

Nature of Transboundary Water Conflicts: Issues of Complexity and the Enabling Conditions for Negotiated Cooperation

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Abstract: Water access, demand, usage and management become complex due to the crossing of multiple boundaries: political, social and jurisdictional, as well as physical, ecological and biogeochemical. This paper focuses on a particular class of complex water problems: the allocation of transboundary water (TBW) among competing riparians with conflicting needs. The complexity in TBW allocation lies in the dynamic consequences of competition that arise from the interconnections and feedbacks among actors, processes and institutions operating in the knowledge and political communities. Consequently, many TBW allocation issues become contingent upon the dynamic changes that occur within the knowledge and political communities as well as the interactions and feedback occurring between these two communities. In addition to understanding and addressing the contingent contextual factors that span the knowledge and political communities, resolving complex TBW problems also needs to be guided by contextual application of two global principles – equity and sustainability – as anchors to accommodate the values and interests of the stakeholders involved in a TBW problem. This paper examines the process that led to the relatively successful resolution of conflict over allocating the waters in the Indus basin between India and Pakistan. Using the Indus water treaty as an illustrative case, the paper identifies three enabling conditions that underlie the effectiveness of negotiating a treaty and its continuous efficacy in addressing TBW problems. The paper argues that effective resolution of complex TBW problems is rooted in the nature of the negotiation process, the provisions in the negotiated agreement and the establishment of institutional means to solve emergent problems that are related to the original agreement.

Keywords: *contingency, Indus Treaty, joint commission, mutual benefits, negotiation, third party*

Water access, demand, usage, and management become complex because of many boundaries: political, social, and jurisdictional, as well as the physical, ecological and biogeochemical boundaries that operates in a specific context. While scientific formulation and engineering solutions are necessary to address complex water problems, societal and political contexts are also an integral part of long-term solutions. The most challenging water problems are framed within contested terrains in which various stakeholders compete to protect their own interests within frameworks created by political boundaries, markets, institutions, laws and social

norms, in addition to scientific research and technological expertise.

The origin of many complex water problems lies in the dynamic consequences of competition, interconnections and feedback that are spread across variables that operate in the knowledge and political communities. Consequently, science alone cannot solve complex water problems that involve policy issues, and policy ideas uninformed by science are no more effective. In this paper, we focus on a particular class of water problems: allocation of international water. Over 276 river basins cross national boundaries (TWAP 2013). While the majority of the international river basins

are shared between two countries, there are 13 basins that are shared between 5 and 8 countries, and five basins are shared between 9 and 11 countries (UNDP 2006).

Changes in population growth, socioeconomic conditions, and ecosystem functions and services are creating more demands on available fresh water resources. Some estimates suggest that the demand for water is projected to grow by over 40 percent by 2050, and over half of the global population could be living in water-stressed conditions (WWAP 2012). This mismatch between supply and demand for fresh water is expected to intensify and may become exacerbated by the mismanagement of water resources, transboundary conflicts, impacts of climate change, development trajectory of countries and the growing rate of urbanization in developing countries (Agnew and Woodhouse 2011; Srinivasan et al. 2012; Brown and King 2012; Islam and Susskind 2015). Such mismanagements may lead to more tensions and conflicts among competing users (Judge 2013; Starr 1991) because some of the basins are shared by countries not only with different interests and economic needs, but also with fragile governance structures and a history of conflict.

The long history of disputes over water is documented in myths, legends, and contemporary academic analyses (Hatami and Gleick 1994; Toset et al. 2000; Wolf 2007). In recent years, we have seen upstream-downstream tensions - between India and Bangladesh, Ethiopia and Egypt, Pakistan and India, and Israel and Jordan - as well as clashes among agricultural and energy interests for water. Yet, the historical evidence of violent conflicts over water is significantly less than the evidence of negotiated cooperation to resolve TBW disputes (Yoffe et al. 2003; Wolf 1999). Beyond this historical pattern and in terms of theoretical reasoning, the literature on TBW points to contingent possibilities of cooperation over sharing TBW. In other words, the competing claims and demands on TBW by its riparians can lead to either conflict or cooperation. Therefore, it is necessary to understand the factors that give rise to conflict and cooperation as contingent and not necessary outcomes. It follows that we need to look for ways to identify the factors that prevent conflict and promote cooperation, as well

as consider constructive conflicts as a means to secure enduring cooperation.

The global understanding of cooperation currently rests on the application of the values of equity and sustainability as normative principles in addressing and resolving TBW issues. In the Berlin rules, Articles 5-9 specify the principle of equity and its contingent interpretation, while Articles 12-16 establish the application of the meaning of sustainability and its contingent interpretations (Berlin Rule 2004). These two guiding principles stand as global norms not only because they are encoded in the Berlin Rules, but also because of their progressive evolution from the 1997 UN Convention (UN Convention 1997), which in turn emerged from the 1966 Helsinki Rules (Helsinki 1966). Using these two principles as anchors, this paper identifies the enabling conditions of enduring cooperation among riparians in sharing transboundary water.

The Complex Problem of Addressing Transboundary Water Disputes

Transboundary water allocation remains a focal issue in a range of water literature (Biswas 1992; Gleick et al. 2002; Prescoli and Wolf 2009; Wolf 2010; Subramanian et al. 2012; Dellapenna et al. 2013 and references therein). TBW cuts across political boundaries and includes surface water, underground water and interconnections between the two (Subramanian et al. 2012). Notably, with a few exceptions, dispute over TBW has not led to major armed conflict (Allan and Mirumachi 2010; Prescoli and Wolf 2009). This is often attributed to the effectiveness of governance (Agnew and Woodhouse 2011) in using bilateral or third party mediated negotiation (Jarvis and Wolf 2010; Priscoli and Wolf 2009; Biswas 1992; Earle et al. 2010). These agreements or treaties are further sustained by a water regime that continues the process of negotiated cooperation among competing stakeholders. This serves as a ground of optimism to not only rely on mediation in resolving water conflicts, but to also make further advances in the efficacy of mediation to address emerging disputes.

Not all TBW allocation issues are complex, even where there is a dispute (Islam and Susskind

2014 and 2013). However, some TBW issues are complex (e.g., Mollinga 2007; Earle et al. 2010; Prescoli and Wolf 2009; Islam and Susskind 2013), their intricacy rooted in coupled human and natural system interactions (Liu et al. 2007; Saravaran 2008; Petersen-Perlman et al. 2012). A key reason for this complexity is the uncertainty of interactions between issues and actors that function in the political and knowledge domains of water management, arising from the different political needs, boundaries, knowledge, know-how, management capacity, and political power of the disputants. These conditions can be present singly or in interaction with each other in a dispute, and thereby constrain the choices available to stakeholders finding mutually acceptable solutions.

Defining the allocation of TBW as a complex problem - rooted in the interactions and feedbacks within and between knowledge and political communities - shifts our focus from seeking efficient tradeoffs from primarily rational perspectives to identifying and negotiating the needs of multiple stakeholders with competing - and often conflicting - values and interests. Thus, a purely economic framework that balances supply with demand and promotes only technocratic interventions fails to account for other values important in managing water as a resource. However, these other values affect TBW policy debates and are generally framed within two communities engaged in water-resource management, referred to in this paper, as the knowledge community and the political community.

The knowledge community includes actors and activities in the technical sphere of water research, water management, and water policy. One key outcome from this community is the formulation and widespread adoption of the integrated water resources management (IWRM) as a comprehensive approach to realizing the value of sustainability. The IWRM now enjoys a paradigmatic status, and hence by usage is normative in scope and application (Gallego-Ayala 2013).

Alongside the knowledge community, the political community also affects water resource management. Decision making processes within the political community involve not only input from the knowledge community, but the perceived

legitimacy, necessity and effectiveness of proposed actions that are aligned with community values. The political community includes both actors and activities that are engaged in governmental policy, and the non-governmental activism of civil-society groups who seek to frame the underlying values of governance that affects water allocation priorities.

For example, the nature of complexity introduced by the political community can be understood in terms of negotiation on the meaning of a criterion like equity. The meaning varies from seeking equitable allocation among different sectors of the economy and polity (for example, agriculture, energy, urban), to providing poor communities access to affordable water as well as establishing sustainable practices of water usage to affect generational equity. A key focus of this community has been the equitable allocation of water to disadvantaged populations and protecting vulnerable ecosystems (Giordano and Wolf 2001).

The two globally understood guiding principles of cooperation in TBW issues - sustainability and equity - are evident in the values and activities of the knowledge and political communities as described above (Brown and King 2012). As a result, we can no longer consider them as dispensable options in an economic tradeoff, say to achieve efficient pricing of water or efficient allocation of water, but as embedded in the complexity of deliberation and decision making that arise from the dynamic interactions of the knowledge and political communities.

These two goals of governance provide normative anchors to advance the important values and interests of stakeholders involved in resolving TBW conflicts within a particular context. Therefore, today the complexity of water problems is contingent not only on the nature of changes that are taking place in the knowledge and political communities, but also in the ways sustainability and equity manifest themselves within a particular context in the midst of competing demands of multiple stakeholders.

Complexity Introduced Through Growth in Know-how in the Knowledge Community

The ongoing growth and refinement of natural, societal, and technological knowledge continues to provide solutions to water problems. This

enhancement in knowledge and informed action creates flexibility in the availability and efficient use of water, for example, through the use of grey water; mapping and accessing aquifer water; desalination of water; and addressing ecological water needs. In this context, effective use of knowledge is crucial for creating new options for competing stakeholders and resolving water disputes (Islam and Susskind 2013). In doing so, however, this growth in knowledge also introduces uncertainty about problems (like climate change), and gives rise to the identification of new problems (like ecosystem vulnerability). Consequently, the efficacy of this knowledge has also become contingent upon the uncertainties associated with the generation, appreciation, perception, and implementation of this knowledge base. For example, what are the impacts of climate change on water availability? At what space-time scales are these impacts important for decision making?

Complexity Introduced Through Competing Values and Interests in the Political Community

The political community adds new problems and solutions as well, thereby, increasing the ambiguous nature of understanding and resolving water problems. The nature of TBW conflicts is dependent on a constellation of interacting societal factors, adding uncertainty to the issues of water use, access, and equity. For example, the conflicting developmental needs of riparian states in terms of economic growth, pattern of urbanization or industrialization and agricultural productivity lead to competing water needs (Agnew and Woodhouse 2011). Two other factors further expand the scope of the conflicts. One is the emergent conventions on water management; for example, how “integrated use of water” conflicts with the established convention of “prior use.” The second is the growing commodification of water (e.g., creation of water markets and full-cost water) conflicting with the equity of access and cost (Prescoli and Wolf 2009).

Interaction Effects of the Political and Knowledge Communities Necessitate a Contingent Approach

There is an increased awareness that community specific solutions that work for simple and

complicated problems usually will not work for complex problems and may contribute to the complexity itself. Given the contextual conditions that operate within the political and knowledge communities and the complexities that arise from their interactions, a more flexible framework than IWRM is needed to resolve TBW problems (Biswas 2004; Saravanan et al. 2009). A key argument for the lack of progress in operationalizing IWRM is the explicit recognition that the political community creates obstacles that distort or displace the objectives of integrated use of water (Metlay and Sarewitz 2012; Donaldson 2001). Therefore, effective resolution of complex TBW problems will require a contingency approach to negotiation that seeks creative options for mutual gains through negotiation among stakeholders with competing interests that span both the political and knowledge communities.

Negotiated Resolution of TBW Problems as a Contingent Process

A contingent negotiated approach - as a means to both characterize TBW problems and seek their resolution - offers a promising framework. In addition to the contingencies that are inherent in addressing competing needs and equitable allocation of TBW resources, the negotiation process itself is subject to a variety of contingencies (Bercovitch et al. 1991). This is because TBW issues are context specific, not only in terms of basin characteristics, but also in terms of the knowledge capacity, development trajectories and power asymmetry of stakeholders.

Put simply, neither the nature of the problem in terms of water allocation, nor the efficacy of solutions to resolve the problem can be pre-specified by theory or politics. Rather, both have to be discovered on the ground, through context specific means and with the involvement of stakeholders spanning the knowledge and political communities. It also means taking account of sustainability and equity – as the two overarching normative anchors of water governance – which the knowledge and political communities have framed through their interactions. The operational meaning of these two anchors rests in specific contexts, which in the context of TBW is a shared basin.

Among scholars, it is sometimes mentioned that each basin is unique, and hence, no universally generalizable prescriptions to solve TBW problems exists. Nevertheless, in practice, we find effective solutions to TBW problems not only exist but endure. We argue that the solutions rest on certain enabling conditions, supplemented by a set of situation specific conditions that are helpful in affecting negotiated resolution of a TBW problem. In the context of the dispute over sharing the Indus water the paper provides the specification of three enabling conditions. The paper further argues that variation in the context of TBW problems will call for the existence or emergence of different set of situational or sufficient conditions to make the enabling conditions operational in practice. In this paper, we are using the Indus Water Treaty signed by India and Pakistan to illustrate the nature of complexity and contingency as they give rise to the enabling conditions of the negotiation process, as well as the continuing relevance of these conditions to sustain cooperation in solving TBW problems.

The sharing of Indus basin water between India and Pakistan remains a paradigmatic case to showcase the success of contingent negotiation in resolving TBW conflicts. The choice of the Indus Water Treaty case is motivated by two criteria. First, in the context of complex TBW problems, the Indus case has often been cited as a successful example of cooperation. Thus, the Indus case functions as an “influential case,” one that is used as a basis to “check the assumptions of a general model or claim in literature” (Seawright and Gerring 2008, p. 303). Here, we use the Indus case to illustrate the enabling conditions of negotiation in the design, operation, and outcome of the negotiation process. The second is the fact that the Indus Treaty not only continues to operate today, but also addresses new issues that have emerged over time, thus demonstrating the resilience of negotiated cooperation. Given these two criteria, the Indus Water Treaty case offers a unique opportunity to inquire into the underlying factors that led to the successful resolution of a TBW problem, which continues to remain effective over time. It is these underlying - hopefully somewhat generalizable - process factors that this paper refers to as enabling conditions in the context of the negotiation process and negotiated outcomes.

We argue that these enabling factors may also transfer to other contexts as long as the situation specific conditions (or sufficient conditions) of securing them, are present or possible. What further justifies the status of these conditions as enabling is the continuing validation of the process factors in the field of conflict resolution (Jarvis and Wolf 2010; Fisher et al. 2011; Islam and Susskind 2013). Here, we focus on identifying the enabling conditions, even beyond the chronology and particular case attributes of the Indus negotiation process as discussed in Biswas (1992) and supported by Rai and Patnaik (2012) and Khan (2013).

Enabling Conditions in the Indus Case

I. Existence and recognition of interdependency among contending stakeholders

For any TBW problem to become a subject of negotiation, the existence and recognition of competing, often conflicting, values and interests are necessary. Such recognition can be manifested through a variety of contingent methods, one of which is having a capable and committed mediator that the parties seek and agree to rely upon.

The capability of the mediator rests on having requisite political authority, technical expertise and fiscal capacity that the parties don't possess. The mediator remains involved with the stakeholders on a long-term basis with sustained activism, thereby keeping the focus and the pressure on reaching a negotiated resolution. Having a capable mediator engaged on a continuing basis increases familiarity, reduces mutual vulnerability, and hence, the perceived risk among the stakeholders. In TBW disputes, stakeholder participation at the beginning of the negotiation process is integral to the effectiveness of negotiation (Kranz and Mostert 2010).

The negotiation of the dispute over Indus water between the two newly independent countries of India and Pakistan began in 1952, mediated first by David Lilienthal, the former head of Tennessee Valley Authority, and later by Eugene Black, the President of the World Bank. The engagement was initiated first by an invitation from the Prime Minister of India, nevertheless, from the very

beginning, Lilienthal made sure that he remained neutral by recognizing the vulnerabilities of both parties; that of Pakistan's in terms of its downstream location and that of India's in terms of its future water needs. At the same time, he also established the ground rules of negotiation with regard to relying on engineering facts, developing the Indus basin as a single unit, and using the financial assistance from the World Bank as the primary criteria for reaching an agreement.

Like his predecessor Lilienthal, Eugene Black, also offered his mediation service directly to the political heads of both countries. Throughout the process, Black initiated and maintained direct and personal contact with the heads of states of India and Pakistan. The negotiation process relied on a working group composed of engineering teams representing India, Pakistan, and the World Bank to come up with the engineering provisions of a long-range plan. The purpose of the Bank's representation in the working group was to mediate technical differences and serve as an impartial adviser to both sides. Thus, an enabling condition for effective negotiation lies in the mediator's ability to bring the recognition of interdependency among active stakeholders.

II. Focus on framing mutual interests via joint fact finding and creating mutual benefits

Achieving an agreement for sharing a competing resource requires the mediator to be involved in the identification of mutual benefits and costs to the stakeholders, as well as devising the instruments of securing the benefits and minimizing the costs. To keep the parties engaged and ensure long term sustainability of the agreement, parties need to explore mutual gains options in terms of creating economic, social, and environmental benefits for all as outcomes of the process (Granit 2010; Islam and Susskind 2012). Eugene Black, through the World Bank, implemented the mutual gains approach by formulating and negotiating financial assistance packages for infrastructure and a package of economic assistance to induce both sides to arrive at a negotiated agreement.

The focus rested on interests only rather than on the favored positions of each side. This allowed for the circumvention of the zero-sum fears of the stakeholders and shored confidence in the process

of discovering mutual gains. Inclusive framing of interests also supported the recognition and importance of all parties in the dispute. Accurate technical knowledge of and management capacity to clearly understand how much one party can secure the benefits through unilateral action, and how much can be gained through negotiation, generate confidence in both sides in framing interests on a long-term and mutual gain basis.

In the Indus case, the principles of negotiation as adopted by Black and the World Bank, kept the focus on creating a joint framing of a long-range plan that would result in mutual gains for the two countries. The benefits were exclusively based on functional needs as opposed to political considerations and did not consider past claims and negotiations. The working group, composed of engineers from both sides as well as those working for the Bank, agreed to identify benefits in terms of water needs based on the amount of cultivable, irrigable land in both countries and the need for engineering works related to water resource development. Each step of the process was subjected to joint fact finding, verified by the Bank's engineering team. However, accepting the accuracy of the data did not automatically bind the two parties to any plan submitted by either side. The countries remained free to formulate separate plans, thereby, ensuring their continuing participation focused on gaining future benefits. Although the plans formulated by both countries were based on similar estimate on the total water availability in Indus, they differed on the amounts to be allocated to each other.

To break the impasse over competing allocation claims, Black offered the World Bank's own proposal in order to keep the negotiation process alive. While India promptly accepted the proposal to move the negotiation to its final agreement, Pakistan objected on the ground of unfair consequence in terms of its vulnerability to the water controlled by India. In recognizing Pakistan's concern over its limited water storage capacity and also that of India's over its storage capacity and financial cost for creating link canals, the World Bank included both items as criteria to be addressed in a comprehensive plan.

Furthermore, the Bank offered assistance to Pakistan in building a storage facility on an Indus

tributary rather than relying exclusively on the water flow from Indus controlled by India. The Bank addressed one of India's key concerns, reducing the costs of the replacement works for India. The Bank further promised financial assistance to build two dams in Pakistan, one in India, and link canals in both countries. It also provided additional financial assistance to Pakistan in foreign exchange to shore up its economy. Thus, clear specification of the costs and benefits, allocation of costs to both countries based on the principle of commensurate benefits, and the willingness of the World Bank to bear additional costs enabled the framing of immediate and long-term mutual gains for both sides, paving the way for both sides to sign a treaty in September 1960.

III. Formation of a joint body to monitor agreements and address new problems as they emerge

To effectively deal with contingencies, the negotiation of an agreement must facilitate the formation of a water regime that can realize the proposed mutual gains via monitoring and upholding the responsibilities of the stakeholders. The involvement of a neutral third party and the design of joint bodies (often in the form of joint river commission) are critical factors that facilitate such regime, because different designs lead to different forms of cooperative mechanisms (Kranz and Mostert 2010; Granit 2010). In operational terms, this involves adequate provision of resources for continuing joint fact finding as well as devising mechanisms to monitor the terms of the agreement. Capacity enhancement of water authorities to act on jurisdictional needs and responsibilities is a crucial condition for the stakeholders to reach agreements without the continuing facilitation by an outside mediator. The investments in capacity building also reduce the suspicion among the stakeholders that one party may later take advantage of the vulnerability of the other.

In the Indus case, the Treaty provided for the formation of a permanent Indus Commission. The Commission was composed of two Commissioners, a hydrology expert from each country to oversee the implementation of the treaty. One particular point of agreement was that the allocation of cost of replacement works was to be based on

commensurate benefits for the country. The Commission was scheduled to meet once a year with meeting location alternating between the two countries for the purpose of identifying areas of cooperation in implementing the treaty, resolving any questions that arise in treaty implementation, and submitting an annual report documenting the level of cooperation. A process of referring disagreements to a neutral expert was also established, failing which, a Court of Arbitration was specified to act as the final resort.

Beyond monitoring treaty agreements, the long-term efficacy of finding mediated solutions rests on the water regime functioning as a professional learning community. This requires enhancing the management capacity of the water regime in order for it to sustain and improve its technical capacity to improvise solutions that emerge beyond the initially agreed treaty. The formation and operation of such a regime promotes a common language with which to exchange technical information and make on-the-ground adjustments and improvements in respective jurisdictions. The fact that the Indus Commission is still operational, and that it aids both sides to provide updates on the nature of the water problems, testifies to the enabling function of institutional learning in the sustenance of the water regime.

Concluding Remarks

Allocation of Transboundary waters of a basin and related issues of water access, demand, usage, and management become complex due to crossing of political, social, jurisdictional, physical, ecological and biogeochemical boundaries. The complexity in TBW water allocation lies in the dynamic consequences of competition arising from, interconnections and feedback operating across variables, processes, actors and institutions in the knowledge and political communities. The complex nature of TBW sharing is intensified by the emergence and increasing acceptance of the two guiding principles of equity and sustainability as goals of effective resolution. Using the Indus Treaty as a successful case of negotiated resolution of a TBW problem, the paper identified three enabling conditions that led to a negotiated treaty with enduring resilience.

The first enabling condition is the existence and recognition of interdependency among contending stakeholders. Such recognition can be manifested through a variety of contingent means, one of which is having a capable and committed mediator that the parties seek and agree to rely upon. The second enabling condition is sustaining a focus on framing mutual interests via joint fact finding and creating mutual gains. Achieving an agreement on sharing water resource requires the mediator to help the riparians to identify mutual benefits and costs as well as devising the instruments of securing them over time. The third enabling condition is forming a joint body or commission to monitor agreements and address new problems as they emerge. The success of such commission rests on becoming a water regime that supports the realization of the proposed mutual gains via monitoring and upholding the responsibilities of the riparians, but also effectively deal with disagreements as they arise. These three conditions are defined as enabling, because they find general support in the conflict resolution literature and they directly contribute to the endurance of the treaty.

Referring to these three conditions as enabling does not mean that they operate in a formulaic fashion. The relative presence or absence of these enabling conditions may offer a quick accounting of the reasons for the relative success or failure of negotiated resolution of TBW conflicts. However, there are other situational factors that will affect the relative efficacy of each of the enabling conditions in a negotiation process. Given the complexity and contextual nature of TBW issues, these situational factors cannot be pre-specified as they are contingent on the issues of a specific basin and the stakeholders that are involved in a dispute. To illustrate one such situational factor, would be specifying the operational meaning of environmental sustainability for a given basin. The specification depends not only on the changing hydrological characteristics of a basin, but also the changing economic needs of riparians and the involvement of stakeholders and their interests spanning the knowledge and political communities - local, regional, and global. Thus, in contrast to the 1960s, when the Indus Water Treaty was enacted, in considering water allocation for the Indus today we need to be cognizant of international

laws and conventions that recognize equitable access and adequate provision of water as a right. Furthermore, the emergence and addressing of new issues - for example, impact of climate change on water availability - may become important. We plan to address identification of such situational conditions to ensure long term viability of any TBW agreement.

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References

- Agnew, C. and P. Woodhouse. 2011. *Water Resources and Development*. Routledge, New York.
- Allan, J.A. and N. Mirumachi. 2010. Why negotiate? Asymmetric endowments, asymmetric power and the invisible nexus of water, trade and power that brings apparent water security. In: *Transboundary Water Management: Principles and Practice*. A.

- Earle, A. Jagerskog and J. Ojendal (Eds.). 13-27. Earthscan, Washington D.C., pp. 13-27.
- Bercovitch, J., T.J. Anagnoson, and D.L. Wille. 1991. Some conceptual issues and empirical trends in the study of successful mediation in international relations. *Journal of Peace Research* 28(1): 7-17.
- Berlin Rules on Water Resources. 2004. Available at http://internationalwaterlaw.org/documents/intldocs/ILA_Berlin_Rules-2004.pdf. Accessed February 15, 2015.
- Biswas, A.K. 1992. Indus Water Treaty: The negotiating process. *Water International* 17: 201-209.
- Biswas, A.K. 2004. Integrated water resources management: A reassessment. *Water International* 29(2): 248-256.
- Brown, C. and J. King. 2010. Environmental flows in shared watercourses: Review of assessment methods and relevance in the transboundary setting. In: *Transboundary Water Management: Principles and Practice*, A. Earle, A. Jagerskog and J. Ojendal, (Eds.). Earthscan, Washington D.C., pp. 107-124.
- Dellapenna, J., J. Gupta, L. Wenjing, and F. Schmidt. 2013. Thinking about the future of global water governance. *Ecology and Society* 18(3): 28.
- Donaldson, L. 2001. *The Contingency Theory of Organizations*. Sage, Thousand Oaks, California.
- Earle, A., A. Jagerskog, and J. Ojendal. 2010. Introduction: Setting the scene for transboundary water management approaches. In: *Transboundary Water Management: Principles and Practice*. A. Earle, A. Jagerskog and Joakim Ojendal. Washington D.C: Earthscan. pp 1-13.
- Fisher, R., W. Ury, and B. Patton. 2011. *Getting to Yes: Negotiating Agreement Without Giving In*, 2nd edition. Penguin Books, New York.
- Gallego-Ayala, J. 2013. Trends in integrated water resources management research: A literature review. *Water Policy* 15: 628-647.
- Giordano, M.A. and A.T. Wolf. 2001. Incorporating equity into international water agreements. *Social Justice Research* 14(4): 349-366.
- Gleick, P. (Ed.). 2002. *The World's Water: The Biennial Report on Freshwater Resources 2002-2003*. Island Press, Washington, D.C.
- Granit, J. 2010. Identifying business models for transboundary river basin institutions. In: *Transboundary Water Management: Principles and Practice*. A. Earle, A. Jagerskog and J. Ojendal (Eds.). Earthscan, Washington D.C., pp. 143-156.
- Helsinki Rules on the Uses of the Waters of International Rivers. 1996. Available at http://webworld.unesco.org/water/wwap/pccp/cd/pdf/educational_tools/course_modules/reference_documents/internationalregionconventions/helsinkirules.pdf. Accessed February 15, 2015.
- Hatami, H and P. Gleick .1994. Conflicts over water in the myths, legends, and ancient history. *Environment*. Apr 1994: 36(3).
- Islam, S. and L. Susskind. 2013. *Water Diplomacy: A Negotiated Approach to Managing Complex Water Networks*. Routledge, New York.
- Islam, S. and L. Susskind. 2014. Managing Drought in California: A Non-Zero Sum Approach. The World Bank Water Blog. February 22. Available at <http://blogs.worldbank.org/water/managing-drought-california-non-zero-sum-approach>. Accessed January 1, 2015.
- Islam, S. and L. Susskind. 2014. Understanding the water crisis in Africa and the Middle East: How can science inform policy and practice? *Bulletin of Atomic Scientists*. Vol. 71(2): 39-49.
- Jarvis, T. and A.T. Wolf. 2010. Managing water negotiations and conflicts in concept and in practice. In: *Transboundary Water Management: Principles and Practice*, A. Earle, A. Jagerskog and J. Ojendal (Eds.). Earthscan, Washington D.C., . pp 125-142.
- Judge, C.S. 2013. "The coming water wars: The next big wars will be fought over water." *US News and World Report*, Feb. 19.
- Khan, M.R. 2013. Crucial water issues between Pakistan and India, CBMd, and the role of media. *South Asian Studies* 28: 213-221.
- Kranz, N. and E. Mostert. 2010. Governance in transboundary basins – the roles of stakeholders: Concepts and approaches in international river basins. In: *Transboundary Water Management: Principles and Practice*. A. Earle, A. Jagerskog and J. Ojendal (Eds.). Earthscan, Washington D.C., pp. 91-106.
- Liu, J., T. Dietz, S.R. Carpenter, M. Alberti, C. Folke, E. Moran, A.N. Pell, P. Deadman, T. Kratz, J. Lubchenco, Z. Ouyang, W. Provencher, C.L. Redman, S.H. Schneider, and W.W. Taylor. 2007. Complexity of coupled human and natural systems. *Science* 317: 1513-1516.
- Metlay, D. and D. Sarewitz. 2012. Decision strategies for addressing complex, 'messy' problems. *The Bridge on Social Sciences and Engineering Practice* 42 (3).
- Mollinga, P.P., R. Meinzen-Dick, and D.J. Merrey. 2007. Politics, plurality and problemsheds: A strategic action approach for agricultural water resources

- management reform. *Development Policy Review* 25(6): 699-719.
- Petersen-Perlman, J., J. Veilleux, M. Zentner, and A. Wolf. 2012. Case studies on water security: Analysis of system complexity and the role of institutions. *Journal of Contemporary Water Research & Education* 149(1): 4-12.
- Prescoli, J.D. and A.T. Wolf. 2009. *Managing and Transforming Water Conflicts*. Cambridge University Press, New York.
- Rai, S. and S. Patnaik. 2012. Water disputes in South Asia. In: *Water Resource Conflicts and International Security*, D.H.Vajpayi (Ed.). Lexington Books, Lanham, Maryland, pp. 114-137.
- Saravaran, V.S. 2008. A systems approach to unravel complex water management institutions. *Ecological Complexity* 5(3): 202-215.
- Saravanan, V.S, G.T. McDonald, and P.P. Mollinga. 2009. Critical review of Integrated Water Resource Management: Moving beyond polarised discourse. *Natural Resources Forum* 33: 76-86.
- Seawright, J. and J. Gerring. 2008. Case selection techniques in case study research: A menu of qualitative and quantitative options. *Political Research Quarterly* 61(2): 294-308.
- Srinivasan, V., E.F. Lambin, S.M. Gorelick, B.H. Thompson, and S. Rozelle. 2012. The nature and causes of the global water crisis: Syndromes from a meta-analysis of coupled human-water studies. *Water Resources Research* 48. doi:10.1029/2011WR011087. Accessed January 1, 2015.
- Starr, J.R. 1991. Water wars. *Foreign Policy* 82: 17-36.
- Subramanian, A., B. Brown, and A. Wolf. 2012. *Reaching Across the Waters: Facing the Risks of Cooperation in International Waters*. World Bank, Washington D.C.
- Toset, H.P.W., N.P. Gleditsch, and H. Hegre. 2000. Shared rivers and interstate conflict. *Political Geography* 19: 971-996.
- Transboundary Waters Assessment Programme (TWAP). 2013. Available at <http://twap-rivers.org>. Accessed February 18, 2015.
- United Nations Development Program (UNDP). 2006. Beyond scarcity: Power, poverty and the global water crisis. In: *Human Development Report 2006*. UNDP. Available at <http://www.undp.org/content/undp/en/home/librarypage/hdr/human-development-report-2006.html>. Accessed February 15, 2015.
- UN Convention on the Law of the Non-navigational Uses of International Watercourses. 1997. Available at http://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf. Accessed February 15, 2015.
- Wolf, A.T. 1999. "Water wars" and water reality: Conflict and cooperation along international waterways. In: *Environmental Change, Adaptation, and Security* 65. Springer, Netherlands, pp. 251-265.
- Wolf, A.T. 2007. Shared waters: Conflict and cooperation. *Annual Review of Environment and Resources* 32: 3.1-3.29.
- Wolf, A.T. 2010. Possible futures for transboundary water resources. *World Politics Review*, January 20. Available at <http://www.worldpoliticsreview.com/articles/4961/possible-futures-for-transboundary-water-resources>. Accessed February 15, 2015.
- World Water Assessment Programme (WWAP). 2012. United Nations World Water Development Report 4. UNESCO, UN-Water, WWAP. March 2012.
- Yoffe, S.B., A.T. Wolf, and M. Giordano. 2003. Conflict and cooperation over international freshwater resources: Indicators of basins at risk. *Journal of the American Water Resources Association* 39 (5): 1109-1126.