to occur when it is weak compared to another state. Since the powerful state is equally aware of the situation, it knows it has bargaining power from the onset of negotiation

and can therefore influence the terms to serve its interests. As the power differential increases, the more powerful state may gain ever greater influence on the terms. Hence, this leads to the hypothesis that power parity is positively and significantly correlated with fairness of agreement. In other words, the smaller the power differential, the less influence can be exerted by a single party, resulting in a fairer resolution that balances the utility of each party.

Certain intervening variables may skew the otherwise controlled relationship between power parity and the terms of agreement, namely the level of water scarcity, level of dependence, and the previous history of cooperation/conflict between the parties involved. When the shared freshwater is extremely scarce or the level of dependence on foreign freshwater is extremely high, I hypothesize that the influence of power parity wanes. My underlying assumption is that a weak state's resistance to coercion increases as the freshwater resource becomes an essential resource over which the state cannot afford to compromise. Previous history must also be accounted for because successful past cooperation fosters further cooperation on the basis of mutual trust (Brochmann & Hensel, 2008).

The two regions to be examined are (1) the Rio Grande and the Colorado River, which are shared by USA and Mexico; and (2), the Nile Basin, consisting of Burundi, The Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda. The different power differentials can provide key insight into the role of power parity in the resolution of freshwater disputes. Although background information is provided, the temporal focus is post 1950. Political boundaries were redrawn following World War II and the end of colonialism, thereby increasing relevance.

## RELATED RESEARCH AND LITERATURE

### *Freshwater Scarcity and Conflict/Cooperation*

In Academia, concern about freshwater scarcity is a relatively new phenomenon, and so is the existing literature on the subject. The relationship between freshwater scarcity and conflict has not been extensively studied, and so there are many gaps necessitating further research. Although relevant research has mushroomed in recent years, generalizable conclusions are scarce. Consensus is difficult to build as there are nearly as many different conclusions as the number of studies conducted. Nevertheless, scholars examining the relationship between freshwater scarcity and conflict/cooperation have reached conclusions that can be roughly divided into two camps: the Neomalthusians and the Cornucopians.

The Neomalthusians—named after Thomas Malthus for his writings concerning population pressure and competition over scarce resources—believe that competition over scarce water resources leads to conflict (Gleditsch, Furlong, Hegre, Lacina & Owen, 2006; Gleick, 1993; Homer-Dixon, 1994; Tose, Gleditsch & Hegre, 2000). A number of preliminary studies, particularly case studies, support this theory (Gleick, 1993; Homer-Dixon, 1994). Positive correlation between transboundary rivers and militarized conflict has also been demonstrated using large-N analyses (Furlong, Gleditsch & Hegre, 2006; Gleditsch et al., 2006; Tose et al., 2000).

On the other hand, the Cornucopians, or institutionalists, assert that sharing water resources is more likely to lead to cooperation (eg., Keohane & Ostrom, 1994). The theoretical basis for this school of thought is that shared interests involved with transboundary freshwater

overwhelm the benefits of engaging in conflict (Wolf, 1998, 2002). Empirically, institutionalists point to the striking difference in the number of times water-related agreements were used to settle claims, compared to the number of times conflict actually occurred (Wolf, 2002). Certain case studies confirm this perspective, as well as large-N studies that show that treaties and institutions decrease the probability of conflict while increasing the probability of peaceful efforts (Kalpakian, 2004; Hensel, Mitchel, & Sowers & Thyne, 2006).

Both camps muster substantial evidence to support their conclusions, yet still obtain conflicting results. This likely indicates that there may be additional factors that also have considerable influence on the relationship between water scarcity and cooperation/conflict, as well as the fairness of the cooperation. One such factor may be power parity, which, despite being a well-studied variable, has not been examined in the context of the fairness of the resolutions.

### *Power Parity and Agreements*

Power is a fundamental concept in international relations, and by definition, the amount of relative power possessed by a state determines its influence in the international arena. Additionally, Scott (2008) concluded that power has the capacity to influence heavily the terms of many types of treaties, and empirically demonstrated that states have historically exploited that capacity. It has also been assessed that depending on a state's prospects for relative gains arising from a possible agreement, power can influence how, when, and what kinds of institutional solutions are employed (Keohane and & Martin, 1995). These studies indicate that power parity plays a central role in the formation of institutions and agreements, albeit not specifically in the context of transboundary freshwater.

Aaron T. Wolf (1999) is one of the only scholars to delve into the specific terms of water-related agreements. He analyzes the ways in which solutions to any water disagreement are equitable. In other words, are the needs of each party being met, and to what degree? Moreover, how can this be measured? His perspectives are helpful in determining what constitutes equality and the role that institutions play in determining the level of equality. Drawing from Wolf's perspectives, the related role of power parity can be examined.

### *The Case Studies*

The existing research and literature on freshwater scarcity, power parity, and terms of agreements can be merged into a focused small-n study that may address gaps in the current body of knowledge. With respect to data, many sources are available that are applicable to the entire world as well as the specific regions examined. Databases such as the United Nation's AQUASTAT and Oregon State University's Transboundary Freshwater Dispute Database (TFDD) offer sufficient information regarding basic water supply and demand statistics worldwide and by country/region. On a regional level, the International Boundary and Water Commission documents virtually everything regarding American and Mexican sharing of the Rio Grande and Colorado Rivers. Similarly, the Nile Basin Initiative documents claims, resolutions, and general discussions for that area. However, the NBI was created much more recently and therefore provides less information.

In addition, scholars have examined these two regions and the prospects for successful resolution of disputes within them. Some have outlined the problems involved with current resolution attempts in the Nile Basin and the US-Mexico border, and have proposed possible

approaches to solving the problems involved with the management and partitioning of these specific freshwater resources (Kameri-Mbote, 2005; Sarquis, 2006; Swain, 1997).

Given the availability of information, all occurring disputes and claims and their solutions can be analyzed for fairness and equality. Cross-referencing those findings with power parity information should support my hypothesis that relative parity increases the odds of mutually beneficial cooperation. When the intervening variables are also accounted for using information from The World Bank, AQUASTAT and TFDD, a clear picture can emerge that reveals the role of power parity in the terms and fairness of agreements.

## METHODOLOGY AND FRAMEWORK

### *List of Hypotheses*

Strewn throughout the above theoretical and methodological discussion are specific questions and expectations that guide the research and analyses. Although the theories and assumptions that shape the hypotheses listed below have already been discussed, they are included here and briefly discussed for organizational effectiveness:

*Hypothesis 1: Power parity is positively correlated with the fairness of agreements drafted between riparian countries. When parity is not present, agreements favor the relatively powerful country.*

Since relative power offers the ability to exert influence, and since coercion is the primary tool by which influence is exerted, it is fair to expect that the greater the asymmetry of power, the more likely the terms of the agreements are to favor the powerful country.

Certain factors may intensify or weaken this relationship:

*Hypothesis 2: High levels of freshwater scarcity decrease the influence of power parity and result in more equitable agreements.*

*Hypothesis 3: High levels of dependence on foreign freshwater decrease the influence of power parity and result in more equitable agreements.*

Hypotheses 2 and 3 are derived from the same logic, that when the availability of freshwater is minimal, the importance of the freshwater is magnified and the ability of countries to compromise over an insufficient necessity decreases. Likewise, there is increased resistance to coercion over salient resources.

History of cooperation and the existence of treaties foster trust, dialogue, and mutual respect between countries. This “friendship effect” is self-perpetuating and has optimistic implications for future agreements. Therefore,

*Hypothesis 4: A history of cooperation between countries leads to more equitable agreements, thereby mitigating the effects of power differentials.*

*Hypothesis 4 corollary: A history of cooperation between countries, achieved through the same institution, leads to more equitable agreements, thereby mitigating the effects of power differentials.*

The corollary to Hypothesis 4 recognizes the faith and trust placed in successful institutions. Institutions that have been successful at promoting past agreements garner respect and eliminate skepticism, thereby gaining legitimacy in future cooperative efforts.

#### *Variables and Definitions*

Accurately analyzing the effects of power parity on freshwater agreements requires a delicate framework that precisely measures power parity, the fairness of any given agreement/resolution (DV), and all the intervening variables involved. Some of these variables can be operationalized quantitatively while others must be analyzed descriptively. One caveat of descriptive analyses is that qualitative data lend themselves to interpretation and subjectivity, but the nature of certain variables requires such analysis. To avoid any unwarranted subjectivity, all inferences and conclusions will be fully and objectively explained with raw data presented as needed. Potential weaknesses or areas that need further study will also be duly noted.

Power parity, the independent variable, can be operationalized quantitatively. In political science, GDP, population and military expenditure are all common approaches for measuring

power, and since they generally generate the same results, GDP will be used as the measure of power. Put in terms of power parity, the factor of interest is the difference of GDP between one country and another. Furthermore, since contention over water resources can also occur among more than two countries—as in the case of the Nile Basin—the difference of GDP between one country and the regional average also deserves analysis. As it may be the case, a regional power may have the ability to influence singlehandedly a multinational agreement process.

The fairness of agreements and resolutions, the dependent variable, is best analyzed descriptively because the existence of innumerable factors that define ‘fairness’ makes a quantitative examination too restrictive for the purposes of this study. Thus, strict operationalization of the dependent variable is rendered impossible. In an effort to maximize objectivity, certain cues can still be used to determine fairness. These include the extent to which the interests of each party are met and the political reaction to the agreements. To allow replication and review, situations where the specific measure of fairness is questionable will be qualified by an explanation of why and how the inferences were made.

Certain factors specific to this topic are likely to influence the relationship between power parity and fairness of agreements. These intervening variables can either strengthen or weaken the relationship, and from a policy standpoint, they can potentially identify specific situations in which each requires a different policy approach. The intervening variables that are expected to have a significant influence are level of freshwater scarcity, level of dependence upon the shared resource, and history of past cooperation and conflict.

The level of freshwater scarcity in a country can significantly alter the nature of relations with another country and therefore also influences the agreements drafted by those countries. As aforementioned, the effects of freshwater scarcity on the prospects of conflict or cooperation are

still inconclusive, so further analysis of this variable is useful for adding to the existing body of research, particularly when power parity is included in the equation. Additionally, it is plausible that beyond a certain threshold of scarcity, the supply of the shared water simply cannot meet the demands of the populations dependent upon that freshwater. In such a scenario, cooperation becomes less appealing as governments are faced with intense domestic demands for the freshwater without which people cannot live. Hence, I expect that beyond a certain critical point, cooperation becomes less and less preferable. If an agreement is reached, it is likely that the agreement becomes more equitable with increasing levels of scarcity; otherwise the weaker country, resisting coercion due to necessity, defects.

Freshwater scarcity is quantified as internal renewable water resources per capita, where internal renewable water resources is the “long-term average annual flow of rivers and recharge of aquifers generated from endogenous precipitation” (FAO, NRL, 2008). Due to regional variance in industrial capacities and/or large-scale irrigation usage, scarcity must be defined with caution; it is a relative term that has different meanings and implications for different states (Abrams). For the purposes of this study, however, the focus is on the overall levels and the temporal change of scarcity; hence, the above quantification is effective and also allows for the control of variables between regions.

Whereas scarcity relates to a country’s internal water resources, the level of dependence on a shared freshwater resource relates to a specific body of water. In other words, a country that has low levels of water scarcity overall may depend entirely upon a single source of water as its lifeline, thereby greatly increasing the importance of that specific source. Thus, there may be more contention vis-à-vis a neighboring state that shares an important body of water as opposed to a neighbor that shares a less important body of water. Note that the level of scarcity in the

country remains constant, but the dependence on specific sources varies. Drawing upon the same rationale used for high levels of scarcity, the expected effect of high levels of dependence is fairer agreements; compromise and entry into inequitable agreements are much more costly.

Dependence on a specific source of freshwater is analyzed qualitatively. While a quantitative analysis is technically possible, the purposes of this research do not require an in-depth analysis of precise measures. Given the two case studies, it is sufficient to note simply whether dependence on the water source in question is high or low. This type of analysis also serves to organize riparian countries by the direction of river flow; i.e. downstream versus upstream countries.

The third intervening variable, the existence and extent of past cooperation/conflict in a dyad or region, is integral to any discussion of interstate relations. Intuitively, a history of cooperation builds trust and fosters future cooperation, and the opposite is true for a history of conflict. This is a central tenet of iterated game theory, and studies have demonstrated that the presence of water-specific treaties increases the likelihood of future cooperation (Brochmann & Hensel, 2008; Giordano & Wolf, 2003). If mutual trust increases the likelihood of cooperation, it is likely that trust also increases the likelihood of equitable agreements, particularly if the agreements are achieved through the same institution.

I expect these intervening variables to have direct and significant effects on the relationship between power parity and fairness of agreements. Nevertheless, a discussion of variables would be incomplete without understanding that a descriptive analysis implies attention to a virtually limitless number of variables. In conducting this study, any factors that may play a role in this issue need to be noted and discussed, whether the variables were mentioned explicitly. Openness to all variables is what makes qualitative analysis particularly effective, and they are fundamental

in raising unexplored questions and directing future research.

## CASE 1: USA-MEXICO

### **Background**

#### *Early History*

The US-Mexican border is lined by four states on the American side—California, Arizona, New Mexico and Texas—and six states on the Mexican side—Baja California, Sonora, Chihuahua, Coahuila, Tamaulipas, and to a minimal extent, Nuevo Leon. The two countries share two important basins, the Rio Grande<sup>1</sup> and the Colorado (see Appendix B). The rivers and tributaries that comprise the basins form a natural border between most of the United States and Mexico, and they also provide freshwater for those living along the border in both countries.

Not surprisingly, these two basins are integral to the border communities for energy production, drinking water, and irrigation, and are therefore highly salient for those border communities. The topic of controversy over the Colorado and Rio Grande initially dealt with border issues. The Guadalupe Hidalgo Treaty of February 2, 1848, which ended the Mexican-American War, combined with the Gadsden Treaty of 1853, established the border between USA and Mexico roughly along present-day lines. In effect, the Rio Grande and the Colorado became transboundary rivers, therefore making their management and allocation an issue of international relations.

Since then, the two countries have experienced times of accord and contention relating to the waters. Initially, much of the contention concerned boundary disputes rather than water use and allocation, primarily because small population demand for freshwater was less than the supply. In other words, water scarcity was not a salient issue. Early cooperation occurred largely

---

<sup>1</sup> In Mexico, the Rio Grande is known as the Río Bravo or the Río Bravo del Norte. It will be referred to as “Rio Grande” throughout this paper.

in the form of surveying and studying the geography of the waters, with both countries sharing information via the temporary joint commissions that were founded bilaterally (IBWC). As population and agricultural communities grew, it became obvious that the shifting flow of the rivers needed constant assessment and cooperation between the two countries. Hence, the International Boundary Commission (IBC) was established in 1889 and made indefinite in 1900. The Water Treaty of 1944 expanded the jurisdiction of the IBC and renamed it the International Boundary and Water Commission (IBWC). To the present day, the IBWC has been in charge of studying the waters, implementing bilateral policies, and settling disputes that may arise.

The first water allocation agreement between the US and Mexico occurred as a result of the Convention of March 1, 1906, allocating 60,000 acre-feet of the Rio Grande annually to Mexico at the expense of the United States. Any variance in water flow was to be distributed proportionally.

#### *Water Treaty of 1944 and the IBWC*

The Water Treaty of February 3, 1944 was extremely important for two reasons. First, it determined the rules regarding water use and allocation of the Colorado and Rio Grande, serving as the basis for all subsequent water-related agreements or disputes. Its purpose is analogous to the Constitution of the United States in that all subsequent actions must adhere to the principles and rules laid forth in the Treaty. Aside from allocating water resources, it also provided for the two governments jointly to survey the waters, and construct and manage water projects to optimize water use. In other words, both Mexico and the US were essentially committed to cooperation by way of joint ownership of the waterways and related projects.

Second, the Treaty established the IBWC as the nexus of research, cooperation and resolution regarding the shared waters. Subsequent agreements between the two nations were achieved through the IBWC, and since the focus of this paper is to determine the terms of agreements, the IBWC serves as the hub of relevant information. The IBWC consists of a Mexican Section and a US Section, each headed by an Engineer Commissioner with full diplomatic privileges. Any recommendations for joint action must be approved by the Department of State of the United States and the Ministry of Foreign Relations of Mexico. The IBWC was created as a permanent cooperative body with the purpose of providing “bi-national solutions to issues that arise during the application of United States-Mexico treaties regarding boundary demarcation, national ownership of waters, sanitation, water quality, and flood control in the border region” (IBWC). All agreements, and the terms therein, are recorded by the IBWC.

## **Results**

### *Power Parity*

For the entire timeframe in question, the US has had a significant advantage in terms of power relative to Mexico, shown in Table 1. In 1960, the US had a GDP of over \$520 billion, with 2009 as the base year. That same year, Mexico’s GDP was merely \$13.1 billion, only 1/40 of the US GDP. By 2009, those figures had grown to a GDP of over \$14 trillion for the US and over \$1 trillion for Mexico; Mexico’s GDP was approximately 1/13 of the US GDP. This indicates that throughout the entire length of time, the US enjoyed a remarkable advantage in terms of economic prowess. Power parity increased over time but not to the extent that it would have practical significance; the US is still undeniably much more powerful.

Table 1: GDP (2009 US\$, in billions)

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2008
U.S.	521	712	1,025	1,624	2,769	4,188	5,757	7,342	9,765	12,376	14,204
Mexico	13.1	21.8	35.5	88	194	184	263	287	581	847	1,086

Source: World Development Indicators 2009, The World Bank

### *Agreements*

The first occurrence of an agreement between the US and Mexico within the set temporal parameters is the Water Treaty of 1944, which established the IBWC. From then on, all agreements were recorded as minutes or treaties by the IBWC. The agreements were analyzed to test for fairness, using the extent to which interests are met, the equitable allocation of waters, and reaction to the agreements by the governments of the respective countries.

Both the US and Mexico brought claims to the attention of the IBWC as well as their respective governments. In addition, there were several instances of both the US and Mexico jointly bringing an issue to the IBWC (IBWC). Regardless of where the claim originated, the results reveal that the terms of the agreements were fair and equitable. Mexico, the less powerful country by far, was not treated unfairly according to the terms. To the contrary, the US was willing to assist Mexico in joint cooperative efforts even if the US realized no immediate benefit by doing so. Beginning in 1947, only three years after the establishment of the IBWC, Mexico requested emergency use of waters from the All-American Canal for irrigation. Large-scale drought wreaked havoc on farming in the Mexicali Valley, and Mexico used the IBWC as the channel through which they procured aid from the United States. The US agreed to temporarily divert flow from the All-American Canal into the Alamo Canal for use by Mexican farmers.

Except for the benefit of long-term cooperation and mutual trust, the US had nothing to gain from this agreement. Moreover, Mexico was unable to pay for the use of freshwater so the US agreed to loan the waters to Mexico.

Mexico petitioned the US for emergency waters on a consistent basis, with the last request occurring in 2008 (IBWC). As before, Mexico was unable to pay the US for the water, but that did not deter the US from continuing to loan water for emergency purposes. Such agreements highlight the absence of coercion, indicating rather that the terms of the agreements were more than fair.

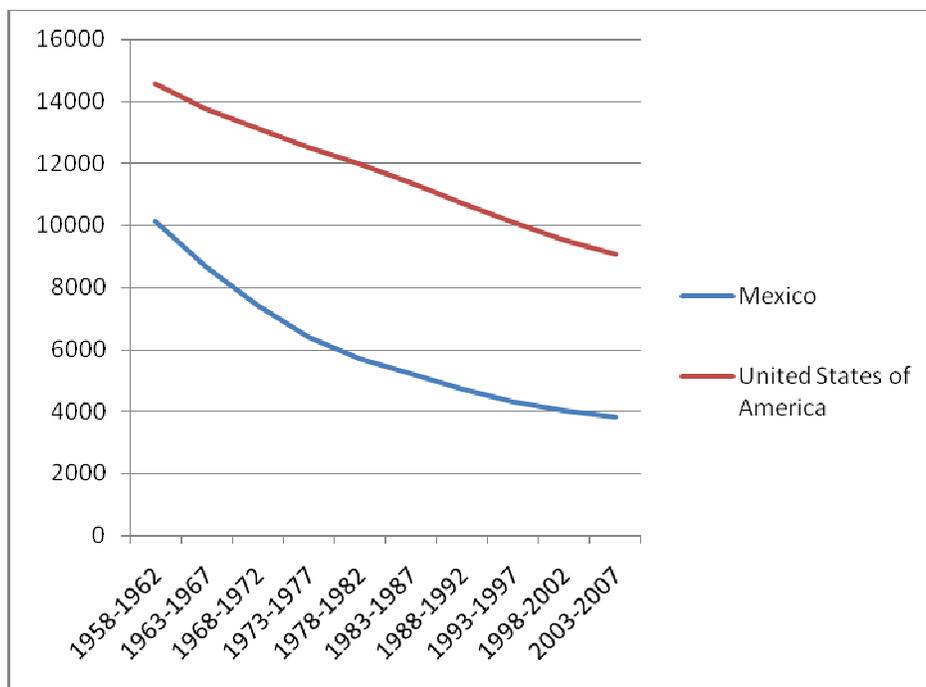
Similar equitable agreements were achieved regardless of who brought the claim or what the issue was; fair agreements were made concerning water quality, water quantity, and joint projects undertaken by the two countries. The agreements also frequently stress the friendly relations between the two countries, and the importance of having such friendly relations. In fact, there was not one instance where the agreements drafted within the jurisdiction of the IBWC could be considered significantly unfair.

### *Intervening Variables*

Although the terms of the agreements are undoubtedly fair, there has been contention in recent years. The Transboundary Freshwater Dispute Database lists water-related events in the Colorado and Rio Grande basins. TFDD also assigns a BAR rating, indicating the intensity of the water event. The spectrum runs from -7 to 7, with negative numbers denoting contention and positive numbers denoting accord (TFDD). Beginning in 1989, the number of negative BAR ratings assigned to events became much more numerous.

Around the same time, Mexico, especially in the north, experienced a severe drought that largely defined the freshwater scarcity issue in the 1990s. The AQUASTAT database reveals that Mexico's freshwater supply was rapidly deteriorating. Combined with industrialization and a growing population, Mexico experienced sharp declines in water resources (see Figure 1). This phenomenon did not manifest itself in the terms of the agreements, but unilateral actions were highly salient and very contentious. For example, in 1989 the American government decided to renovate the All-American Canal to decrease seepage. That seepage of water, which eventually makes its way into underground aquifers, was used by Mexican farmers for irrigation. The decision to renovate the canal during a time of water scarcity created hostility between the two nations. TFDD assigned a BAR rating of -3, indicating "diplomatic-economic hostile actions" (TFDD).

Figure 1: US-Mexico Water Resources per capita ( $\text{m}^3/\text{inhabitant}/\text{year}$ )



Source: FAO, NRL, 2010

Diplomatic relations on this specific issue are becoming more contentious as levels of freshwater scarcity are increasing. Insufficient supply for basic needs is becoming an issue. To deal with this impending threat, the Mexican government has attempted to renegotiate the terms of the 1944 Treaty (TFDD). However, such an agreement has not been achieved.

Neither the US nor Mexico have a high level of dependence on the Colorado and Rio Grande. Obviously, local communities depend greatly on the two basins, evidenced by the salience of the 1990s drought, but the focus is on the state level of analysis. Both countries have other freshwater sources, so the Colorado and Rio Grande are not as salient from a national perspective as, for instance, the Nile River is in Egypt.

The results of the final intervening variable, previous instances of cooperation, reveal the extent to which the two countries have had a cooperative past. Agreements over these basins date back to the Guadalupe Hidalgo and Gadsen treaties. Albeit these were agreements imposed upon Mexico as the loser of war, in subsequent years, as noted in the discussion of history above, agreements were plentiful. Additionally, agreements from the 19<sup>th</sup> Century dealt with border issues. Cooperation over water allocation and quality began in 1906, and since then, the two countries engaged in consistent cooperation, often through the IBWC, to handle virtually all issues regarding the Colorado and Rio Grande.

## CASE 2: THE NILE BASIN

### **Background**

#### *Early history*

The Nile River is the longest river in the world, finding its roots in central Africa and flowing north until it reaches the Mediterranean Sea. The Nile has two major tributaries; the White Nile, the longer tributary, begins in southern Rwanda, and the Blue Nile, the source of most of the Nile's water, begins in Ethiopia. The two tributaries meet in Sudan and then flow northwards through the Egyptian desert. The basin of the Nile, covering 10% of the African continent, supplies ten riparian countries: Burundi, the Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, the United Republic of Tanzania, and Uganda (see Appendix C).

The Nile serves as the lifeline for many riparian countries. The fact that the northern section flows through desert makes the Nile especially important for upstream countries like Egypt. Considering the infinite value of the Nile's water, and that it flows through many countries, it has been an eventful region in the history of international relations. Dating to ancient times, Egypt made it a priority to control the entire Nile, invading Sudan many times for this purpose. During colonial times, European powers realized the importance of the Nile to the region and undertook several water projects to ameliorate the flow (ICE). In 1920, foreign powers established the Nile Projects Commission in order to allocate water between the Egyptian and Sudanese colonies. They estimated the river's average flow to be 84 BCM/year, and that Egypt needed 58 BCM/year whereas Sudan can be sustained on the Blue Nile alone.

A new commission formed in 1925 used the 1920 estimates to draft an agreement between the newly independent Egypt and the still-colonized Sudan. This resulted in the Nile Waters Agreement of 1929 which allocated 48 BCM/year and all timely flow to Egypt, and 4 BCM/year to Sudan. Egyptian interests were further secured by being guaranteed that no works would be developed along the river that would threaten its interests. Egypt was therefore relatively successful in using its newfound independence to negotiate with foreign powers. Sudan, on the other hand, was excluded from negotiations, such as preparation for the controversial Aswan High Dam, until 1954, the same year that Egypt and Great Britain signed a treaty guaranteeing Sudan's independence in 1956. Those negotiations between Egypt and Sudan eventually culminated in the Agreement for the Full Utilization of the Nile Waters (Nile Waters Treaty) in 1959 (Wolf & Newton, 2008).

#### *Post-colonialism and the Nile Waters Treaty*

The Nile Waters Treaty was signed on November 8, 1959. Although Sudan gained its independence in 1956, tensions between Egypt and Sudan remained high until an Egyptian-friendly military regime took control of Sudan in 1958. In 1958, for example, military confrontation was narrowly avoided after Egypt sent an expedition into disputed territory. Moreover, in 1959, Sudan unilaterally constructed the Sennar Dam, contrary to the terms of 1929 agreement (Wolf & Newton, 2008).

Negotiations resumed shortly after the coup in Sudan and the result of those negotiations comprised the terms of the Nile Waters Treaty, the first post-colonial agreement in the Nile Basin. The terms allocated 55.5 BCM/year to Egypt and 18.5 BCM/year to Sudan, based on 84 BCM/year total water flow. Variance in flow and any costs associated with projects were divided

evenly. Finally, a Permanent Joint Technical Committee was established to resolve disputes. This committee was also responsible for handling claims that other riparian nations might raise. This signified that only Egypt and Sudan had the privilege to decide on the allocations for a basin that consists of eight other countries. The fact that Egypt and Sudan took it upon themselves bilaterally to manage the Nile's allocation was met with resentment by the upstream countries, especially Ethiopia. Unlike the weaker countries farther south where low populations and undeveloped economies made the Nile issue less salient, Ethiopia declared in 1957 that it would unilaterally pursue developments of the Nile's waters. In 1963, Ethiopia demanded 6 BCM/year, a request that was ultimately ignored (Swain 1997).

#### *Subsequent Events and the NBI*

As early as 1967, there had been several cooperative efforts in the Nile Basin. From 1967-2002, the United Nations Development Programme sponsored HYDROMET to collect data on the Nile's geography. In 1993, several basin countries launched the Technical Cooperation Committee for the Promotion of the Development and Environmental Protection of the Nile Basin (TECCONILE). The same year, informal dialogue was fostered with the first of ten Nile 2002 conferences. In 1997, the Council of Ministers of Water Affairs of the Nile Basin States (Nile-COM) was given the responsibility of directing and coordinating donor activities (Wolf & Newton, 2008).

Nevertheless, this era was also filled with contention. In the 1980s, Sudan requested to renegotiate the Nile Waters Treaty due to its growing population. Egypt steadfastly refused. Ethiopia also declared in 1977 that it would begin unilateral projects that would cut the flow of the Blue Nile. In response, Egyptian president Anwar Sadat warned that "If Ethiopia takes any

action to block our right to the Nile water, there will be no alternative for us but to use force” (Smith & Al-Rawahy, 1990). The upper riparian states also voiced their concerns; Kenya, Tanzania and Uganda, for example, want to harness the water resources of Lake Victoria (Wolf & Newton, 2007). Requests for development of the Nile’s resources have been occurring with greater frequency to this day.

Recognizing the need for immediate cooperative action, nine of the ten Nile Basin countries launched the Nile Basin Initiative (NBI) in May 1999<sup>2</sup>. The objectives of the NBI are to develop the Nile’s resources in a sustainable and equitable way, ensure efficiency of management and resources, promote cooperation and joint-action, target poverty and promote economic integration, and to ensure that NBI plans are acted upon (NBI). The NBI is composed of three bodies, Nile-COM, the Technical Advisory Committee (Nile-TAC), and the NBI Secretariat (Nile-SEC). In 2004, the NBI launched in Sudan the first of its eight basin-wide projects, demonstrating its ability to move from the planning to implementation (NBI). By fostering an all-inclusive mentality, the NBI hopes to achieve the greatest level of utility in a sustainable fashion. Whether it can consistently do so with growing water scarcity remains to be seen.

## **Results**

### *Power parity*

The GDPs of the riparian nations are displayed in Table 2 below. In addition, the regional average is also displayed in order to analyze power relative to the entire basin. Empty cells indicate a lack of data. There are a number of observations pertinent to the question of power parity. In general, Egypt has been the regional hegemon. The Democratic Republic of Congo

---

<sup>2</sup> Eritrea signed on as an observer but does not participate in the activities of the NBI.

rivalled Egypt in the 1960s, but its GDP stagnated most likely due to recurring political conflict. By 2008, The Congo's GDP only grew to \$11.6 billion compared to Egypt's \$163 billion. Sudan, in general, has been the second most powerful country, bypassing The Congo in the 1980s.

Table 2: GDP (2009 US\$, in billions)

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2008
Burundi	0.2	0.16	0.24	0.42	0.92	1.15	1.13	1.0	0.71	0.8	1.16
Congo, D.R.	3.42	4.04	4.88	10.2	14.4	7.2	9.35	5.64	4.31	7.24	11.6
Egypt	4.14	5.11	7.68	11.4	22.9	34.7	43.1	60.2	99.8	89.7	163
Ethiopia						9.41	12.1	7.61	8.18	12.3	26.5
Kenya	0.79	1.0	1.6	3.26	7.27	6.14	8.59	9.05	12.7	18.8	34.5
Rwanda	0.12	0.15	0.22	0.57	1.16	1.72	2.58	1.29	1.73	2.38	4.46
Sudan	1.13	1.45	2.1	4.8	7.6	12.5	12.4	13.8	12.4	27.4	58.4
Tanzania							4.26	5.26	9.08	14.1	20.5
Uganda	0.42	0.89	1.26	2.36	1.24	3.52	4.3	5.76	6.19	9.23	14.5
Regional Average*	1.14	1.42	2.0	3.67	6.17	8.48	10.9	12.2	17.2	20.2	37.2

Source: World Development Indicators 2009, The World Bank

\* regional averages are calculated using the data provided by The World Bank

The data reveal that Egypt and Sudan have been the dominant actors in the basin. By looking at the regional averages, it can be noted that while other countries have varied in their

GDP growth, Egypt and Sudan are commonly above the regional average. They are followed in rank by Kenya and Ethiopia, who frequently find themselves slightly below the regional average. Lastly, Tanzania, Burundi, the Congo, Rwanda and Uganda can all be considered weak countries relative to the region.

### *Agreements*

The first agreement to be considered is the Nile Waters Treaty of 1959 since it is the first post-colonial agreement between any of the riparian nations. The treaty was a bilateral agreement between Egypt and Sudan, and it excluded the interests of the other states. Prior to the agreement, Egypt's position, based on an 80 BCM/year average flow estimate, was to allocate 62 BCM/year to Egypt and 8 BCM/year to Sudan. Egypt also wanted to build the Aswan High Dam on the border between Egypt and Sudan. Ethiopia's position, based on an 84 BCM/year average flow estimate, was to allocate 59 BCM/year to Egypt and 15 BCM/year to Sudan. Additionally, while it preferred that smaller dams be built as opposed to the Aswan High Dam, it agreed that if the Aswan High Dam were built that Egypt bear the costs (Wolf & Newton, 2008).

The terms of the Nile Waters Treaty, based on an average flow estimate of 84 BCM/year, allocated 55.5 BCM/year to Egypt and 18.5 BCM/year to Sudan. Variance in flow due to evaporation, flooding or drought was to be split evenly. Egypt also agreed to compensate Sudan for flooding and relocations due to the Aswan High Dam. The allocations signify that Egypt received slightly less and Sudan received slightly more water than their respective wishes. Considering their relative powers, the opposite could have been expected.

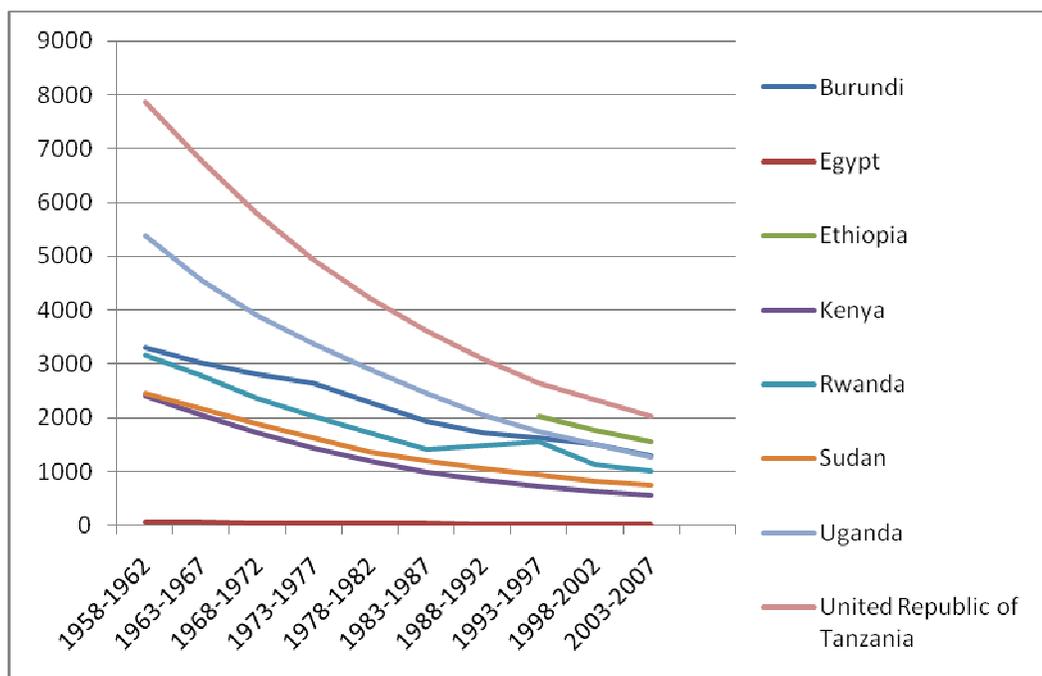
The next agreement occurred in 1991 between Sudan and Ethiopia, and then in 1993 between Egypt and Ethiopia. These agreements, however, were abstract frameworks that merely

stressed the importance of cooperation for mutual benefit and resulted in nothing substantive. In 1995, the UNDP launched Project D3 as a forum to oversee the political dialogue regarding use of the Nile (Foulds 2002). Project D3's mission to create a cooperative framework for use of the Nile was approved by all basin countries in 1999, thereby forming the Nile Basin Initiative, the organization responsible for future agreements that would include all of the basin countries.

Since the NBI has only been in existence for a decade, formal agreements are scarce and resemble memorandums of understanding rather than anything concrete. Key milestones listed on the NBI website refer to the establishment of workshops, forums, sharing of information, and creation of awareness. Additionally, NBI successes have related to power-sharing and the raising of funds (NBI). These agreements are fair insofar as all the countries share common goals. That is to say, those common goals relate to using the Nile waters optimally. Application of these goals is the difficult part, and that is the reason that discussion of specific allocations is avoided.

### *Intervening Variables*

The Nile basin case study is characterized by extreme water scarcities. Figure 2 shows internal renewable water resources per capita in the Nile Basin. The Democratic Republic of Congo is omitted because unlike the other countries, it is not experiencing high levels of water scarcity due to abundant rainfall. In 2007, the Congo had per capita water resources of 14,395 m<sup>3</sup>/inhabitant/year, which would have made visible analysis of the water levels of the other countries tedious.

Figure 2: Nile Basin Water Resources per capita ( $\text{m}^3/\text{inhabitant}/\text{year}$ )

Source: FAO, NRL, 2010

The trend has been rapidly decreasing water levels due to a number of factors, especially population growth. When water levels drop below  $1,000 \text{ m}^3/\text{year}$  per capita, the country is said to be experiencing water scarcity (Larsen 2004). Rwanda, Sudan, Kenya and Egypt have already entered this level, and the rest of the countries (except the Congo) are also converging on this level. Egypt is of particular interest since it has faced severe water scarcities for many years. Its reliance on foreign freshwater is almost absolute.

Nevertheless, this trend did not skew the fairness of agreements. However, the upper riparian states experienced the most rapid change in water resources due to rising populations. Therefore it is not surprising that claims to the Nile's resources combined with unilateral plans to develop those resources began occurring as their water levels dropped dramatically. As

dependence on the Nile increases with decreasing water levels, these unilateral initiatives are likely to become more numerous and contentious.

The lower riparian states, especially Egypt, have been keen to prevent the upper riparian states from restricting the flow of the Nile. Egypt depends on the Nile for 95% of its water use (Swain, 1997). Its dependence on the Nile makes any project upstream extremely salient. The same holds true for the other lower riparian states, but their relative power does not permit them to obstruct the intentions of the upper riparian states. Egypt, on the other hand, has frequently threatened to use force due to its dependence and preponderance of power. Following Sudan's threats to restrict some of the Nile flow in 1995, the Egyptian foreign minister immediately declared, "I am warning [Sudan's leader] Turabi not to play with fire, at the same time, not to play with water" (Swain, 1997).

The final intervening variable, previous history and cooperation, is a central factor in the Nile basin. Colonialism resulted in the fragmentation of the Africa, and political relations were fragile following independence. Cold War politics and frequent regime changes only exacerbated this problem. While prior interaction does not influence the fairness of agreements, it does influence the tendency to enter into agreements and the tendency to act unilaterally after those agreements have been made.

Of particular interest is the relationship between Egypt and its neighbors. Recall that the Nile Waters Treaty of 1959 was possible only after regime change in Sudan. Sudan has had several regime changes since then and has experienced constant civil war. Thus, international politics are very difficult when agreements made with one regime may be void when another takes power. Indeed, Swain (1997) has noted that "unresolved mutual suspicions between Khartoum [Sudan] and Cairo are likely to reduce the possibility of other joint efforts being

designed to develop the water resources of the two neighbours” (686). The addition of multiple regimes to multiple states makes hydro politics and cooperation very painstaking.

## THE BIG PICTURE

### *Discussion of Results*

The two case studies provide similar results regarding the research and hypotheses. Regarding Hypothesis 1, power parity has no discernable effect on the fairness of agreements. In fact, the overwhelming conclusion regarding the fairness of agreements is that agreements over water resources in these two river basins are almost always fair. In both case studies a much more powerful nation entered into fair and equitable agreements with less powerful nations. There are two likely reasons that agreements are always fair, at least in their explicit terms. The first possibility is that states entering into agreements over such an invaluable resource do not want to risk defection by any party because that could hinder any cooperative efforts for some time. Therefore, they make relatively fair agreements but may not apply them in the same way. The relatively powerful country can still act unilaterally if it deems the agreements as not conducive to its interests. Egypt acted unilaterally with the construction of the Aswan High Dam, and the United States acted unilaterally with the renovation of the All-American Canal.

The second reason that agreements tend to be fair regardless of other factors is because the agreements avoid highly contentious issues. Both cases reveal a necessity to revisit allocation agreements, but the agreements do not mention new allocations. This is especially important in the Nile Basin where the scarcity and dependence levels are very high. In fact, the latest agreement allocating the Nile's waters was the Nile Waters Treaty of 1959, which only apportioned water to Egypt and Sudan. With rapidly growing populations in the upper basin and an obvious increase in water use, the NBI's main focus should be revisiting allocations.

Nevertheless, no mention of specific allocations is found in NBI documents. It is considerably easier to agree over water quality issues or power sharing than it is to agree over what truly matters, and that is access to the water for the country's own use.

As the results indicate, high levels of water scarcity and high levels of dependence increase the salience of access to water resources. While they do not affect the terms of the agreements for the reasons mentioned earlier in this section, they promote tendencies to bypass or repudiate agreements and pursue unilateral strategies. Hence, the results do not support Hypotheses 2 and 3 because the equitability of agreements is constant. Nevertheless, high levels of freshwater scarcity and high levels of dependence decrease the influence of power parity in general. A relatively powerful country can develop unilateral projects and can use the threat of force to dissuade a weaker country from doing the same. However, as water becomes more crucial to supply national demands, the resistance to coercion increases. Alternatively put, the dangers of not accessing the waters eventually overshadows the dangers posed by a relatively powerful country.

In the USA-Mexico case, water stress has already led to tensions between the two nations, indicated by the increase of negative BAR-rated events. Because Mexico is not experiencing water scarcity defined as under 1,000 m<sup>3</sup>/year per capita, it has not found it necessary to risk a breakdown of relations with its more powerful northern neighbor. On the other hand, in the Nile Basin, the severe water scarcity being experienced by many countries has led to more claims over water rights and plans by upper riparian nations to begin harnessing the Nile's waters, namely Uganda and Tanzania. As Swain (2007) mentions, Egypt's threats have been successful in deterring other nations' unilateral plans, but those threats are becoming less effective given the increase in demand and given Ethiopia's rise in power.

A history of cooperation does not affect the fairness of agreements since the agreements are generally fair, thereby not supporting Hypothesis 4. However, a history of cooperation is crucial to the formation of agreements and institutions, and it deters unilateral action. Building dialogue and fostering trust are essential for further cooperative behavior. From a psychological perspective, in-group vs. out-group mentalities are shifted since in-groups form alongside trust. From a political perspective, trust decreases anarchic behavior and increases the likelihood that another actor will behave in an expected fashion. The Nile Basin states are drenched in mistrust due to shifting political landscapes and the after-effects of colonialism, so unilateral actions are more likely. In the USA-Mexico case, unilateral actions are less likely since both sides are willing to help the other out due to the benefits realized from continued cooperation. This is evidenced by the USA's repeated consent to deliver emergency waters to Mexico when Mexico cannot even pay for the water loans.

The corollary to Hypothesis 4 assumes that agreements will be more equitable if previous instances of cooperation were handled through the same institution, the IBWC in the first case and the NBI in the second. Although the corollary is not supported because agreements are equitable in the first place, the case of the IBWC implies that when faith is placed into a specific organization that has been successful in the past, the organization is likely to catalyze further cooperation, thereby increasing the organization's longevity. The decade-old NBI cannot tackle issues of the same salience because it has not been successful in completely eliminating the mistrust between member states. This makes both the NBI and cooperation in general more fragile, but it can be expected that the longer the NBI retains its legitimacy, future cooperation over more salient issues is likely. On the other hand, if the NBI fails, prospects for cooperation will be hindered and regional instability may result.

The results in relation to the hypotheses are presented in Table 3 below:

Table 3: Results

<b>Variable</b>	<b>Effect on Fairness of Agreements</b>	<b>Effect on Unilateral Tendencies</b>
Power parity	0	-
Scarcity	0	+
Dependence	0	+
History of cooperation	0	-

#### *Notable differences*

The two case studies present valuable insight concerning agreements and hydropolitics. However, the two cases have notable geographic and political differences that cannot be overlooked and are mentioned here briefly to facilitate further study. Geographically, the two cases differ in the direction of river flow. The Rio Grande and the Colorado form the border between the two countries, flowing from Mexico to the United States and vice versa several times. The Nile flows northward through the basin countries, creating an upstream/downstream effect. Countries downstream are more sensitive to projects along the Nile because it will result in decreased water flow. Egypt's relative power has deterred the negative effects expected from being the downstream state. Other geographic variables are the levels of scarcity and dependence. The effects have already been discussed, but in summary, the levels of scarcity and dependence

are not as high as in the Nile Basin, and the effects associated with scarcity and dependence have been felt much more recently relative to the Nile Basin.

There exist many political factors that distinguish the two cases. The most apparent is the number of actors. The first case has two actors, so determining power relations is simplified, whereas the Nile Basin consists of nine actors that are involved in complex political interplay, which is further complicated by the ever-shifting political regimes. Furthermore, the Nile Basin consists of states that deal with internal struggles, making implementation of cooperative efforts much more difficult. For example, the Jonglei Canal that was to be built in Sudan had to be abandoned due to repeated attacks by rebels (Swain, 2007). Such events render the outcomes of agreements unpredictable, hindering cooperative efforts. Analyzing the specific effects of these variables will be useful for further study.

## CONCLUDING THOUGHTS

The significance of these findings is useful for directing future policy and research. It has been uncovered that the explicit terms of agreements are fair for all those involved, but may discriminate against those not involved. This implies two things: First, further study regarding the equity of agreements should not be conducted by looking at the terms of the treaties. Rather, it may be more useful to look at the specificity, durability and implementation of the agreements. Since agreements generally avoid contentious issues, the specificity of the agreements regarding salient issues may be a better indicator of the effectiveness of agreements. The durability of the agreements should also be analyzed, since it is fair to expect that the longer an agreement remains in effect without one party requesting to revise it, the fairer it is in the long term. Finally, the implementation of the agreements is arguably more important than the drafting of those agreements. Even if agreements tackle highly contentious issues, implementation may prove to be impossible, rendering the entire agreement useful, regardless of how fair it may seem.

A second implication regarding the fairness of agreements concerns the inclusiveness of the agreement or organization. Agreements are fair for those involved in the agreement, but as the Nile Waters Treaty of 1959 has revealed, they discriminate against the other actors. A sound policy would follow the lines of the NBI and equitably encompass all actors in a basin.

The effects of power parity may be further understood if cases are studied that involve an overtaking of power. If a country like Sudan grows more powerful than Egypt, then the relationships may be very different. It would directly involve power transition theory and necessitate the consideration of satisfaction with the status quo (Lemke & Werner, 1996).

The significant effects of scarcity and dependence deserve further attention. Tackling water allocation issues are easier to do before the levels of scarcity are too great. The reason for this is because continuous cooperation fosters further cooperation. Thus, if the cooperative efforts begin early, the likelihood of cooperation over very salient issues may be greater. Furthermore, the levels of scarcity change significantly every year, and therefore may present unique policy issues each year. Research needs to be updated consistently to be able to provide current and relevant policy prescriptions.

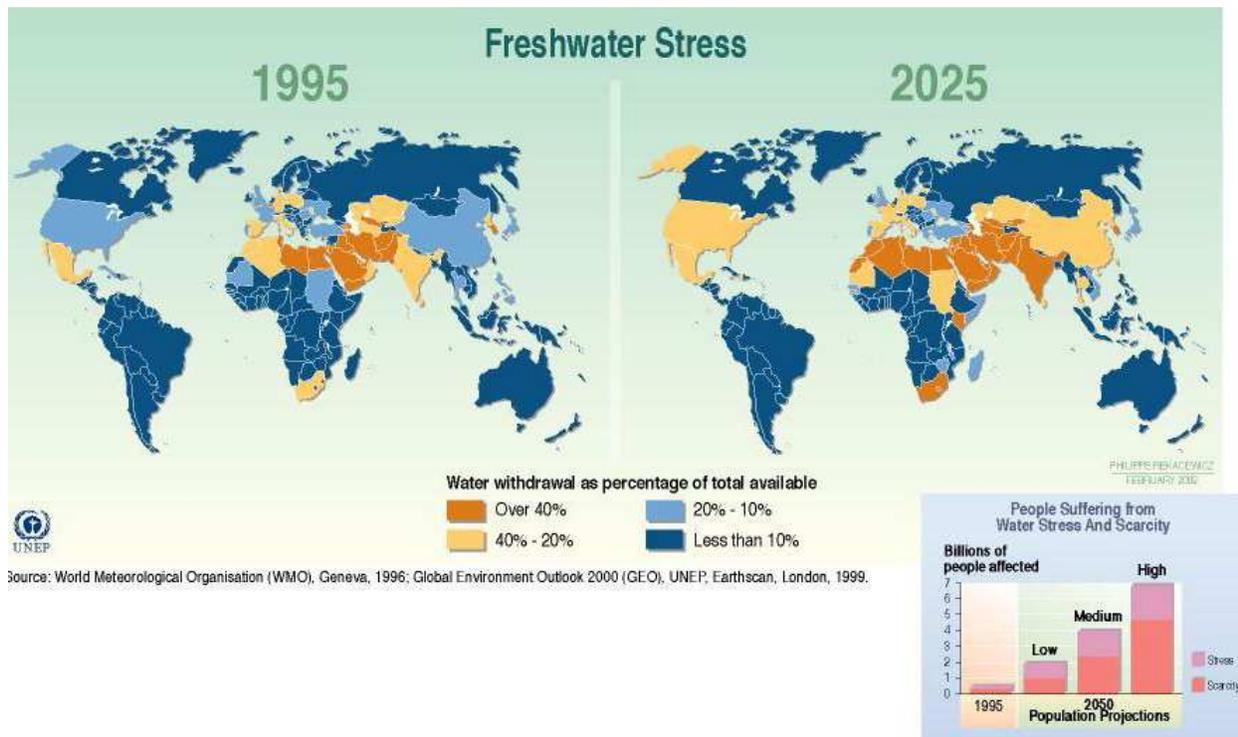
This research focused on interaction between states. The agreements between countries that may be considered fair for those countries may not necessarily be fair for local communities affected by those agreements. The construction of the Aswan High Dam displaced entire communities whose voices were unheard in political discourse. The effects and the circumstances under which local communities have on the behavior of the states should be studied.

Finally, research should eventually include all basins, not just the two cases studied here. If results hold across cases, reliability is increased. Otherwise, the specific variables that are questionable can be isolated and studied, potentially (and hopefully) resulting in a fine-tuned theory that can be applied to basins at risk.

“When the well is dry, we know the price of water.” These words by Benjamin Franklin are all too salient today. The goal then is to appreciate the price of water before that well runs dry.

## APPENDIX A

### The World's Freshwater



## APPENDIX B

### Map of the USA-Mexico border

Source: IBWC



### APPENDIX C

#### Map of the Nile Basin

Source: TFDD



## REFERENCES

- Abrams, Len. "Water Scarcity." Water Policy International Ltd. Retrieved from  
<[http://www.africanwater.org/drought\\_water\\_scarcity.htm](http://www.africanwater.org/drought_water_scarcity.htm)>.
- Brochmann, Marit, and Paul R. Hensel (2008). "Peaceful Management of International River Claims." Paper presented at the Annual Meeting of the International Studies Association, Chicago.
- FAO, NRL (2010). "AQUASTAT." United Nations (database). Retrieved from  
<<http://www.fao.org/nr/water/aquastat/data/query/index.html>>.
- Furlong, Kathryn, Nils Petter Gleditsch, and Håvard Hegre (2006). "Geographic Opportunity and Neomalthusian Willingness: Boundaries, Shared Rivers and Conflict." *International Interactions* 32, 1: 1–30.
- Giordano, Meredith A. & Aaron T. Wolf (2003). "Sharing Waters: Post-Rio International Water Management." *Natural Resources Forum* 27: 163–171.
- Gleditsch, Nils Petter, Kathryn Furlong, Håvard Hegre, Bethany Lacina, and Taylor Owen (2006). "Conflicts over Shared Rivers: Resource Scarcity or Fuzzy Boundaries?" *Political Geography* 25, 4: 361–382.
- Gleick, Peter H. (1993). "Water and Conflict, Fresh Water Resources and International Security." *International Security* 18, 1: 79–112.
- Hensel, Paul R., Sara McLaughlin Mitchell, Thomas E. Sowers II, and Clayton L. Thyne (2006). "Bones of Contention: Comparing Territorial, Maritime, and River Issues in the Western

Hemisphere.” Paper presented at the Annual Meeting of the American Political Science Association, Philadelphia.

Homer-Dixon, Thomas F. (1994). "Environmental Scarcities and Violent Conflict: Evidence from Cases." *International Security* 19, 1: 5–40.

ICE. “Nile River Dispute.” American University. Retrieved from  
<<http://www1.american.edu/TED/ice/nile.htm>>.

International Boundary and Water Commission (IBWC): United States and Mexico. Retrieved from <<http://www.ibwc.state.gov/home.html>>.

Jarvie, Jenny. (2007, Nov 4). “Atlanta water use is called shortsighted.” *Los Angeles Times*. Retrieved from <<http://articles.latimes.com/2007/nov/04/nation/na-drought4>>.

Kalpakian, Jack (2004). *Identity, Conflict and Cooperation in International River Systems*. Aldershot: Ashgate.

Kameri-Mbote, Patricia (2005). “From Conflict to Cooperation in the Management of Transboundary Waters. Linking Environment and Security – Conflict Prevention and Peace Making in East and Horn of Africa.” Heinrich Boell Foundation: Washington, DC. Retrieved from <<http://www.ielrc.org/content/a0509.pdf>>.

Keohane, Robert O., and Elinor Ostrom (1994). "Local Commons and Global Interdependence: Heterogeneity and Cooperation in Two Domains." *Journal of Theoretical Politics* 6, 4: 403–428.

Keohane, Robert O., and Lisa L. Martin (1995). “The Promise of Institutional Theory.” *International Security* 20, 1: 39-51.

Lemke, Douglas, and Suzanne Werner (1996). “Power Parity, Commitment to Change, and War.” *International Studies Quarterly* 40, 2: 235-60.

Mayell, Hillary (2001, Apr 26). "Shrinking African Lake Offers Lesson on Finite Resources."

National Geographic News. Retrieved from

<[http://news.nationalgeographic.com/news/2001/04/0426\\_lakechadshrinks.html](http://news.nationalgeographic.com/news/2001/04/0426_lakechadshrinks.html)>.

NBI (Nile Basin Initiative). Retrieved from: <<http://www.nilebasin.org/>>.

Sarquis, D. (2006). "Perspectives in the Repartition Water Process between Mexico and the USA,

in the Border Zones of Texas and Coahuila-Tamaulipas, in the Beginning of the 21st

Century." Paper presented at the annual meeting of the International Studies Association,

Town & Country Resort and Convention Center, San Diego, California.

Scott, Shirley V. (2008). "The problem of unequal treaties in contemporary international law:

how the powerful have reneged on the political compacts within which five cornerstone

treaties of global governance are situated." *Journal of International Law & International*

*Relations*.

Scot E. Smith and Hussam M. Al-Rawahy (1990). "The Blue Nile: potential for conflict and

alternatives for meeting future demands," in *Water International (Lausanne)*, 15, 4: 217-22.

Swain, Ashok, 1997. "Ethiopia, the Sudan, and Egypt: The Nile River Dispute." *The Journal of*

*Modern African Studies*, 35, 4: 675-694.

TFDD (2007). "International Freshwater Treaties Database." Oregon State University (database).

Retrieved from <<http://ocid.nacse.org/tfdd/treaties.php>>.

Toset, Hans Petter Wollebæk, Nils Petter Gleditsch, and Håvard Hegre (2000). "Shared Rivers

and Interstate Conflict." *Political Geography* 19, 6: 971–966.

Wolf, Aaron T. (1998). "Conflict and Cooperation Along International Waterways." *Water*

*Policy* 1, 2: 251-265.

Wolf, Aaron T., ed. (2002). "Conflict Prevention and Resolution in Water Systems." Cheltenham: Edward Elgar.

Wolf, Aaron T. (1999). "Criteria for equitable allocations: The heart of international water conflict." *Natural Resources Forum* 23, 1: 3-30.

Wolf, Aaron T. and Joshua T. Newton (2008). "Case Studies of Transboundary Dispute Resolution." Appendix C in, Delli Priscoli, Jerry and Aaron T. Wolf. *Managing and Transforming Water Conflicts*. Cambridge: Cambridge University Press.

World Development Indicators 2009. The World Bank (database). Retrieved from <<http://go.worldbank.org/U0FSM7AQ40>>.

"World's largest aquifer going dry." (2006, Feb). U.S. Water News Online. Retrieved from <<http://www.uswaternews.com/archives/arcsupply/6worllarg2.html>>.

## ACADEMIC VITA of Kristian Soltes

Kristian Soltes

1807 Augusta Drive

Jamison, PA 18929

[kvs5015@psu.edu](mailto:kvs5015@psu.edu)

### Education:

Bachelor of Arts Degree in International Politics, Penn State University, Spring 2010

Bachelor of Arts Degree in International Studies, Penn State University, Spring 2010

Minor in Economics; French and Francophone Studies

Honors in International Politics

Thesis Title: Power Parity and Transboundary Freshwater Agreements

Thesis Supervisor: Douglas Lemke

### Related Experience:

Internship with Commissioner Casey at the U.S. Securities and Exchange Commission

Summer 2009

Supervisor: Justin D. Daly

### Awards:

Institute for American Universities Outstanding Achievement

College of the Liberal Arts Dean's List

Schreyer Honors College Academic Excellence Scholarship

Smeal College of Business Dean's List

National Honors Society

### Presentations/Activities:

Co-founder and treasurer of "A Night on the Town" Senior Ball for the Elderly

Studied at the Institute for American Universities in Aix-en-Provence, France

Scholars Alumni Society Mentoring with Honors Program: Protégé