Water management in the Middle East and North Africa

- The effect of signed water treaties

Marit Brochmann
PhD student at the University of Oslo & Centre for the Study of Civil War, International Peace Research Institute, Oslo (PRIO)
Contact address:
Department of Political Science, University of Oslo
PO-Box 1097, Blindern
NO-0317 OSLO, NORWAY
e-mail: marit.brochmann@stv.uio.no

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Abstract

Water cooperation is most often formalized through water treaties, and more than 3,600 such agreements have been identified from AD 805 to 1984. This paper examines the effect of these treaties in the Middle East and North Africa (MENA) regions. The Middle East and North Africa are normally regarded as the regions most prone for water conflicts. Several case studies of river basins have illustrated this. Much less research has focused on cooperation and management of basins in MENA. An earlier, global study indicated that treaties are less effective in MENA than elsewhere. Statistical analysis of dyads in MENA for the period 1948-1999 in this paper supports this. Although treaties signed in MENA increase the chances of later water related cooperation, they also increase the risk of later water conflicts. Compared to the rest of the world, widespread cooperation over water is also less extensive in MENA than in other parts of the world. This is not a promising combination and the results cries out for more focus on the content of treaties, both from scholars and policy makers. Is any attempt of cooperation, even a poor one, ending in conflict, better than slower progress and perhaps less vague agreements?

Keywords: conflict, cooperation, environmental security, transboundary rivers, treaties, water events, water management

Introduction

Conflict and cooperation in international river basins have received increased attention in recent years. The potential scarcity of freshwater and the following lack of sufficient access to this vital resource have led policy makers as well as scholars to be concerned about the future. Water is absolutely necessary for human survival and thus has the potential to be a source of serious conflict if not managed properly. Internationally shared waters face this threat to a large degree. There is to date no supranational agency or international law to govern international rivers although recent decades have seen ongoing efforts to develop some common ground for joint management of transboundary waters. However, there is also cooperation, most commonly realized through international river treaties. The theme for this paper is the degree of success of these treaties and more specifically, the effect of treaties signed in the Middle East and North Africa (MENA)[1] on later water-specific conflict and cooperation. A previous study has indicated that MENA differs significantly from the rest of the world with respect to the effect of signed treaties (Brochmann, 2006).

A reasonable measure for whether a river treaty is successful or not, is the degree to which it manages to enhance further water cooperation and reduces the chance of later water conflict. This argument builds on a liberal institutionalist idea that cooperation once in place will increase in scope and spread. It also draws upon the idea of preventive cooperation. That is, states when faced with a threat of conflict choose to cooperate in order to avoid the realization of this threat. A previous article (Brochmann, 2006) found support for the claim that a signed treaty increases later water cooperation in a dyad. The same study also found that the impact of a treaty on the level of water conflict only showed the desired conflict reducing effect when MENA was excluded from the analysis. This calls for a more thorough scrutiny of the MENA region. This paper is a first step on that road.

MENA is perhaps the most frequently studied area concerning the issue of water conflict. It is usually regarded as the region most prone for water conflict in the world. It is relatively water scarce, heavily dependent on the large river basins and experiences a substantial population growth. The region is also plagued by other conflicts. Nevertheless, treaties are signed and implemented in the river basins. This study does however differ from the bulk of the previous studies. It is not a case study focusing on a single river basin. It focuses instead on all dyad years in the region from 1948-1999 that share a river basin.

[1] In this paper I examine dyads on the same continent that share a river basin and where at leas tone of the countrieas are in the Middle East or North Africa. The countries coded as belonging in these regions are: Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, Turkey, United Arab Emirates, Yemen (Arab Republic), and Yemen (Peoples Republic).

Through multivariate analysis I will address the question of the effect of treaties signed: Do treaties signed in MENA increase the chances of later water cooperation and reduce the risk of later water conflicts?

Before turning to the actual analysis, I will present the theoretical background based on international relations theory and also a brief historical summary and the current status of international water law and some previous empirical findings. Then a methodological outline and presentation of the data follows. The analysis and discussion of the results ends in some concluding remarks with suggestions for future research.

Interaction and management in international river basins

– Theoretical and empirical debates

Traditionally international relation theories have been divided into three broad schools with different views on the nature of interaction. Realists generally focus on the structure of international power relations (Morgenthau, 1978; Waltz, 1959). Liberal scholars put more emphasis on the influence of trade, interdependence and cooperation (Keohane, 1984; Nye, 1993). Finally, radical (or structuralist) scholars stress the importance of the power divide between the north and the south and the uneven global distribution of wealth (Wallerstein, 1984). Several scholars who have written recently about cooperation and conflict over scarce resources are less stringently attached to one particular school, and tend to draw on elements from several of these three schools (Bannon & Collier, 2003; Kalpakian, 2004).

Starr (1978) introduced the widely applied concepts opportunity and willingness to the study of war. Opportunity and willingness are meant to be ordering concepts linking environmental and systemic factors to the behaviour of decision makers and governments that represent states (Siverson & Starr, 1990; Starr, 1978). The opportunity factors are structural factors representing the total set of environmental constraints and possibilities available within a given environment. The willingness factors represent the process of choice or the selection of specific behaviour for one or more of a state's decision makers (Siverson & Starr, 1990). Opportunity is often operationalized as geographic factors, more specifically different measures of proximity. Willingness has remained a somewhat more elusive concept commonly measured through for instance democracy (Mitchell & Prins, 1999). This theoretical framework is also applicable to more cooperative interaction. In fact, Starr himself acknowledged this when he in a later article (Starr, 2002: 213) states that one of the most frequently used opportunity measures, boundary length, can be used to investigate

'questions in the study of international politics involving both cooperative processes as well as conflictive ones'. A main point to all sorts of interaction is of course that the issue in question has to be important enough for the states to be willing to get engaged over it.

Applying Starr's framework on interaction over international rivers has been done before (Furlong, Gleditsch & Hegre, 2006) and is straightforward. A shared river can provide both the opportunity for interaction being a geographical asset making interaction easy, and it can affect the willingness of a state's decision maker to take action as water is regarded as a vital source of life and worth preserving. Factors such as the importance of the given river, both to people in the region and technology and industry or incidents of scarcity or flooding can also affect the willingness to take action. A state leader can choose to go to war, or initiate a smaller conflict, to secure his or her country's interests or to cooperate. The desire to avoid a conflict should according to liberal institutionalist theory increase the chance of a cooperative solution - in this case, the signing of a river treaty. According to liberal institutionalist theory, cooperation tends to increase in scope and spread to related fields (Keohane, 2002).

It follows from this that a reasonable measure for the success of a treaty is the degree to which it increases the level of water cooperation among the signatories at the same time as it has a negative impact on the level of water conflicts. This relationship and the concepts of opportunity and willingness are at the core of the development of international water law.

Although there have "always" been contentious local issues over shared waters, the focus on the management of internationally shared water resources is a relatively recent phenomenon, closely connected to the development of the nation state, industry and trade (Allouche 2005: 31). Trading states need free and secure navigation on shared waters. However, the regulation of transboundary waters for non-navigational use did not become a significant topic until the beginning of the 20th century, with the Treaty of Versailles as one of the first that dealt specifically with issues such as hydropower, irrigation, and water supply. More recently, the need for international management of shared water resources has grown as a result of an increased demand for water driving from industrial developments, urbanization and population growth (Allouche, 2005: 33ff).

In 1911 the Institute of International Law published the Madrid Declaration on the International Regulation regarding the Use of International Watercourses for Purposes other than Navigation, which outlines certain basic principles of shared water management and recommended that co-riparian states established permanent joint commissions within the respective basins. In 1966 the International Law Association expanded these guidelines and

developed the Helsinki Rules on the Uses of Waters in International Rivers (Giordano & Wolf, 2003: 166). Still it is only after the end of the Cold War that the world really has experienced an increase in the organizational and legal development of international river basins. The International Conference on Water and the Environment in Dublin 1992 led up to the UN conference on Environment and Development in Rio in 1992. Even though the water issue was only one of several issues in this summit, it did result in the expansion of international freshwater resource institutions and programs. For instance the World Water Council was created in 1996 (Giordano & Wolf, 2003: 163ff) and this organization has hosted four World Water Forums from 1997 to 2006.[2]

Despite the growing focus on international regulation, no supranational agency or unitary international law exists to govern shared river basins. Closest to a joint legal doctrine for management of international rivers, is the UN Convention for the Law of the Non-Navigational Uses of International Watercourses, which was adopted by the UN General Assembly on 21 May 1997 and is still undergoing ratification. By 18 October 2006, only 21 countries were party to the convention in one way or another, well below the 35 needed to bring the convention into force (Giordano & Wolf, 2003: 168; www.internationalwaterlaw.org 2005). The convention offers general guidance to co-riparian states, but it is vague and occasionally contradictory (Giordano & Wolf, 2003: 168). Many critical issues such as those concerning the handling of groundwater and the actual property rights in the basins are not dealt with (Allouche, 2005: 56f; Dinar, 2003: 11).

Despite the lack of consensus on a common governing body, there are numerous agreements and treaties concerning shared waters. More than 3,600 river treaties have been identified from AD 805 to 1984, and more than 400 water treaties and other water related agreements were signed between 1820 and 2001 (Giordano & Wolf, 2003: 168). The legal principles applied can be grouped into five doctrines (Allouche, 2005: 51f); *1) Absolute territorial sovereignty; 2) Absolute territorial integrity; 3) Limited territorial sovereignty and limited territorial integrity; 4) A community of interests in the waters* and finally; *4) Equitable utilization*[3]. Despite the recognition of these general principles, international

[2] For the most recent World Water Forum in Mexico in 2006, see www.worldwaterforum4.org.

[3] A more detailed explication of these doctrines: (1) a state may adopt all measures deemed suitable to its national interest in regard to watercourses within its territory. This will usually favor the state upstream in the river. (2) a country can claim to receive uninterrupted water flow from the state(s) upstream, thus favoring the downstream state. (3) emphasizes reciprocal rights and duties as it asserts that every state is free to use the waters flowing in its territory on the condition that such utilization does not harm the territory or interests of other states. (4) holds that state boundaries should be ignored in dealing with shared rivers and that a basin should be regarded as a distinct unitary unit managed as an integrated whole. Finally, (5) proposes that each basin state has a right to utilize the waters of the basin and is entitled to a reasonable and equitable share of the water (Allouche 2005: 51f).

basins tend to operate on needs rather than principles, and for prior uses to be protected and prior management regimes to be preserved (Furlong, 2006: 448).

Most river treaties contain vague formulations that open for diverging interpretations. Critical issues such as water allocations are frequently left unsettled and enforcement mechanisms are lacking. And although the number of treaties is growing, only a minority of basins has an agreement, with formal management institutions established in only 117 of the 263 international basins (Giordano & Wolf, 2003: 168). Diffusion of agreements to new basins has been slow, according to Conca et al. (2006: 271). Of the 62 accords they investigated in the period from 1980-2000, roughly three-fourths of the agreements concern basins with a prior history of cooperation.

Nevertheless, the existence of a river treaty appears to be the most reliable basis for establishing formal cooperation in international river basins. Based on a review of several disputes between river sharing states in The Nile, The Euphrates, The Syrdarya, The Ganges, The Danube, The Rhine and The Rio Grande, McCaffrey (2006) argues that the presence of a functional treaty seems to decrease the severity of water disputes, and that political tension is more likely to be present where there is no such agreement. Giordano & Wolf (2003: 166) also emphasize the importance of treaties when they, through reviewing international basins, claim that in international basins with high dam densities relations are significantly more cooperative in those basins with established water treaties than in basins where there are none.

Good management of internationally shared rivers is central to the question of whether riparian countries will end up in cooperation or conflict. The very recognition that joint management of a basin is necessary represents a first step towards cooperation. At the same time, water conflicts are more likely to occur where transboundary water management has become necessary (Allouche, 2005: 30). The integrated management of water resources is inherently complex. Freshwater systems ignore most political and administrative boundaries and consequently confound the creation of resilient basin-wide management institutions, particularly where multiple countries are involved (Giordano & Wolf, 2003: 163). Furthermore, lasting sustainable governance requires long-term perspectives and often calls for participation by multiple parties in addition to the central governments, such as local governments and non governmental actors and organizations (Carius 2006: 11).

Managing shared waters can thus be a force for both conflict and cooperation and one can stimulate or inhibit the other. This makes the causal chain fuzzy, but the aim of a formal agreement must be to reduce the conflict level and increase further cooperation. It is however

easily perceived how a signed treaty if insufficiently designed, or not implemented in a desirable manner can spur later water conflicts. Not disregarding these threats, signing treaties should be a vehicle for further and more comprehensive cooperation, hopefully spreading beyond the direct issues regulated by the treaty in question. In fact more than 40 percent of transboundary water treaties include provisions that go beyond the narrowly defined water management. This includes investment provisions (for instance Thailand's financing of a hydroelectric project in Lao PDR), data and information sharing (the Mekong Committee), trade, especially in energy resources (e.g. India purchasing hydropower from the Tala Dam in Bhutan) and political linkages as part of general peace talks (the Israel-Jordan water accord was part of the peace agreement between them in 1994) (HDR 2006: 224f). Thus, in the following analysis the degree to which signing a treaty has a positive effect on late water cooperation and a negative impact on later water conflicts will be the measure for success. This is a new area of research. Although a growing body of research exists on interaction in international river basins, very few are concerned with the effect of treaties.

Tir & Ackerman (2004) investigated contiguous states entering into water treaties in the period from 1900–93 and found that while economic development, democracy and common IGO memberships increase the chances for a treaty, the lack of common security interests and balanced power inhibits treaties. Conca et al. (2006) performed a content analysis of 62 international river agreements for the period 1980–2000, and found that previous cooperation has a positive effect on the likelihood of signing a treaty at basin level. In a previous paper on the effect of treaties, I found that a signed treaty increases the chance of more cooperation over water, but only had a conflict reducing effect when dyads in MENA were excluded from the analysis (Brochmann, 2006).

Middle East and North Africa are heavily studied with regard to their shared waters. These studies are mostly case studies of the large shared river basins (e.g. McCaffrey, 2006; Homer-Dixon, 1994; Kalpakian, 2004; Lowi, 1995), and most of them have a negative outlook of MENA as the regions most prone for water conflicts in the world. Lowi (1995) for instance states that the Middle East is the most water-poor region on the globe, with an acute situation of water scarcity as the region has one of the fastest growing populations. A similar argument is made by Homer-Dixon (1994; 13).

Traditional research on conflict and cooperation in international river basins more generally has normally focused on the above mentioned combination of resource scarcity and population growth. Two broadly defined groups, neomalthusians and cornucopians, can

be identified in the theoretical and empirical debate (Gleditsch, 2003). Neomalthusians tend to be pessimistic about the future availability of scarce resources and see conflict as increasingly shaped by resource constraints. They focus on the combination of population growth and increased consumption, exacerbated by an uneven distribution of resources between and within countries. According to UNEP (1999: 4), if present patterns of increasing consumption persist, two out of every three persons on earth will live under water-stressed conditions by the year 2025. While North America has an annual run-off of 17,000 m^3 per capita per year, Africa has 6,000 and Egypt just 50. Less than 1 percent of the world's usable freshwater is located in the Middle East or North Africa with 5 percent of total world population. Many countries with low water availability also have a high rate of population growth, so the problem may increase further in the future (Beaumont, 1997: 358).

Cornucopians have almost the opposite view. They see water as a globally abundant resource. It circulates in a never-ending cycle and therefore will not be exhausted. Very little water is actually needed for vital human life processes. A person requires between 0.75 and 2.2 m^3 of drinking water per year. Adding the amount required for the transportation of urban or industrial wastes, including normal inefficiencies and losses, the figure rises to 255.5 m^3 per capita. This is still a relatively small figure compared to the projected average availability of 4,692 m^3 per capita in 2025 (Beaumont, 1997: 359). Cornucopians argue that an impending threat of local scarcities of freshwater can be overcome by market pricing, new technology and conservation (e.g. drip irrigation and desalination), and by increased trade in water-demanding agricultural products. Fighting over scarce water resources is therefore irrelevant.

In a position between the two extreme poles of pure neomalthusians and cornucopians we find scholars with a liberal institutionalist orientation. They acknowledge that water availability is skewed globally, that lack of access to freshwater is a problem, and that scarcity if not counteracted may lead to conflict. According to HDR (2006: v) more than 1,000 million people lack access to clean water. Liberal institutionalists traditionally emphasize the growing interdependence in the international community and shared waters are an important part of that interdependence. Transboundary waters link users in different countries within a shared hydrological system (HDR, 2006: 203). Joint management thus becomes a critical challenge. For liberal institutionalists, cooperation is a more rational and more likely outcome of competition for scarce water resources than armed conflict. The opportunity and willingness factors mentioned thus become decisive for the nature of the interaction. It is not straight forward to assume that these factors will be the same throughout

the world. Hensel et al. (2006) argue for instance that resource scarcity and institutionalization levels create different contexts that differ between regions. Sowers (2002) also finds a number of regional differences with respect to water conflict.

As noted, the MENA region has traditionally been considered prone to water conflicts. However, water cooperation through treaties exists here as well. Based on the theoretical arguments above we can reasonably assume that treaties are signed to increase later water cooperation avoid future water conflicts. Based on my earlier results however the success of treaties in MENA is questionable and should be examined more thoroughly (Brochmann, 2006). A signed treaty here will most likely increase the chance of later water cooperation, but not necessarily reduce the risk of later water conflicts. The willingness factors to engage in conflict may be stronger than the forces for cooperation. This sounds particularly plausible considering the general conflict level in the area. Two hypotheses will be tested:

H_1: Dyads that have recently signed a treaty and where at least one of the countries is located in the Middle East or North Africa will have more water cooperation

H_2: Dyads that have recently signed a treaty and where at least one of the countries is located in the Middle East or North Africa will not have a smaller risk of experiencing water conflicts.

Research Design and Data

The statistical analysis in this paper is carried out by means of logistic regression analysis. In order to facilitate comparison between MENA and the rest of the world , the research design and the explanatory variables will be the same as in the earlier study (Brochmann, 2006). The control variables are widely used in analyses of international relations.

The dataset consists of dyads where at least one of the countries is in the Middle East and North Africa that share a river basin. With the dyad-year as the unit of analysis for the time period 1948–99, the number of cases is 1,679. The data on water events and water treaties have been coded from the Transboundary Freshwater Dispute Database (TFDD) project provided by Aaron Wolf and his colleagues at Oregon State University (www.transboundarywaters.orst.edu). The events data cover the period 1948–99 while the treaties data extend from 1820 to 2002. The data in the events database were originally organized at the basin level and have been recoded into a dyad-year format. The control variables are collected from well-established datasets within the conflict tradition (mostly the

Correlates of War Project). The origin of the data will be specified for each variable described below.

Variables

Dependent variables

I use two dependent variables in the empirical analyses; *conflictive water event* and *cooperative water event.* The water event data come from the International Water Events Database of the TFDD project. They cover the time period from 1948–99. Two dummy variables are coded for cooperative and conflictive events. The coding is based on the BAR (Basins at Risk) scale, which indicates the intensity of conflict and cooperation. It is a 15 point scale ranging from –7, the most conflictive event to +7, the most cooperative event[4] (Yoffe et al., 2003: 1112). A *Cooperative event* is one with a BAR value between 1 and 7 and a *Conflictive event* is an event in the previous year coded from –1 through –7. Water events, even if disaggregated down to conflictive and cooperative events are still broad terms. Nevertheless, they capture the overall conflictive or cooperative interaction in a basin and it is the occurrence of an event and not the severity that is my focus here. The events do not spread out evenly on the scale. Approximately 53 percent of the conflictive events are assigned a number -2 or -3 on the BAR scale, while only 13 percent have -4, -5 or -6. The remaining 34 percent has a value of -1. This indicates that most conflictive water events are mild. The cooperative events are even more skewed with about 58 percent with a value of 1 or 2, and approximately 39 percent have the value of 3 or 4. An alarmingly small 3.5 percent have 5 or 6. The lack of serious water cooperation in MENA becomes apparent!

Independent variables

Treaty signing is collected from the International Freshwater Treaties Database of the TFDD Project. This is a dichotomous variable coded 1 in the dyad-year a river treaty is signed[5]. This database contains information about international river treaties in the period from 1820-

[4] The events in the BAR scale consider water specific events only. The numbers describe: -7: Formal declaration of war; -6: Extensive war acts causing deaths, dislocation or high strategic costs; -5: Small scale military acts; -4: Political-military hostile actions; -3: Diplomatic-economic hostile actions; -2: Strong verbal expressions displaying hostility in interaction; -1: Mild verbal expressions displaying discord in interaction; 0: Neutral or non-significant acts for the interaction situation (not included here); 1: Minor official exchanges, talks or policy expressions—mild verbal support; 2: Official verbal support of goals, values or regime; 3: Cultural or scientific agreement or support (non-strategic); 4: Non-military economic, technological or industrial agreement; 5: Military economic or strategic support; 6: International freshwater treaty: Major strategic alliance (regional or international); 7: Voluntary unification into one nation. More thoroughly described on http://ocid.nacse.org/tfdd/barscale.html.

[5] A multilateral treaty is coded as a set of treaties between all dyads within the treaty.

2002, although I am unable to use the information for the complete time-range because of limitations on the other variables. The variable is lagged one year.

Control variables

Most of the included control variables derive from an established tradition within peace and conflict studies (Bremer, 1992). Some additional variables are also included as more river specific controls.

Peace history is a decay function containing the number of years since the last MID in the dyad[6] or since the younger of the two countries gained independence. This is a measure to assess the overall hostility level in the dyad[7]. I expect that cooperation will grow with a long period of peace and that this variable therefore should have a positive impact on cooperative water events, and a negative impact on conflictive events.

Regime type is included by means of three dummy variables, with a dyad made up of two democracies as the reference category. These variables are from the Polity IV project (Jaggers & Gurr, 1995; Marshall & Jaggers, 2001). I label the variables *One democracy, Two autocracies* and *Unconsolidated regime* according to the political make up of the dyad[8]. The democratic peace (Gleditsch & Hegre, 1997) indicates that we should expect double-democratic dyads to have less conflict and politically mixed dyads to have more. Neumayer (2002) argues that democracies have higher international environmental commitment. They tend to sign more environmental agreements and participate in international environmental organizations. In MENA there are only 42 double democratic dyad years recorded, compared to over 500 of all the other constellations. I expect the reference category to have more water cooperation than the other categories and less water conflicts.

Distance between capitals and *Contiguity* are included to control for proximity. A number of studies have shown both conflict and cooperation to be higher for contiguous states because of higher interaction opportunity and lower transaction costs (Buhaug & Gleditsch, 2006). Although states that are in the same basin by definition will be relatively close they are not necessarily neighbors and I still expect the distance measures to have a negative impact on both the dependent variables. The further the countries are apart, the less immediately they will be affected by the actions the other country may undertake in the river. And conversely, neighbors will interact more all over. Both variables are from the Correlates of War (COW) project. The distance variable is log transformed while the

[6] The variable is defined as –(2^(–years of peace)/α) (Gleditsch et al., 2006: 14, fn 12).
[7] Empirical support for this is found in Jones et al. (1996).

contiguity variable is dichotomous with the value of 1 indicating that the countries in the dyad are neighbors.

GDP is included as a measure for the economic level in the dyad. *GDPdyad* is the sum of the GDP in the two countries and it is log transformed. I assume that the larger the economic level, the more the states will interact. GDP is also highly correlated with the size of the dyad and larger dyads make for more interaction opportunities. I thus expect economically larger dyads to have more cooperation and also more conflictive events. The last statement hinges on the argument that a lot of the potential actions taken upon the river that affects other countries are costly or result from cost consuming activity (e.g. hydropower plants and pollution from industry). The GDP variable is from Oneal & Russett (2005).

Alliance is a dichotomous variable that is coded 1 if the two countries in the dyad are part of an entente or a defense pact. The data for this variable are also from COW (2005). An alliance relationship is expected to have a positive impact on cooperative water events and a negative impact on conflictive water events. The well known spill-over effect where cooperation within one field spreads to other fields (Keohane, 2002), leads me to expect that *Joint memberships in IGOs* will have a positive impact on cooperative events and a negative impact on conflictive events. This variable sums up the number of IGO memberships shared by the two countries in a dyad and is an upgrade of an earlier version collected by the Correlates of War project (COW) (Pevehouse et al., 2004)[9].

Based on the water conflict literature I include two river specific control variables, *Percent of the basin upstream* and *Total basin size.* The former measures the share of the basin in the upstream state. The upstream-downstream constellation is usually considered to be the most conflict-prone river scenario, and Tir & Ackerman (2004) argue that this river pattern even cripples the possibility for a treaty to exist in a basin in the first place. Based on an earlier study of cooperation and conflict (Brochmann & Gleditsch, 2006) that argues that the underlying threat of a conflict may also produce cooperation in order to prevent escalation, I expect this variable to have a positive impact on both the dependent variables. The size of the basin can be considered a proxy for the importance of the basin. Larger basins have more development possibilities and are likely to be perceived as very important to the lives of peoples living in the basin areas, which will affect the willingness to take action towards the river. It is likely that the larger the basin, the more interaction and I thus expect a positive impact on both water cooperation and water conflict. This variable

[8] For a dyad to be labeled One democracy, one of the countries has to have a Polity code of 6 or higher. In Two autocracies, both countries have –6 or lower. Unconsolidated dyads have measures between –5 and 5 or a combination of one autocratic and one unconsolidated regime.

[9] The variable includes 495 different IGOs of all kinds for the period from 1815 to 2000 (Pevehouse et al., 2004). In its original form, the dataset had the IGOs listed as a series of dummy variables. To generate the dependent variable used here, the number of joint memberships is counted for each dyad. The dataset only contained information for every fifth year for the period until 1964. The missing data were estimated through linear interpolation. Finally, the variable has been transformed by taking the square root. In Version 2.0c of the updated dataset, the data are at the dyadic level. See the Correlates of War website at www.correlatesofwar.org.

measures the size in square kilometers and is log transformed. Both river variables are from the dataset used by Gleditsch et al. (2006).

Analysis

In the analysis in this article I only examine dyads where at least on of the countries are in the Middle East or North Africa that share a river basin. Dyads on different continents can not, by definition, have river treaties or water events. The time-period covered is 1948–99. These restrictions give a total of 1,679 dyad-years. In 14 dyad-years a treaty signing occurred. There are 243 conflictive or cooperative events registered, of which 151 are cooperative and 92 are conflictive. Overall there is thus more cooperative activity in the basins. However, compared to the rest of the world the relative frequency of conflictive events is much higher in MENA. Approximately 38 percent of the events here are conflictive while the corresponding number for the rest of the world is only about 12 percent.

In a global analysis of the effect of treaties on dyadic water interaction a signed treaty will have a positive effect on later water specific cooperation in the given basin and a negative effect on water specific conflicts. This result is conditioned on the Middle East and North Africa being excluded from the analysis[10]. The effects are thus not as promising when MENA is studied isolated. Bivariate analyses of the effect of a signed treaty in MENA are shown in Table 1. A treaty signed in the previous year does indeed have a positive impact on cooperative as well as conflictive water events in a dyad. Lagging the treaty variable with two or five years does not alter these results.

Table 1. Bivariate regression analysis of the effect of a treaty signing, 1948–99

	(1) Water cooperation	(2) Water conflict
Treaty signing	2.336	2.595
	(4.31)***	(4.71)***
Constant	-2.336	-2.883
	(26.68)***	(26.01)***
Observations	1636	1636

* p<0.1, ** p<0.05, *** p<0.01

Introducing a multivariate model allows us to control for potentially relevant factors. Table 2[11] shows a Model similar to the replicated Model in the Appendix. And there are

[10] The result of this replication can be found in the Appendix, Table A1.

[11] The final models are clustered on the identification variable, *Dyadid*. Furthermore autocorrelation does not appear to be a problem in my models as none of the variables correlate critically high.

significant differences between the two tables. The most important difference when the MENA region is examined separately is that the conflict-reducing effect of treaties disappears. Instead a signed treaty seems to spark both water specific conflict and cooperation here. Hypotheses 1 and 2 are thus confirmed. The results for the control variables also differ quite a bit[12]. In the rest of the world the longer time of peace a dyad has experienced, the larger are the chances of water cooperation and the smaller the risk of water conflict. In MENA the history of peaceful relations seems to affect both negatively although only conflicts significantly. The effect of regime type is not clear in either of the Tables. In MENA it is however worth noting that there are very few double democratic dyads (only 42 of 1679). The other regime constellations are relatively evenly distributed with around 30 percent each.

The effect of distance is negative all over. The further two states are apart, the less they interact, positively or negatively. However, neighbours in MENA have less water cooperation whereas in the world as a whole they have more of water cooperation as well as conflict. Neighbours in MENA also seem to have more water conflicts, but this variable is not statistically significant. Being allied does not have a significant impact on water conflict or cooperation in MENA, but the variable shows signs in the expected directions with more water cooperation and less water conflict if the states in the dyad are allied. In the gobal study, this variable has a negative impact on both event variables, but only significantly on water cooperation. The higher the economic level in the dyad the more the states interact regardless of whether or not they are in MENA. The impact of the economy is not significant on water conflicts in MENA though. Joint IGO memberships is not statistically significant in Table 1, but have positive signs. In the rest of the world the effect of joint IGO memberships is positive and significant on the risk of water conflict, and negative, but insignificant on water cooperation. Finally, the two river specific variables, the percent of the basin upstream and the total basin size have positive effects all over[13].

Table 2. Logistic regression analysis of the effect of a treaty signing, 1948–99

	(3) Water cooperation	(4) Water conflict

[12] In the Table in the Appendix major power is included as a control variable. There are no major powers in MENA (coded as permanent members of the UN Security Council and this variable is thus excluded from the analysis here.

[13] As a measure for scarcity a variable that stated whether or not one of the states in the dyad had experienced a drought during the past five years was tested. This variable was not significant. It is not included in the final models because it reduces the time period covered to the time after 1975 only.

Treaty signing	1.989	1.686
	(3.25)***	(2.53)**
Peace history	-0.397	-1.547
	(1.44)	(4.45)***
One democracy	0.179	-0.294
	(0.25)	(0.40)
Two autocracies	-0.656	-2.072
	(0.76)	(1.68)*
Unconsolidated regime	-0.379	-2.209
	(0.48)	(2.35)**
Distance between the capitals (ln)	-1.536	-1.802
	(5.99)***	(5.49)***
Contiguity	-0.913	0.294
	(1.73)*	(0.25)
Alliance	0.306	-0.117
	(0.76)	(0.22)
GDPdyad (ln)	0.697	0.321
	(3.00)***	(1.07)
Percent of the basin upstream	2.374	2.825
	(2.97)***	(2.58)***
Total basin size (ln)	0.784	0.827
	(5.21)***	(3.81)***
Joint IGO memberships	0.063	0.065
	(0.32)	(0.25)
Constant	-15.688	-9.083
	(3.75)***	(1.54)
Observations	1619	1619

* p<0.1, ** p<0.05, *** p< 0.01

Focusing on the results for MENA provides a basis for some pessimism. A treaty signed one year increase the risks of both more water conflict and more water cooperation the following year. More specifically, a signed treaty increases the odds of experiencing a water cooperative event about 7.3 times and the odds of experiencing a water conflict about 5.3 times compared to if no treaty has been signed. Lagging the treaty variables further, by 2 or five years respectively alter these results. A treaty signed two years earlier does not affect water conflicts significantly, although it has a positive sign. It still has a positive and significant effect on water cooperation. If a treaty is signed five years earlier it has a positive and significant impact on the risk of water conflict again, and still a positive, but now not significant effect on water cooperation. A pattern of interaction emerges. Water cooperation seems to be stronger closest to the signing. This is counter to the theoretical assumption of spill-over effects. According to that the cooperation should increase and spread over time. In the immediate aftermath of a treaty signing there is also a higher risk of experiencing a water

conflict. Two years after the signing the conflict risk as a result of the signing is less apparent, but after additional years have passed, the risk increases again.

Discussion and concluding remarks

Treaties in MENA seem to be only partly successful, at best. It is a positive result that a signed treaty increase the chance of later water cooperation, but worrisome that the effect seem to vanish rather than to increase over time. The interaction pattern above shows that the time close to the actual signing is the most active. And when most active the risk for failure seems to be higher. This can again be due to the content of the treaty. Is it vague, does it avoid the most critical questions? Are there guidelines made out for the implementation and are proper enforcement mechanisms in place? These are some of the main critical points raised against current river management. These are important questions to address for future research. This paper can only offer a preliminary indication that something may be failing in the treaty process. More detailed case studies can elaborate on this important question and help policy makers to get insights into why cooperation seems to lack and conflicts prevail. The results here only imply what is the case, details can discover why. The analysis undertaken her is general, it does not state whether the conflictive or cooperative events following a treaty signing are directly connected to the treaty. What it does confirm is that the events are water specific and related to international rivers. And the statistical effects are strong. When a treaty is signed a dyad has increased chance of experiencing both water cooperation and water conflicts in the following year. The willingness factors that are decisive for the action chosen by the state leaders will probably partly be formed by the content of the treaty. The importance of specificity in a treaty can therefore not be overstated. Of course, this is also the hardest part to agree on, and in many cases there is the reality a choice between a vague treaty and no treaty. The HDR (2006: 228) emphasises the importance of making the ground for all attempts to cooperate in river basins, no matter how slight. But is a failed treaty perhaps leading to a conflict better than no treaty?

Water is a salient issue in the MENA region. The upstream-downstream constellation that is normally regarded the most conflict prone, is measured here through the percent of the basin that is in the upstream state. This should increase the overall stress level as the already presumably stronger riparian controls a larger portion of the river. This clearly has a positive effect on dyadic interaction. The good news is that it also affects cooperation, but the effect on conflict is stronger. The total size of the basin also has a similar effect. Seen together these two variables indicate that water is important and that the states interact over their

shared waters. The challenge is to channel all this interaction in a positive direction. Keep in mind that most conflicts reported here are mild, but compared to the rest of the world there are relatively speaking more severe conflicts in MENA than elsewhere. Approximately 13 percent of the conflictive events in MENA have -4, -5 or -6 on the BAR scale, while the number for the rest of the world only is about 2.5 percent. The case is opposite with respect to the cooperative events where only about 3.5 percent of the cooperative water events in MENA have a number 5 or 6, while for the rest of the world the percentage point is about 30. These differences makes MENA earn the questionable honour of being the most water problematic region in the world.

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Appendix

Table A1. Logistic regression analysis of the effect of a treaty signing, 1948–99

	(1)	(2)
	Water cooperation	Water conflict
Treaty signing	0.994	-0.173
	(6.30)***	(0.38)
Peace history	0.163	-1.229
	(0.93)	(2.88)***
One democracy	0.446	0.888
	(2.27)**	(2.21)**
Two autocracies	0.158	0.145
	(0.59)	(0.22)
Unconsolidated regime	0.796	0.130
	(3.49)***	(0.26)
Distance between the capitals (ln)	-0.522	-0.383
	(4.48)***	(1.92)*
Contiguity	0.183	2.332
	(0.90)	(2.49)**
Major power	-0.587	-1.440
	(2.36)**	(3.07)***
Gdpdyad	0.341	0.469
	(4.04)***	(3.19)***
Alliance	-0.361	-0.423
	(2.12)**	(1.23)
Joint IGO memberships	-0.022	0.186
	(0.40)	(2.01)**
Sub Saharan Africa	-0.188	-0.568
	(0.78)	(1.20)
Percent of the basin upstream	2.089	3.117
	(5.93)***	(4.79)***
Total basin size (ln)	0.486	0.444
	(8.83)***	(3.96)***
Constant	-12.708	-21.172
	(8.14)***	(7.17)***
Observations	9093	9093

* p<0.1, ** p<0.05, *** p< 0.01