

Chapter 2

Literature Review

2.1 Climate Change, Fluctuations in Water Availability and Security

The focus of this review is to examine the relationships between international conflict and changes in climate (with shifts in water availability being a key factor in these changes). There is a vast amount of literature touching on the issues of climate and conflict, and by extension on environment and natural resources and their influence on societal and political stability (Brown et al. 2007; Eckstein 2010; Swart 1996). Global warming has raised concerns that changes to climate will pose unique challenges to many nations' security interests. Several studies have examined how already stressed systems that are vulnerable could be driven past a tipping point by shifts in climate (Barnett 2003; Dabelko 2008; Mabey 2007).

The 2007 IPCC report summarizes the scientific understanding of climate change's impact on both air temperature and water resources, including far-reaching changes in the intensity and variability of precipitation and increases in the risk of flood and drought in many areas of the world (Bates et al. 2008; IPCC 2007).⁶ Models indicate that changes in climate will vary significantly in time and in space and, consequently, international river basins, and the stability of the treaties that govern them, will not be impacted uniformly. Those areas that are already vulnerable to drought may have its frequency and intensity increased. Likewise, areas that have floods may receive higher intensity flooding more often. For many locations, the IPCC projects that the changes in water resources are likely to be dramatic. Historically, long-term fluctuations in water supplies have typically occurred on a relatively limited scale, with usually only localized areas impacted. However, climate change will likely intensify the global hydrologic cycle, impacting multiple regions at the same time (Fowler et al. 2003). When

⁶ Such climate shifts are predicted with fairly good certainty at the global level, but this certainty is reduced as scales decrease to the national and local level.

stresses to a basin are severe or long-term (such as from shifts in climate patterns), sometimes second, third, and fourth order changes must develop before a new equilibrium is attained. Putting a finger on the causes and responses to change that are often indirect and at multiple scales requires an understanding of the social and physio-chemical dynamics within these ecosystems that is undoubtedly a daunting challenge.

Many of the impacts of climate change, both positive and negative, will coincide with fluctuations in water resources that in many areas are already scarce. Twenty-one countries fell below the threshold for water scarcity in 2000 and “another 14 will join them by 2030. This represents 55% of the world’s population” that will have insufficient domestic water (Falkenmark 1990; World Economic Forum Water Initiative 2009).⁷ Changes in precipitation and temperature from climate change create uncertainty regarding the timing, quality, and quantity of current water resources. A change in absolute water resources also has an impact on the relative wealth of countries and causes changes in relative power. Allan (2007) notes that contemporary conflict theory postulates that “conflict and social change originate from shifts in relative deprivation, from absolute deprivation, where the availability of even the lowest quality of life is uncertain, to a state of relative deprivation, which raises an awareness that others have more.” Migration could result from both the increased appeal of areas with abundance or from shifts to scarcity that can make areas less habitable. Such rapid shifts have been proposed as causes of conflict in the past, especially in areas where governance structures are not robust and institutional resiliency is low (Giordano et al. 2005; Lee 2010).

Fluctuating or inadequate water resources, such as those predicted by the IPCC, have been cited by many scholars as a potential major factor in political conflict and even war (Starr 1991). Despite a lack of historical precedent, some studies continue to revert to environmental determinism, with a linear relationship between climate change induced resource scarcity and resulting conflict (World Economic Forum Water Initiative 2009). While recognizing that the relationship between resource scarcity and conflict is complex and non-linear, climate-related stresses can certainly complicate relations (UNEP 2004; Giordano et al. 2005).

Conflict over transboundary water resources, when it has occurred, has usually been associated with rapid change and the introduction of stress to a system such as from drought, dam construction, or shifting political boundaries, as well as negative overall political relations (Wolf 2007). When such stresses to the status-quo are beyond the available water management capabilities of nations, often incorporated in institutions such as treaties, they have often struggled to find satisfactory solutions that fulfill both their own requirements and the needs of neighbors who share the water. The complexities of nations sharing a vital, valuable, and

⁷ Although water requirements are highly variable depending on the demands of an individual country, 1,000 m³/capita/year water scarcity in this case is used as a measure of where water becomes a limitation to economic development (Falkenmark 1990). Many countries exist and flourish on much less than this amount, while other countries lack the infrastructure or management capacity to utilize their abundant existing resources.

increasingly variable natural resource cause water management to blend more into international diplomacy and conflict management (Odom and Wolf 2008).

Internal instability within states often carries over into the international realm and must also be considered. For example, the Darfur conflict at least partially stemmed from local pastoral and agricultural groups fighting over access to scarce resources that then grew to have international aspects. The current UN General Secretary Ban Ki-Moon has made such connections, stating that the Darfur crisis “grew at least in part from desertification, ecological degradation, and a scarcity of resources, foremost among them water” (UNEP 2010).

The interaction between environmental stresses, responses at various scales, and state stability have been described by scholars through the lens of securitization (Allan 2007). Buzan (2000) considers security from different scales to describe how people or societies construct or “securitize” threats. The three levels used to describe interactions at different scales are individuals, states, and international systems (Buzan and Waever 2009). Starting at the individual level, security can be considered as a factor of “life, health, status, wealth, freedom” (Stone 2009). While defining individual security can be complicated by personal differences, Maslow’s Hierarchy type-requirements generally hold true (Maslow 1943). However, the concept of security at the individual level does not directly translate and apply to national security (Stone 2009). For the level of state security, Buzan (2000; Buzan and Waever 2009) considers that states are larger, more complicated entities with a constantly shifting hierarchy of requirements in often overlapping sectors of Political, Military, Economic, Societal, and Environmental. Each sector impacts security, but also is linked to all the other sectors in often intricate and complex ways so that a discussion of each sector on its own does not adequately address the issue of security (Stone 2009). It is necessary to decipher where one sector ends and another begins to determine how each sector individually affects overall security.

Buzan (2000, 2001) discussion of security and stability at different scales and for different sectors is especially useful in the context of climate change. The impacts of climate change will be largely in the Environmental sector, but it will arguably be as much of a factor and influence in other sectors, with consequences that are largely unpredictable. As opposed to most problems, climate change is unique as an environmental stressor since it has the potential to have a varying degree of impact on the Political, Military, Economic, Societal, and Environmental sectors at the same time and at all three scales (individuals, states and international systems). Allan (2001) builds on Buzan’s ideas and notes that contentious issues arising over shared freshwater resources occur when extreme circumstances temporarily elevate the ‘normal’ lower status of water to the ‘high’ level of ‘security politics.’ With climate change and added scarcity, this increased importance has the potential to become permanent.

Many of the impacts of climate change will have little to do with the actual, realized environmental shifts within their borders, but instead are based on responses to the perceptions of projected change and the international political and economic ramifications of change in other areas. Nations are taking notice of and are already planning for the security implications of climate change. Many

countries' actions for mitigating or taking advantage of climate change are already having second and third order impacts on both national and international stability. In India, approximately 2.6% of the country's 2006–2007 GDP was spent on adaptation to climate variability, likely intended to protect the 18.6% of their GDP and 60% of their employment that originates from agriculture (Paskal 2010). "All countries will need to attain a reasonable measure of water security to compete effectively in global markets" (World Economic Forum Water Initiative 2009). Perhaps in response to climate change projections, water-scarce, developed countries seeking their own water solutions are causing changes in the geopolitical landscape by securing agricultural land overseas from less developed nations. Wild fluctuations in global food prices associated with the 2008 crisis coupled with forecasts for future water demand has led many countries that were previously willing to rely on 'virtual water' in the form of food and other imports to now believe that "rapidly industrializing economies across South Asia, the Middle East and North Africa" (supporting approximately 2.5 billion people) will need to acquire additional water resources, including in the form of water-rich agricultural land outside their borders (World Economic Forum Water Initiative 2009). Countries with more natural water resources will become more attractive locations for investments, and instability could be exacerbated in less developed countries willing to mortgage long-term water scarcity for immediate financial gains (World Economic Forum Water Initiative 2009). Many countries have already taken steps towards this.⁸ In this way, the projections (and not the documented impacts) of physical scarcity from climate change are driving and influencing changes in geopolitical and socio-economic scarcity both between and within nations.

Conflict often has indirect and multiple causes, and similarly the path from changes in climate to conflict between nations, if it is to occur, will not be a direct one (Lee 2010). Conflict is not a linear response to stresses and changes from a shifting climate. Lee (2010) proposes three pathways for climate change to lead to conflict: sustained trends, conflict triggers, and intervening variables. Sustained periods of divergent weather leads to decreased national management capabilities and increased vulnerability to any additional stress. Lee's second pathway is conflict triggers, which include events that spark conflict such as assassinations, extreme natural events, or acts of violence. Climate change can create conditions where the threshold is lowered in order for conflict triggers to incite international conflict. Intervening variables include a degradation in adaptive abilities originating from factors other than climate change such as poverty, inequities between groups, weapons availability, ethnic tension, and institutional resilience. From Lee's analysis we see that

⁸ Saudi Arabia considered its options to continue growing sufficient wheat for the country. In 2008, they gave up being self-sufficient and instead chose to "set up an investment fund to acquire land overseas to grow crops, possibly in Pakistan or the Horn of Africa. China is acquiring agricultural land in Southern Africa for similar purposes" (World Economic Forum Water Initiative 2009). South Korea was looking to lease land from the government of Madagascar to grow food until protests occurred, which may have had some influence on a regime change in 2009 (African Economic Outlook 2010).

the institutional resilience that treaties help to engender is only one of a number of determining factors for climate change related conflict. Treaties may be especially important, though, from the international aspect of managing climate stress. Paskal (2010) states that treaties should be considered not only for their equity and legality, but also for their ability to adapt to changing environmental circumstances.

2.1.1 Environmental and Water Institutions

Institutions can take on a number of different appearances and designs, but are generally understood as agreements or procedures intended to establish a protocol for enhancing mutually beneficial political or technical interaction. Institutions can be formal or informal, and can be applied across a wide variety of scales from the individual to regional to global. Dombrowsky (2008) states that institutions make up international regimes which in turn are the “implicit and explicit principles, norms, rules and decision-making procedures around which actors’ expectations converge in a given area of international relations.”

Institutions are often regarded as an important explanatory variable with regard to conflict or cooperation, with most studies indicating that institutions have helped to prevent disputes over shared water resources and increased cooperation between riparian states (Mitchell 2006; Wolf 1997). Under regime theory, treaties act as tools intended to better manage and share natural resources, such as water (Daoudy 2008; Jagerskog 2003). Institutions represent a nation’s means to manage environmental stress and the “will, wit or capacity to change (a) state of knowledge, social goals, cultural modes, and technological mixes, or form of economy” (Selby 2006). Treaties can define acceptable behavior and direct political interactions, and thus enhance stability. Recognized rights that have been previously established in a treaty can limit the potential for conflict since the likelihood of conflict generally decreases with “explicitly stated rational goals; and when there are norms and legal channels available for resolving conflict” (Allan 2007, p. 231). If all parties have agreed upon limits, transgressions are easier to avoid and redress. Transgressions of a well-designed treaty with clear definitions can often be solved with simple objections or communication without broaching the larger, perhaps more volatile subjects that were tackled at the time of the treaty signing (Hamner 2008, p. 40).

Mitchell (2006) notes that institutions can help with compliance and with conflict management through processes that include “facilitative intervention in the form of good offices, mediation, conciliation, and fact finding, and binding intervention in the form of arbitration or adjudication.” Many bilateral and regional water sharing agreements incorporate the overarching principles or general concepts of international law, but do not include specific mechanisms designed to facilitate negotiations and interactions between nations. In other words, the means to “not only solve disputes between states, but facilitate negotiation and positive interaction to resolve minor points of disagreement before they become legal disputes” (Subedi 2003, p. 35).

While the establishment of a comprehensive regime is almost universally recognized as a positive, the effectiveness of specific principles (with the principles within the 1997 UN treaty most often cited) during the application of the treaty has not been empirically determined (Tanzi and Maurizio 2001). Research concerning the impacts of institutional design on the management of international rivers remains limited and the mere creation of an international water regime “does not provide any guarantees that it will ultimately contribute towards problem solving” (Dombrowsky 2008). With regards to environmental institutions in general, there have been many explanatory models/variables proposed in an effort to account for their success/failure [e.g. (Gerlak 2004, 2007; Gerlak and Heikkila 2006, 2007; Heikkila and Gerlak 2005; Young 2006, 2002)]. Chasek and Brown (2006) discuss how regime effectiveness is tied most closely to three main factors: first, regime design, which includes enforcement, reporting, and monitoring; second, implementation, which includes the “extent to which actors adopt formal legislation and other regulations to enact the agreement.”; third, compliance, or how much actors actually observe the treaty and regulations. Chasek then notes several obstacles to implementing/complying with conventions. These include transition from regime laws to domestic laws, lack of capacity to implement laws, lack of respect for the law, compliance costs, and lack of funding.

Treaties are often considered for their perceived impact without any knowledge of their inner workings. Blomquist et al. (2004) notes that additional investigation of institutions is warranted to determine how they affect the outcome by prompting people to change their management practices, easing or hindering change, and shaping the management alternatives that water uses and organizations consider and adopt. The next step for treaty research is to go beyond a generic view of their positive nature towards an examination of the design and application that determines how and why they matter.

2.1.2 International Water Law

A review of international law reveals very few accepted general rules and guidelines for governing water resources. International water law is still in its formative state and nations have generally been solving their water sharing issues on an ad hoc basis with very few specific internationally recognized, overarching principles. An examination of the world’s inter-state water agreements shows a wide array of mechanisms used to manage flow variability and minimize disagreement with varying degrees of effectiveness. According to the Oregon State University Transboundary Freshwater Dispute Database (TFDD 2008), there are over 450 international treaties that govern river basins worldwide. Interpretations vary among the global community regarding which mechanisms are most important and the extent to which they have contributed to a successful agreement. Consequently, there is a lack of uniformity in the broad range of principles and prescriptions found within the world’s water treaties.

Perhaps prompted by the limits of established international water law, nations have employed a wide variety of tools to facilitate compliance. The extent to which nations agree to enforce their treaties is sometimes described in terms of ‘hard’ or ‘soft’ law. Both terms have broad definitions that can refer to a number of processes, but the common thread generally used to segregate them is the binding nature of an agreement. Soft law sometimes refers to codes of conduct or is explained as ‘customary law’ that is not formally binding. There is not usually a set protocol for enforcing soft law; instead, the opinion and feedback from funding agencies, donors, and other nations is perhaps the greatest force for applying pressure.⁹ Hard law includes some sort of obligation, sanctions, and/or an *enforcement* mechanism (Trubek et al. 2005). International hard law provides the greatest leverage to enforce a state’s or community’s desired impact. Abbott and Duncan (2000) describe the international use of hard and soft agreements, finding merit for both types of agreement. They state, “private actors generally seek hard legal arrangements that reflect their particular interests and values.” However, hard laws “often conflict with those of other private actors or of government.” For this reason, “soft legalization helps balance competing considerations, offering techniques for compromise among states, among private actors, and between states and private actors.”

International water law, which is shaped by and includes the treaties themselves, almost always falls under the category of soft or customary (Vinogradov et al. 2003). The most comprehensive, widely referenced summary of customary law for international water management is in the United Nations 1997 Convention on the Law of the Non-Navigational Use of International Watercourses.¹⁰ The convention states its intent is to lay a widely-applicable “codification and progressive development of rules of international law” and framework that “will ensure the utilization, development, conservation, management and protection of international watercourses” (U.N. 1997). The convention builds on the International Law Association’s Helsinki Rules on the Uses of the Waters of International Rivers and summarizes many of the core concepts found in treaties at the time of its signing (McCaffrey 2007).¹¹ Negotiations for the 1997 UN Convention began in 1981 and had participation from all UN member states. “Adopted by a large majority on May 21, 1997, the Convention has not entered into force since...35

⁹ Soft, or customary law, enforcement tactics can include ‘naming and shaming’ those parties that are not in compliance with an agreement (McCaffrey 2007).

¹⁰ The convention was constructed by the International Law Commission, which is a “UN body composed of legal experts nominated by states, elected by the United Nations General Assembly, and tasked with the codification and progressive development of international law” (Salman 2007).

¹¹ The 1997 Convention is based in large part on the Helsinki Rules. “Concepts such as equitable utilization and the consideration of all beneficial uses, as well as using the international basin as the primary unit of analysis, were laid out in the Helsinki Rules” (McCaffrey 2007).

countries are needed to make the UN Convention applicable to all parties” (Salman 2007).¹² As of 1 July 2010, it has only been ratified or approved by 19 countries.¹³ Wouters and Salman (2000) notes that the Convention did not require 35 ratifications by May 20, 2000 in order to come into force and that “as with many other global international treaties, the UN Watercourses Convention will come into force upon acquiring the necessary number of ratifications. This could occur at any time and, in fact, is a feasible possibility.” Even if it does enter into force, only countries who have signed the convention will be party to it. States that initially voted for the convention are not obligated to then sign or abide by it.

The 1997 UN Convention presents baseline principles in order to provide a framework for managing international waters or dispute resolution. There are very few specifics; instead, common definitions and expectations are laid out with the intent that they be applied in a way that is appropriate for the specific basin. For example, broad terms such as “watercourse” are defined, but the specifics are left to those applying the definitions (Salman 2007). There are four principles in the convention that are increasingly referenced by those managing international watercourses. They are:

- Article 5 is the “equitable and reasonable utilization and participation” obligation to utilize an international watercourse in an equitable and reasonable manner (often summarized as ‘equitable utilization’) (U.N. 1997);
- Article 7, which presents the “obligation not to cause significant harm” to other riparian states (the “significant harm” rule) (U.N. 1997);
- Article 12, entitled “notification concerning planned measures with possible adverse effects” discusses the notification of other riparians of water management and construction that could “have a significant adverse effect upon other watercourse States” (often summarized as “prior notification”) (U.N. 1997);
- Articles 20–26, entitled “Protection, Preservation and Management,” these articles deal with obligations to protect the environment associated “with international watercourses, including protection and preservation of ecosystems; prevention, reduction and control of pollution; introduction of alien or new species; and protection and preservation of the marine environment” (Salman 2007; U.N. 1997).

A twenty-year analysis of hundreds of treaties led to the establishment of the core principles found in the 1997 UN Convention (Conca 2006). The pendulum now swings in the other direction, with nations encouraged to take the general

¹² 106 countries voted for the Convention, and three against (Burundi, China, and Turkey), with 26 abstentions (from personal communication with Ms. Flavia Loures, at the World Wildlife Fund).

¹³ Finland, Germany, Hungary, Iraq, Jordan, Lebanon, Libya, Namibia, Netherlands, Norway, Portugal, Qatar, South Africa, Spain, Sweden, Syria, Tunisia, Uzbekistan, and, most recently, Guinea-Bissau have signed onto the Convention (from personal communication with Ms. Flavia Loures).

principles from the convention and apply them in the hundreds of specific agreements. While the convention may never get the necessary signatures to enter into force, it does influence nations regarding how they manage their agreements, especially new agreements or the diplomatic negotiations regarding their shared watercourses. For instance, Southern African Development Community Protocol on Shared Watercourses have rewritten the protocol to include the main provisions of the Convention (Loures et al. 2010; Wouters and Salman 2000). Unfortunately, the broad and vague language used in the convention can be interpreted in a variety of ways that can often be conflictive. There is no overarching management body to provide direction and it is left up to the parties involved to determine whether actions and principles conform to the convention. Application of the convention is further complicated by a lack of oversight or practical enforcement by the UN for situations that cannot be resolved independently.¹⁴ The net effect is that abstract UN Convention principles, such as absolute territorial sovereignty and absolute territorial integrity, can be the basis for an agreement, but also require a compromise based on basin-specific water requirements (Odom and Wolf 2008).

For practical application of the convention, interpretation of general principles such as 'equitable utilization' and 'no harm' is accomplished by looking at existing treaties and how they have already applied these terms. This is, in essence, the basis for all legal construct as established under 'Customary International Law.' The definitions of 'fair and equitable' and 'no harm' are determined by the widespread repetition of similar acts by States "out of the belief that the law required them to act that way" (Berkeley 2007). In other words, "it is by looking back at previously established treaties that we can best understand how to go forward with these principles" (Dinar et al. 2007). However, detecting and quantifying these principles is often difficult. From examination of the actual treaties, the "aforementioned principles of causing no significant harm, prior use and priority of use are not explicitly referred to in documents that allocate water" (Odom and Wolf 2008).

International law has arguably not kept up with the shifting management requirements that stem from increased use and new applications of water. Many international problems from the expanding and myriad uses of water have yet to be solved. Thus far, "most attempts to manage the new suite of water sharing problems have simply mirrored the methods used for navigation" (McCaffrey 2007). As McCaffrey (2007) states, "maintaining harmony between nations sharing freshwater resources and providing equitable allocation of those resources while protecting ecosystems and water quality is one of the great challenges facing international law and institutions in the twenty-first century."

¹⁴ The International Court of Justice will hear cases that may be in violation of the Convention, but only when both parties agree to it and only regarding specific issues (McCaffrey 2007).

2.1.3 Water Treaty Implementation and Application

The application and implementation phase of water treaties has largely gone unanalyzed. Some suggest that empirical research of the sort that catalogues representative observations is too limited for properly identifying critical factors and for creating regression equations that speak towards causality (USACE 2006, p. 13). Academic work has largely been focused on how water treaties were established (i.e. how to get parties to cooperate enough to sign and implement these agreements), rather than the impact of the treaty subsequent to its signing (Bernauer 2002; Koundouri 2006; Siegfried and Bernauer 2007). Research examining the impact and effectiveness of treaties has generally been limited to individual basin case studies, which have been conducted for several specific basins around the world (Alam 2002; Eyal Benvenisti 2003; Jagerskog 2003; Mimi 2003; Williams 2007). These case studies often examine the effectiveness of treaty design features in order to provide answers to when and why each treaty fails or succeeds. While a strong institutional influence is almost universally acknowledged by these studies as a positive causal factor for successful management of trans-boundary waters, the construction and performance of the different institutions is highly variable.

Since a comparison with other treaties and locations is often not pursued, the applicability of these results is usually limited to a specific study basin (Bernauer 2002). Very few researchers have empirically examined the relative strengths and weaknesses of institutions across multiple basins (Marty 1999; Shira Yoffe 2003; Yoffe et al. 2003). A quantitative study across a large number of basins that generalizes the extent to which common and dissimilar institutional characteristics may influence the success or failure of a treaty has not been undertaken.

2.1.4 Water Treaty Design

Most international organizations limit their prescriptions for modifying old treaties and creating new ones to general guidelines such as those in the UN Watercourses Agreement. For example, UNDP Water Governance Facility at SIWI acknowledges that there is no blueprint for how transboundary water cooperation should be accomplished, but instead gives general guidelines such as:

- “The respective riparian feel an ownership of, and a political commitment to, processes of promoting cooperation”;
- “The respective riparian shifts focus and moves from challenges and constraints to opportunities”; and
- “Trust and personal relations are developed among riparian delegations from countries and between domestic water user groups” (U.N.D.P. Water Governance Facility 2010).

Overarching principles such as these are indeed needed to provide goals and a vision from which all parties can agree to base their negotiations. However, what is often lost in the generalities is a blueprint of how to best implement such nebulous ideas as ‘promoting cooperation’ and developing ‘trust and personal relations’. In other words, what are the ‘nuts and bolts’ that can be applied to mold these principles into a workable agreement? This section examines the academic literature and provides a summary analysis of the treaty parameters that are most often cited as essential to successful treaty implementation.

Treaty parameters and principles that have theoretically been important, but are not shown empirically across a large number of treaties, have been put forth by multiple authors. Recent work (Dinar et al. 2008; Drieschova et al. 2008; Itay Fischhendler 2007, 2008; Stahl et al. 2010) has shown that some water allocation mechanisms are better able to cope with climate-uncertainty, based on their ability to manage hydrologic changes and subsequent reductions in the number of interstate grievances associated with changes in runoff. Drieschova et al. (2008) and Fischhendler and Feitelson (2005) found that specific allocation mechanisms resulting from negotiations vary and that many that had been agreed upon by all involved parties were not ideal due to technical or political barriers.¹⁵ Dinar et al. (2008) describes eight allocation methods that include “fixed quantities that vary according to water availability, fixed quantities recouped in the following period, by percentage available, prior approval (e.g. by joint management commission), geographic distribution/allocation of entire rivers, consultation, and prioritization of uses.” Using this classification, Dinar et al. (2008) identified 137 treaties and associated grievances that pertained to water quantity, hydropower and flood control. Statistical analyses were conducted on a subset of 74 treaties (basins with only two riparians) to infer how precipitation variability affected the frequency and intensity of complaints and found that “various mechanisms are statistically different in their resiliency to complaints and grievances” (De Stefano et al. 2009; Dinar et al. 2008).

Overall, the works by Marty (1999) and Drieschova et al. (2008) have perhaps best framed the terms for water institutional effectiveness/resiliency, and supported the hypothesis with some empirical data across multiple basins. Marty provides a solid foundation for proceeding to a larger-scale research (with a larger number of basins) using social and political theory as explanatory mechanisms. Marty proposes that treaties that are detailed and have exact guidelines are more successful. The more specific the expectations, the more behavior can be influenced since the parties know how they should behave to comply with the regime specifications. He contends that increased clarity inherently resulting from most treaties prevents future confusion or conflict and simplifies the implementation and operation of the basin management plan. However, while *specificity* in treaties may be an indicator of strength, the mere presence of a mutually agreed upon thresholds could also be

¹⁵ In that case, ‘ideal’ meaning flexible in the face of change but still enforceable and binding.

superficial in its importance. Institutions that go beyond metrics and also define outcomes and strategies for successfully achieving those outcomes, including specific goals and thresholds, may be inherently more focused and resilient.

Drieschova et al. (2008) look at treaty mechanisms for addressing flow variability. They propose several mechanisms that are likely to aid in managing variability. They then examine large numbers of treaties and calculate the percent of treaties that contain those mechanisms. While they propose that each mechanism could play a role in management, they do not attempt to empirically quantify or evaluate the role of each mechanism in treaty resiliency. While some treaties include mechanisms that are explicit in their intention to manage flow variability, the majority use broad, non-specific mechanisms that “deviate from an ‘ideal’ state of being both flexible in the face of change but binding in enforcement” that rather “reflect trade-offs between flexibility and enforcement.”

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Zentner, M.

2012, X, 214 p., Hardcover

ISBN: 978-3-642-23742-3