INTERNATIONAL FOOD
POLICY RESEARCH INSTITUTE
sustainable solutions for ending hunger and poverty
Supported by the CGIAR

IFPRI Discussion Paper 01052

January 2011

Impacts of Global Change on the Nile Basin

Options for Hydropolitical Reform in Egypt and Ethiopia

Anja Kristina Martens

Environment and Production Technology Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI) was established in 1975. IFPRI is one of 15 agricultural research centers that receive principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR).

PARTNERS AND CONTRIBUTORS

IFPRI gratefully acknowledges the generous unrestricted funding from Australia, Canada, China, Denmark, Finland, France, Germany, India, Ireland, Italy, Japan, the Netherlands, Norway, the Philippines, South Africa, Sweden, Switzerland, the United Kingdom, the United States, and the World Bank.

AUTHOR

Anja Kristina Martens, Goethe Universität
Student, Political Science, Sociology, Ethnology (Magistra Artium), Faculty of Social Science
amartens@stud.uni-frankfurt.de

Notices

[1] Effective January 2007, the Discussion Paper series within each division and the Director General's Office of IFPRI were merged into one IFPRI–wide Discussion Paper series. The new series begins with number 00689, reflecting the prior publication of 688 discussion papers within the dispersed series. The earlier series are available on IFPRI's website at http://www.ifpri.org/publications/results/taxonomy%3A468.

[2] IFPRI Discussion Papers contain preliminary material and research results. They have been peer reviewed, but have not been subject to a formal external review via IFPRI's Publications Review Committee. They are circulated in order to stimulate discussion and critical comment; any opinions expressed are those of the author(s) and do not necessarily reflect the policies or opinions of IFPRI.

[3] The boundaries and names shown and the designations used on the map(s) herein do not imply official endorsement or acceptance by the International Food Policy Research Institute (IFPRI) or its partners and contributors.

Contents

List of Tables

List of Figures

ABSTRACT

This paper analyzes drivers of global change and their impacts on the current and future availability and accessibility of water resources in the Nile Basin. Drivers include changes in demography, climate, the socioeconomy, and politics, all of which are likely to increase the demand for freshwater and thus competition over its use across riparian countries. As a result of historic bilateral agreements, Egypt, as the most downstream country, uses the lion's share of the Nile's waters, which makes reallocation particularly difficult. Egypt is nearly totally dependent on water from upstream countries but considers any change of the status quo a threat to its national (water) security. Ninety-six percent of Egypt's water originates outside its territory—86 percent in Ethiopia. This paper assesses the special upstream–downstream relationship in the Nile Basin and the potential for change as a result of global change. It hypothesizes that under global change, not only will water availability in the Nile Basin change but so will the current hydropolitical situation in the basin. In any case, meeting the challenges in the Nile Basin depends on cooperation among countries and regulation of competing interests and demands. Avenues for hydropolitical reform, including the Nile Basin Initiative, and the role of China and other donors or investors are discussed. The findings—that global change might well bring down the old hydropolitical regime—are confirmed by recent developments, in particular, the signing by five upstream countries of a new framework agreement for management and development of the Nile Basin.

Keywords: Nile Basin, Egypt, Ethiopia, hydropolitics, cooperation, conflict, global change, reform

ACKNOWLEDGMENTS

Special thanks go to Claudia Ringler for her invaluable feedback and comments on earlier drafts. This paper would not have been realized without her constant support and kind encouragement.

I would like to thank the members of IFPRI's water team as well as other colleagues for their kind support and fruitful discussions. Their feedback during my visit is kindly appreciated.

I am most grateful for the opportunity to visit IFPRI from March to June 2010 and the financial support granted by GTZ BEAF (Beratungsgruppe Entwicklungsorientierte Agrarforschung), Advisory Group on Agricultural Research for Development.

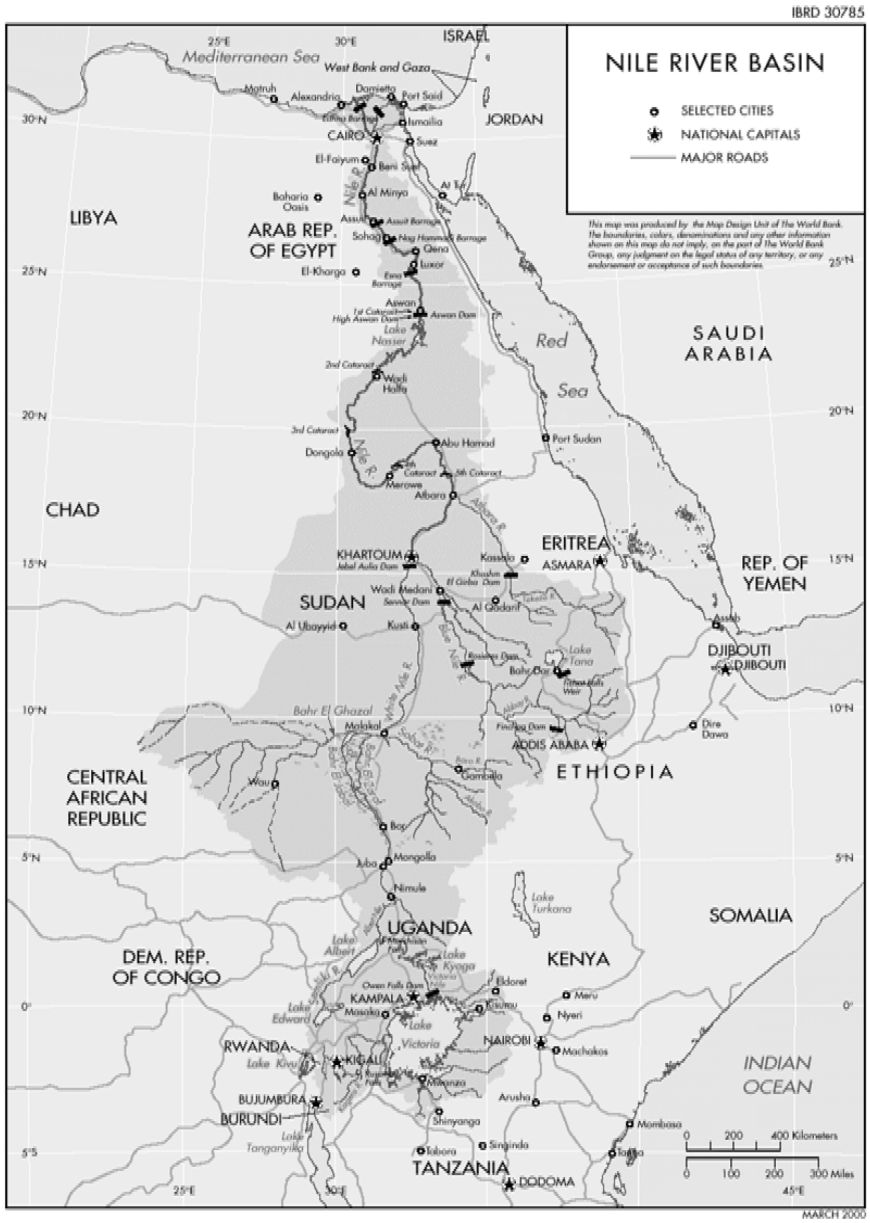
ABBREVIATIONS AND ACRONYMS

AR4	Fourth Assessment Report (IPCC)
CFA	Cooperative Framework Agreement
ENSAP	Eastern Nile Subsidiary Action Program
ENB	Eastern Nile Basin
FDI	Foreign direct investments
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation)
GDP	gross domestic product
IPCC	Intergovernmental Panel on Climate Change
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
MENA	Middle East and North Africa
NBI	Nile Basin Initiative
NGO's	Non-Governmental Organizations
NRBC	Nile River Basin Commission
ODA	Official Development Assistance
SAP	Subsidiary Action Programs
SVP	Shared Vision Programs
UNDP	United Nations Development Program

1. INTRODUCTION

The Nile, at 6,671 kilometers, is the longest river in the world. It has a long history of influencing the cultures that live along its banks and is a source of life to 171 million people living in the basin today. The Nile is shared by 10 countries and has three main sources: Lake Victoria, one of the largest freshwater lakes in the world, from which the White Nile derives; the Blue Nile; and the Atbara River, both originating in Ethiopia (Figure 1). The riparian countries can be distinguished by dividing them into upstream and downstream countries. The upstream group includes Burundi, the Democratic Republic of Congo, Eritrea, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda. The two downstream countries are Egypt and Sudan.

Figure 1. The Nile Basin



Source: World Bank, 2000.

In most international river basins, upstream countries are able to control the runoff because they have the superior geographical location, but the case among the Nile riparians is different. Egypt, which is the country farthest downstream, has always dominated hydropolitics in the Nile Basin. At the same time, Egypt, which is in economic and military terms the most powerful among the riparians, is nearly totally dependent on the Nile for water, as 97 percent of its water originates outside Egypt's territory—86 percent from Ethiopia alone. Since the White Nile loses half of its water in the Sudd, a vast swamp in southern Sudan, the percentage of the White Niles water that finally reaches Egypt accounts for only 14 percent (Waterbury 1979: 16).

The situation of a downstream country that is geographically in the weaker position in terms of claims on upstream resources but is the most powerful country among all of the riparian states makes this a particularly interesting case to study. Thus, this discussion paper analyzes hydropolitical relations within the Eastern Nile Basin (ENB), especially between the two countries of Egypt and Ethiopia.

Definitions

It is important to distinguish between two forms of water scarcity. As described by the International Water Management Institute (IWMI), "[much] of the world is faced with a situation where water supplies for various uses are over allocated, with river flows much reduced, groundwater levels dropping, and important ecosystems threatened—a situation of physical water scarcity. Much of this is driven by agricultural water use. In other parts of the world, availability of water in rivers, wetlands, and aquifers is ample, but access is difficult because people have not found means to develop the water resource—a situation of economic water scarcity" (IWMI 2010, italics by author).

With regard to water uses, there are different actors, such as nation states or differing social groups, for example, farmers and industries or more generally, rural areas versus urban areas, who claim the same resource for different purposes, and thus a social or political conflict, may emerge. The expression "conflict", however, does not automatically indicate war or violent conflict.

Approach

First, the conceptual framework underlying this research is sketched out. As the challenge to future Nile hydropolitics lies in coping with different demands on and conflicts over water uses, the paper mostly focuses on the issue of international water regime formation. Among scholars of international relations, "[international] regimes are sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actor's expectations converge in a given area of international relations" (Krasner 1983, 2). It can be said that a "water regime is formed when riparian countries engage upon norm- and rule-based cooperation for the political resolution of problems and conflicts in the field of international river basin management" (Lindemann 2005, 4). International water regimes are needed to handle problems on international rivers, particularly when different actors claim the same resources for different purposes or on unequal terms. Where problems on Transboundary Rivers emerge, affected riparians may find that it is harder to address them unilaterally and/or easier to solve them multilaterally. To channel efforts, riparians may choose to build international institutions in which these problems can be addressed properly. In the Nile Basin, several efforts have been made in the past to address transboundary water-sharing problems.

Second, as the hydropolitical situation in the Nile Basin is marked by divisive historic legal agreements and a history of saber rattling among its riparians, section 3 presents a short description of the historical, political, and legal background of the Nile Basin, followed by information on the present political, socioeconomic, and water availability situations.

Section 4 focuses on Egypt and Ethiopia, assessing impacts on the Nile under drivers of global change. Based on this and current developments, the options for hydropolitical reform among the Nile riparians are assessed. With a new regime currently in the offing, we analyze the conditions and circumstances that are important for a new international water regime in the Nile Basin. The paper ends by highlighting significant issues and questions that remain and concludes with recommendations.

2. CONCEPTUAL FRAMEWORK

In recent years, a growing number of scholars and scientists have sought answers to the question of how to solve resource conflicts with cooperation, rather than conflict. Since the 1990s, some studies have emphasized the link between resource scarcity and conflicts, arguing that an increased demand for freshwater resources would likely lead to conflicts (Homer-Dixon 1991, 1994). The securitization of environmental issues even led to a discourse of upcoming "water wars". According to exponents of neo-realist theory in international relations, the world is in a state of anarchy. As a result, the national behavior is driven by an ongoing security dilemma in which cooperation is almost impossible because nation states fear a relative loss of power. States are not willing to become dependent on other states, and therefore they will not hand over their national sovereignty. As a result, only short-time alliances are possible. These are the easiest ways to manage bi- or multilateral challenges, but they are constantly unstable due to the actors' perpetual struggle for power.

However, it can also be argued that environmental degradation could lead to cooperation rather than conflict. Neo-liberal theories assume that under conditions of anarchy in the international system, the role of international regimes is to make it possible for nation states to choose to cooperate. In other words, since the role of international regimes is to reduce transaction costs, build trust, and provide information, the liberal approach assumes that it is a rational choice for states to cooperate. The regime in this case is a set of principles, norms, and rules that is expected to change actors' behavior in a given area of international relations. According to this school of thought, it can be expected that nation states will be willing to restrict their national sovereignty and independence and to impose self-restraint on their own behavior in order to deal with particular transboundary issues.

Most empirically based studies have concluded that disputes over the use of transboundary water are more likely to result in cooperation than in conflicts. Research by Aaron Wolf and the Oregon State University shows that there has been a remarkable increase in the number of international water treaties in the second half of the 20th century (Wolf 1998). These treaties vary to a high degree in subject, number of riparians involved, and the extent of cooperation. The latter can range from low levels of cooperation, for example, when carried out through a permanent joint technical committee, to a high level of cooperation, for example, when administered through a basin-wide legal framework. The concept of Integrated Water Resources Management (IWRM), which has its roots in the Dublin Principles and which was emphasized during the UN Conference on Environment and Development in Rio de Janeiro in 1992, has been defined as a holistic, cross-sectoral "process which promotes the coordinated development and management of water, land, and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. IWRM is a comprehensive approach to the development and management of water, addressing its management both as a resource and the framework for provision of water services" (Jønch-Clausen 2004, 14).

The focus of IWRM is the river basin as a systemic unit. The definition used for this discussion paper states that

> "All states sharing a particular river basin should cooperate closely and make efforts to address the problems and issues pertaining to their basin in a holistic way. Basin states should coordinate, or even better, integrate their respective policies, and they should establish a legal regime, which covers the whole of the basin and defines the rights and the duties of all actors using the basin resources. Ideally, the form a separate organization in which is vested the responsibility and the authority to deal in a comprehensive way with all aspects pertinent to the river basin" (Marty 2001, 23f; italics by the author).

The objective of this study is to emphasize the possibility of changing the hydropolitical situation in the Nile Basin toward a more integrated approach.

Some central questions should be raised with regard to regime formation:

1. Why is an international water regime needed in the Nile Basin?
2. Do preexisting regimes influence the formation of a new regime, and if so, how? What is needed to have all riparians agree to join the new regime and give up the status quo?
3. What is the role of third parties with regard to regime formation, and how could they influence a positive outcome?

Regarding the first question, it is understood that "there is good reason to expect that the problems on many international rivers will increase in the coming decades under the impact of the rising demand for water resources and worsening pollution problems" (Marty 2001, 14).

In general, problem factors contribute to regime formation because they help us to visualize the need for problem solution. A distinction between collective problems and problems related to the upstream–downstream structure is needed. Collective problems affect all riparians because such problems rarely recognize national borders and impose costs on all riparian states. Given a rational choice behavior, it is to be expected that nation states are "willing to restrict their independence and impose self-restraint on their behavior in order to cope with particular transboundary problems" (Marty 2001, 33). Positive externality problems are present if one riparian provides a benefit, like the unconditional use of the resource, and does not receive compensation from the riparian that is using it.

In general, it can be assumed that collective problems are easier to solve than problems related to the upstream-downstream relation, as all riparians seem to recognize the urgency related to these sorts of problems. Additionally, problem pressure is of great importance, as increased pressure is supposed to initiate a process for resolving these problems more easily. It is further argued that all affected riparians must experience the threat by a certain driver to the same degree in order to transform the adverse situation into a benefit to all of them (Marty 2001, 42).

Regarding the second question, preexisting regimes can be a major obstacle to international water regime formation. Riparians are likely to try to maintain the status quo by keeping specific qualities of already existing regimes that favor their current position. Since existing regimes are protecting the status quo, they often present a legal–political deadlock, as riparians are not willing to change the status quo. This is certainly the case in the Nile Basin. It is therefore important to recognize historic realities when developing new water regimes. Proper compensation must be guaranteed to those riparians who favor the status quo and perceive that they have most to lose. However, in line with principles of sustainable development, sustainable solutions in general and development needs for the poorest should have priority over sustaining the status quo.

The next steps toward regime formation are so-called process factors. These are "tools that can be employed by participants in the process of regime formation to positively influence the process" (Marty 2001, 38). Riparians must be convinced that by changing their behavior toward the problem, they will be better off in the future. In order to present the advantages of regime formation, the incentives and benefits the regime can offer must be clearly explained to all actors concerned, especially the fact that they face costs if they maintain the status quo. One central obstacle to choosing cooperation is concern about a decline in the present status of welfare in the riparian country. A second obstacle, distributive equity, is riparian's fear and suspicion that they might end up comparatively worse off than other riparian states involved. Therefore, a consent agreement is more likely to be achieved if the riparians who are requested to change their behavior receive new or additional incentives. These incentives have to be sufficient to create a distributive equity and preserve a nation's welfare. To summarize this point, process factors are tools that help to alter a given constellation of interests and in so doing promote cooperation among the riparian states.

Since asymmetrical incentives and transaction costs are main obstacles to regime formation, parties can assist in realization of regime formation by helping to reduce the costs and adjust incentive structures. Therefore, with regard to the third question, international donors and other investors have the chance to influence regime formation by offering incentives. This is especially the case when it comes to a reduction of transaction costs. In the past, international institutions have shown that they have the

capacity to build trust among different actors and therefore to reduce uncertainty and related costs. For instance, international organizations such as the World Bank could play a significant role in supporting the formation of water regimes because they can offer incentives such as financial and technical assistance and transfer of knowledge. By making use of their prominent role, international organizations can motivate regime members to invest in cooperation, thus increasing the likelihood that a water regime will be formed.

Country-specific factors, such as geographical position, military and economic power, and the potential for exploitation of a resource, contribute to hydro-hegemony (Zeitoun and Warner 2006, 435). The actor in possession of a hydro-hegemonial position has a significant possibility of creating, maintaining, and challenging the situation in water conflicts. Hydro-hegemony is further achieved by "using water resource control strategies such as resource capture, integration, and containment…by the exploitation of existing power asymmetries within a weak international institutional context" (Zeitoun and Warner 2006, 435). Even more important is the way that factors of international context interconnect with hegemonic structures and the role of power in the international system. Factors of international context can be intertwined with and have impacts on current hydro-hegemonic relations. They can either contribute to strengthening the hegemon's position or may have certain interests in the hegemon's decline. If the nonhegemonic riparians decide to act against the hydro-hegemon, this could again be influenced by factors of international context. As Cascão (2008a, 13) notes: "nonhegemonic riparians… challenge unequal hydropolitical configurations and eventually contribute towards a more sustainable and equitable water and benefit-sharing regime." This can be called a counter hydro-hegemonic moment.

Egypt, as the Nile Basin's hegemon, has used its role to maintain its comfortable position. International actors have played a major role in sustaining and maintaining this situation. It could be argued that having "powerful friends can be a very efficient source of power…enjoying a favored political position globally can directly result in a favorable position in the competition over water" (Zeitoun and Warner 2006, 449). Today, new powers have emerged in the international arena, and these are likely to influence the current hydropolitical situation in the Basin. Recent developments might be called the "counter-hydro-hegemonic-moment," because they challenge Egypt's hegemony. The section on "International factors" highlights the role of third parties in sustaining and challenging the hegemonic structures, in the past and today.

3. PAST AND PRESENT HYDROPOLITICS

In the Past

Hydropolitics in the Nile Basin generally have been dominated by Egypt. Today's hydropolitical situation is determined by two historic agreements from the years 1929 and 1959. For centuries, Egypt has developed the Nile's waters unilaterally. However, in the 19th century, Great Britain played a major role in influencing the Egypt's situation. As Egypt was particularly vulnerable to variation in the Nile's runoff, the first Aswan Dam was built in order to prevent harm from peak flows in Egypt, to cope with low-flow seasons and years, and to store floodwater for agricultural production, especially cotton. After Egypt became independent in 1922, the Aswan Dam was extended, and more water became available for irrigation development. Egypt, a former British protectorate, and Great Britain signed the Nile Water Agreement in 1929, which grants Egypt a veto power for every upstream project and allocates 48 cubic kilometers (km3) of water to Egypt and 4 km³ to Sudan, while the rest stayed unallocated. However, this agreement excluded Ethiopia, which is the major provider of the Nile's water. In 1959, Egypt and Sudan signed the Agreement for the Full Utilization of the Nile Waters, which again excluded other riparians. The original text states that "the Nile Water Agreement [which] concluded in 1929…provided only for the partial use of the Nile waters and did not extend to include a complete control of the River waters." Based on Egypt's so called "acquired rights and needs", it was agreed to allocate the Nile's water "between Sudan and Egypt…with 55.5 km³ for Egypt, 18.5 km³ for Sudan, and 10 km³ for evaporation" (Conway 2005, 106). The two countries further agreed to construct several water storage projects at Aswan and to share the benefits equally between both republics. Based on those two agreements, Egypt and Sudan claim the majority of the Nile's water, despite their downstream location in the basin.

The Nile's water even became an issue of national security when Anwar Sadat, president of Egypt in 1979, confronted by Ethiopian plans on constructing dams, declared that the only matter that could take Egypt into war again was water. However, to date, no war has been fought over the Nile's water, and conflicts over Transboundary Rivers in general have generally been solved peacefully. Between 1967 and 1992, attempts were made to develop multilateral cooperation among the Nile riparians. These attempts failed at bringing all of the riparians into one regime (Cascão 2009b, 17). As upstream countries, including Ethiopia, are starting to develop their economies, demands for increased water use have become more prevalent, leading to the hydropolitical situation that the Nile Basin faces today.

Hydropolitics Today

Since 1999 comprehensive efforts have been made toward the development of a new Nile Basin regime called the Nile Basin Initiative (NBI). The NBI is a partnership initiated and run by the riparian states of the Nile River through the Council of Ministers of Water Affairs of the Nile Basin states (NBI 2010). All riparian states of the Nile Basin are included in the NBI, except for Eritrea, which has observer status.

The objectives of the NBI are

- to develop the Nile Basin water resources in a sustainable and equitable way to ensure prosperity, security, and peace for all its peoples;
- to ensure efficient water management and the optimal use of the resources;
- to ensure cooperation and joint action between the riparian countries, seeking win-win gains;
- to target poverty eradication and promote economic integration; and
- to ensure that the program results in a move from planning to action. (NBI 2010)

The NBI tries to develop the river basin by implementing a broad approach, using different tools at different levels. At the international level, the NBI intends to promote a shared vision among all riparians. This Shared Vision Project (SVP) includes "grants-based activities to foster trust and cooperation and build an enabling environment for investment" (NBI 2010). At a sub-basin level, the NBI

promotes Subsidiary Action Programs (SAP). These programs aim at "identifying cooperative development opportunities to realize physical investments and tangible results (that is, action on the ground) through sub-basin activities in the Eastern Nile and the Nile Equatorial Lakes region" (Cascão 2009b, 19).

Another important cooperation effort involves the creation of a Nile River Basin Commission (NRBC). As outlined previously, establishing a new organization under the new regime would be the right way forward in promoting cooperative and integrated water resource management among the Nile Basin riparians. The ratification of a legal agreement is the first step in this direction. The Cooperative Framework Agreement (CFA) is the key element for the formation of the new regime and the most contentious part of the regime negotiations. Once ratified, the CFA is expected to replace the 1929 and 1959 agreements and therefore implement a new legal entity for allocating the Nile's waters. The dispute over the CFA originates from the question of maintaining the legal–political status quo of existing water allocation. Egypt, as it can be imagined, would not light-mindedly hand in the agreements that are beneficiary for its own status quo. Clearly, the preexisting regimes present huge obstacles to formation of a new regime in the Nile Basin.

The World Bank and the Canadian International Development Agency are the donors most involved in the NBI process. The Nile Basin Trust Fund (NBTF), established in 2003, is managed by the World Bank and encompasses most of the international donor support. It is unlikely that the NBI would have come to life without the strong international (donor) support. "As such, donor support in the establishment and evolution of the NBI is considered to have been crucial and indispensable. But because of its over-reliance on multilateral donors, the NBI has also been frequently portrayed by several critical voices as excessively donor-driven" (Cascão 2009b, 59). Yet, without international technical, financial, and political support, it is unlikely that the NBI would have come this far. This clearly demonstrates the importance of international actors in the formation of a new water regime.

Considering that the hydropolitical situation has been in a legal–political deadlock for decades, recent developments in the Nile Basin have shown that the downstream countries, Egypt in particular, are willing to put some effort into cooperation, through their support of selected upstream water development projects. This development can be interpreted as "a partial shift in the behavior of the states in the Eastern Nile basin. They now at least to some degree accept one another's political concerns and national interests" (Arsano 2007, 93). However, the size and scope of this first set of projects does not threaten Egypt's hydropolitical status quo. Still it shows that the "old school" of political thinking might be softening, especially with regard to the need for cooperation among riparian states.

While Egypt has been able to maintain its hydropolitical position for many decades, exploiting the water resources for its own economic development, this position of power within the Basin and in the region as a whole is now being questioned: in May 2010, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda signed the new CFA, while the signatures of Burundi and the Democratic Republic of the Congo are expected in the next few months. This movement marks a giant step forward in achieving a legal status for cooperation in the Nile Basin, including formation of a new international water regime and the Nile River Basin Commission (NRBC). Once the CFA is ratified, the NRBC will supersede the NBI. However, both Egypt and Sudan have announced that they might not sign this version of the CFA, since it threatens the status quo of current water allocations. Both developments usher in a clear shift in the hydro-hegemonic positions in the basin.

As will be shown later on, current trends indicate an increase in the demand for fresh water in the Nile Basin, and therefore an increasing potential for conflict. Upstream riparians have, until recently, not shown much interest in developing their water resources for various reasons, including lack of financial resources, and weak political and economic capacity. This situation is slowly changing clearly challenging Egypt's hydropolitical position. As political stability has increased recently in upstream countries, they are poised to withdraw more water from the Nile in order to develop their agriculture and overall economies. We can proceed on the assumption that with stronger upstream interests in Nile waters, a conflict between upstream and downstream users may be set in motion, creating a window of opportunity for Basin-wide agreements.

4. EGYPT AND ETHIOPIA – TWO UNEQUAL RIPARIANS

Socioeconomic Background and Water Availability

The countries of the Eastern Nile Basin (ENB), namely Egypt, Sudan and Ethiopia, are facing dynamic changes, such as rapid growth of population, poverty, land degradation, and food and water insecurity. The land in the ENB countries is given to geographical extremities, varying from the deserts of Sudan and Egypt to the highlands and wetland areas of Ethiopia. Every riparian has an entirely different capacity for using the Nile waters, which depends on a combination of geographical position, economic capacity, and the potential to develop resources.

In most African countries, agriculture is still the sector that contributes the largest amount to the gross domestic product (GDP). The sector also supports the livelihoods of the rural population, which is in many cases already facing severe degradation of natural resources. Any further changes will therefore have harsh impacts on income and food security for the rural poor. According to IWMI (2009, 33), particularly vulnerable groups are those living "in hotspots with high population densities in mixed rainfed agricultural systems—and particularly those [dependent on] cereal-legumes cropping and banana/cassava systems," which are concentrated in the highlands of East Africa.

Tables 1 and 2 summarize some of the relevant socioeconomic and water-use related facts on Egypt and Ethiopia. In the next section, they will be referred to several times.

Table 1. Socioeconomic indicators for Egypt and Ethiopia, 2008

Indicator	Egypt	Ethiopia
Total land area (sq. km)	995,450.00	1,000,000.00
GDP (US$ billions)	162.82	26.49
GDP growth (annual %)	7.10	11.30
Agricultural sector (% of GDP)	14.10	42.70
Official Development Assistance (ODA) and official aid (million US$) in 2005	995.00	1,916.00
ODA and official aid (million US$) in 2000	1.327	686.00
Population total (millions)	81.53	80.71
Population rural (% of total population)	57.30	83.00
Population growth rate (%)	1.80	2.60
Population involved in agriculture (% in 2005)	30.90	80.20
Access to improved water source (%)	98.00	42.00
Life expectancy at birth (total years)	70.20	55.40
Prevalence of undernourishment (% of population in 2005)	5.00	46.00

Source: World Bank. 2008.

Table 2. Aspects of water use in Egypt and Ethiopia, 2007

Aspects of water use	Egypt	Ethiopia
Average precipitation in volume (billion m^3/yr)	51.07	936.40
Total actual renewable water resources (km3/yr) actual/natural	57.3 / 85.8	122.00
Total renewable water resources per capita (m^3/inhab/yr)	702.80	1,512.00
% of withdrawals of total actual renewable water resources	117.20	5.1
% of total actual renewable water resources withdrawn by agriculture in 2002	103.00	4.3
Dependency ratio (%)	96.86	0
Irrigation potential (1,000 ha)	4,420.00	2,700.00
Area equipped for irrigation (1,000 ha)	3,422.00	290.00

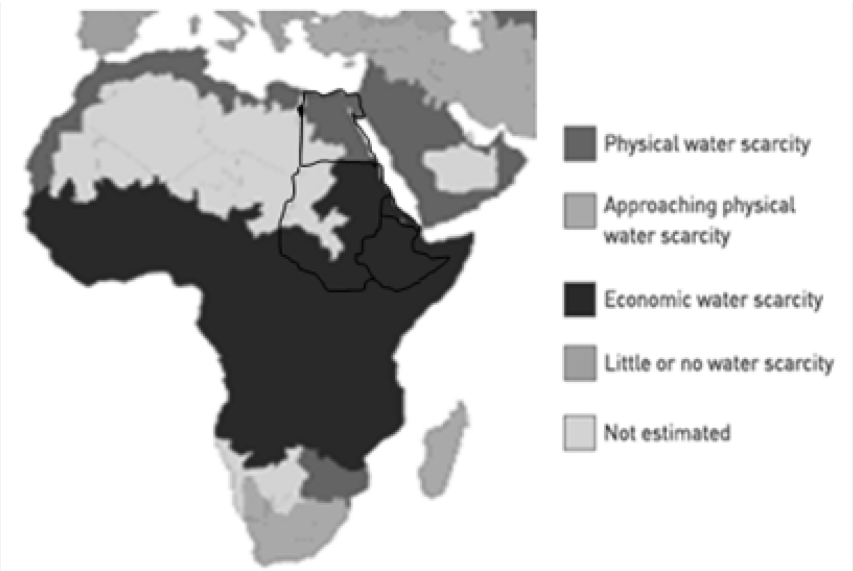
Sources: FAO Aquastat database as cited in Svendsen, Ewing, and Msangi 2009, 16.
Note: [a] FAO Aquastat database 2010.

Egypt

Located in Northern Africa, Egypt has a climate that is dominated by hot, dry summers and moderate winters. The Saharan Desert dominates a large part of Egypt's territory. Settlements in Egypt are found along a narrow strip of land, which makes up less than 5 percent of Egypt's land area (OECD 2004, 14). In economic terms, all other Nile riparians lag far behind Egypt. This can be observed in their "GDP, economic diversification, external political support, and access to international funding" (Cascão 2009b, 14). Egypt's role as a mediator in the Middle East conflict has been of great importance over the last several years in the eyes of the international community and the United States.

As remarked earlier, we distinguish between two forms of water scarcity. While much of Africa faces economic water scarcity, Egypt, the most powerful and most developed Nile riparian, faces physical water scarcity (Figure 2). The country has sufficient resources to use and regulate the Nile water but has little potential for further exploitation. According to the water stress index, Egypt, with an average water availability of about 702.8 cubic meters (m^3) per capita in 2007, can be classified as a country facing chronic water scarcity. The current available amount of water in Egypt is already being overused, as can be seen in Table 2. Egypt withdraws more water than its allocated share, partially as a result of Sudan under-utilizing its own share based on the 1959 Agreement. Egypt's main agricultural products are wheat, cotton, rice, maize, and sugarcane, basic staple and cash crops, which require significant amounts of water.

Figure 2. Areas of physical and economic water scarcity



Source: FAO 2010a.
Note: Rough sketch of borders by author.

To ensure future food and water security, Egypt has been developing new irrigation projects, such as the Southern Valley Development Project (Toshka Project), which would require utilization of approximately 10 percent of Egypt's share of Nile waters to irrigate 970,000 hectares (ha) of farm land (Stroh 2010, 296). As a result of high population pressure, the Toshka project also aims at resettling parts of the Egyptian population from the narrow Nile valley to the "greening desert."

Ethiopia

Ethiopia is located in Eastern Africa, bordered by Djibouti, Eritrea, Sudan, Kenya, and Somalia. In 2009, the country had a population of 80 million people, with an annual growth rate of 2.6 percent. Ethiopia is the only African country that has never been under colonial rule, with the exception of a five-year occupation by Italy during World War II. Ethiopia is a mountainous country, and its climate varies from hot and arid to cold and humid. It is one of the least developed countries in the world and extremely vulnerable to changes in climate, as recurring droughts and successive famines have shown. The country's economy and population heavily depend on rainfed agriculture, with few agricultural inputs and limited development of rural infrastructure; including poor irrigation development (see also Tables 1 and 2). However, political stability has increased in recent years. Thus, developing its infrastructure, economy, and agriculture is receiving increased national and international (donor) interest. Developing the nation's water resources is at the heart of much of the economic development in the country.

At a per capita water availability of 1,512 m^3 Ethiopia faces economic water scarcity rather than physical. Up to now, the country has "only been able to utilize 5 percent of its total surface water, or a meager 0.6 percent of the water resources of the Nile" (Arsano and Tamrat 2004, 16), 4.7 percent of which are used in irrigated agriculture. However, this situation is changing, with plans to double and triple irrigation capacity in the country over the next several years. The Nile as the major water source will therefore play a significant role. However, this is not to say that there are no alternatives to Nile waters. Technologies, such as rainwater harvesting, for instance, can offer some reprieve from rainfall variability, but only reservoirs will bring about real water control for agricultural development and "there is the need to dam the river flows in Ethiopia, including that of the Nile, and use this for more predictable reservoirs in small, medium, and large-scale irrigation" (Arsano 2007, 23).

Regarding hydropower projects, Ethiopia has a comparative advantage in construction over Egypt due to sharp differences in altitude in the mountainous areas. While the potential to develop hydropower in the Nile Basin is vast, only 11 percent has been developed, while 58 percent of the potential resides in Ethiopia (Mason 2004, 19). Further, Ethiopia's climate is more moderate than that of Egypt, reducing reservoir evaporation losses. Upstream dams for hydropower would provide Ethiopia with electricity for internal use or to sell to other interested parties. At present, the construction of five hydropower projects in Ethiopia has started, as a result, chiefly, of financial and technical support from China. The Tekeze Dam, a large hydropower dam on the Tekeze River, that joins the Atbara and eventually the Nile, is the key joint Sino-Ethiopian project. It is important to remember that before the Aswan Dam was constructed, it was argued that a water storage system should be built in Ethiopia rather than in Egypt. But British policymakers at that time were more interested in having superior control over this vital resource; therefore, constructing the dam on Egyptian territory was more important to them than sustainable and equitable use of the Nile waters. Since international actors have greatly altered the hydro political situation in the Basin, aspects of changing international power relations will be analyzed further in the section on drivers of global change.

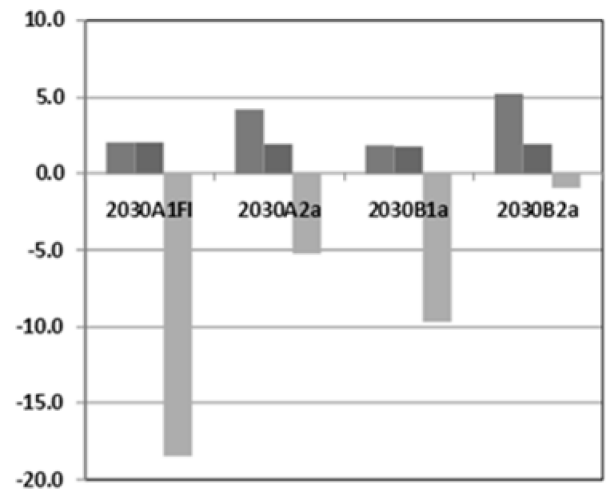
It can be argued that Ethiopia's GDP is likely to stabilize with improved and stable water availability, if other large impacts, such as economic reaction or natural disasters, do not interfere. Improving agricultural water utilization and developing new ways of using its resources is therefore an important target for Ethiopia. This complex situation demonstrates the conflict between sustaining or expanding the status quo in downstream countries, on the one hand, and the vital importance of "water for development" aims for upstream riparians, and Ethiopia in particular, on the other hand.

5. DRIVERS OF GLOBAL CHANGE AFFECTING EGYPT AND ETHIOPIA

Global change, as defined in this paper, refers to the impacts of overall climate change and population growth. However, we also consider here the effects on the Nile Basin of economic growth, increasing poverty, and the rise of new political and economic powers like China. This section outlines the main challenges the countries of the Nile Basin, especially Egypt and Ethiopia, are facing or will face in the future, given the impacts of global change.

The 2007 Fourth Assessment Report (AR4) by the Intergovernmental Panel on Climate Change (IPCC) outlines the international scientific consensus and current state of knowledge about climate change and its global and regional impacts on different ecosystems and sectors. Regional models for Africa show that by the year 2020, between 75 and 250 million people are projected to be exposed to increased water stress due to climate change. Moreover, production from rainfed agriculture might decrease up to 50 percent (Boko et al 2007, 448). In general, the number of dry days will increase in some regions, such as Egypt, while more intense rainfall events will occur in others, such as Ethiopia (WDR 2010, 138).

Figure 3. Impact of climate change on Nile Basin runoff, precipitation (precip) and potential evapotranspiration (ET) (percent change from 2000 values)



Percent change from 2000
Potential

	Precipitation	ET	Runoff
2030A1FI	2.0	2.0	-18.4
2030A2a	4.1	1.9	-5.2
2030B1a	1.8	1.7	-9.7
2030B2a	5.2	1.9	-1.0

Source: IFPRI Global Hydrologic Model Simulations 2008.

Today, as a result of high temperatures, a vast amount of the Nile waters stored in Lake Nasser and in the Sudd is annually lost to evaporation. As can be seen in Figure 3, evaporation is likely to increase in every scenario. "A rise in temperature of just 1°C, assuming a 4 percent increase in evaporation per degree centigrade rise in temperature, would lead to large increases in losses to evaporation…which would significantly reduce Nile flows" (OECD 2004,14). It is estimated that temperatures in the northern part of Africa will increase by the year 2030 by 1–1.5° Celsius, and for the Saharan region, an estimated increase of 3.6° Celsius can be expected by 2080 (UNEP 2009, 45). Even if there are a lot of uncertainties with regard to precipitation, "it is clear that the increased evaporation due to rising temperatures will result in greater water stress" (Sterman 2009).

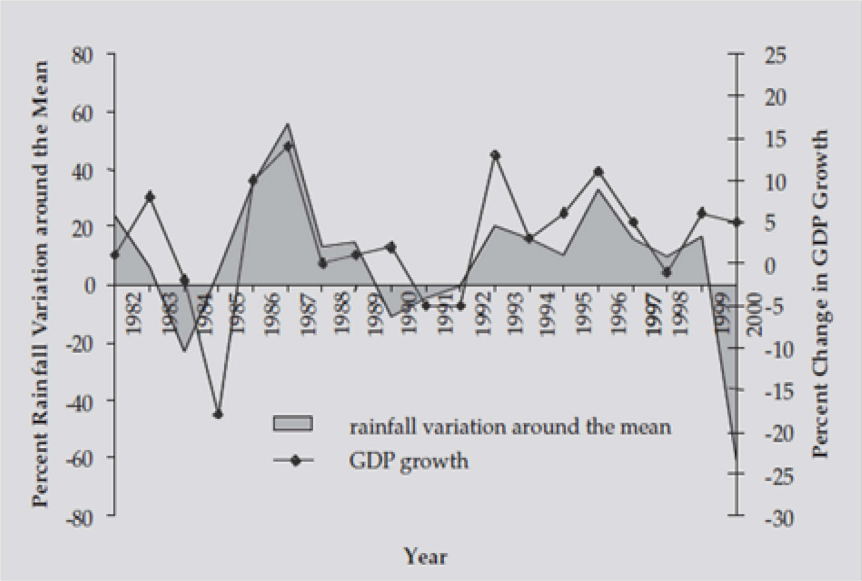
Further, the overall runoff in the Nile is likely to decrease by varying amounts as seen in Figure 3. Moreover, the increasing demand for water from various sectors in Egypt (as well as upstream countries) poses a threat to the sustainable use of water resources. Thus, according to Bates et al. (2008, 84) "the rate of water utilization has already reached its maximum for Egypt, and climate change will exacerbate this

vulnerability." A key issue for Egypt is "to close the rapidly increasing gap between the limited water availability and the escalating demand for water from various economic sectors."

Higher temperatures will likely reduce the yield of major crops and simultaneously increase their water needs, thus directly decreasing their water-use efficiency (Bates et al. 2008, 84). Moreover, the expansion of large-scale irrigated areas might decrease Egypt's ability to handle future variations in the Nile's runoff. Nevertheless, the country is trying to accelerate irrigation projects such as Toshka to increase agricultural output. One central question at this point is where the water for such projects shall come from if water availability is already at stake. Further, given that some drivers of change will affect water availability and hydropolitics in the Nile Basin in upcoming decades, where will the water come from? It appears that Egypt is trying to push forward not only the Toshka project, but also the North Sinai and the West Delta irrigation projects prior to negotiating a new agreement "to put more facts-on-the-ground to cement its 'historic rights' to the Nile water" (Cascão 2009a, 249).

As Figure 4 shows, climate variability is closely correlated with GDP growth in Ethiopia. Variability is expected to increase in both frequency and intensity as a result of climate change with expectations of both increased floods and droughts.

Figure 4. Rainfall variation around the mean and GDP growth in Ethiopia



Source: World Bank, 2006.

Changing Socioeconomic Circumstances

Current population in Egypt stands at 81.53 million and at 80.71 million in Ethiopia, where the population growth rate of 2.6 percent is one of the fastest in the basin and Africa. The question is how the countries of the Eastern Nile Basin are going to provide their growing populations with water and food if the current status of economic and agricultural development cannot be maintained.

With economic growth, urbanization, and higher living standards, water consumption increases. The growth rate of Ethiopia's GDP was 11.3 percent in 2008 and that of Egypt was 7.1 percent (see Table 1). Of course, there is concern about reduced availability of drinking water for people in water-scarce regions. But agriculture still dominates water use, and this is also true in the Nile Basin. The concept of virtual water measures the water embedded in agricultural production. "Each day, a person drinks 2–4 liters of water but eats food that requires 2,000–5,000 liters of water in its production" (World Bank 2010, 140). Hence, the amount of water needed for agricultural production is vast.

With growing incomes, people tend to consume more water-intensive diets, including meat products, milk, fruits, and vegetables, but also sugar. For example, one kilogram of beef contains 15,500 liters of virtual water (Water Footprint Network 2010). Hence, we can expect that in the coming years, overall water consumption will increase as a result of increased living standards.

International Factors

Foreign direct investments (FDI) or the phenomenon of "land grab" became a public concern in 2008, when more than 1.3 million hectares of farmland in Madagascar were to be leased for 99 years to a Korean corporation. As this is nearly half of the country's arable land, it threatened the food security of thousands of farmers and resulted in a riot of the local population that eventually brought down the government. Land grab is also an issue on the African mainland. For example, in 2008 and 2009, Jordan bought 25,000 ha and South Korea bought 690,000 ha of land in Sudan. Even a "regional land grab" by downstream countries in upstream countries is a possibility. In addition to the positive impacts, FDI might have on agriculture and land, it also may have negative effects for the rural poor, because "deals may not be made on equal terms between the investors and local communities" (von Braun and Meinzen-Dick 2009, 2). Land grab can worsen water shortages. "The ecological sustainability of land and water resources slated for foreign investment is another important issue….irrigating the landholdings of foreign investors may take away water from other users in the area" (von Braun and Meinzen-Dick 2009, 2). Land grab also means that new actors and new interests are entering the area, and their demands for land and water add to the water insecurity situation.

The key foreign actor influencing land and water in the Nile Basin is China. China's interest in Africa generally focuses on obtaining energy supplies and raw materials for its industries and economic development, but it may also have an interest in the impacts it can have on the countries' development. "The exponential growth in foreign trade between China and Africa since the end of the 1990s has shocked the Western public" (Schüller und Asche 2008, 10). Whatever the reasons for China's engagement in Ethiopia might be - China is well aware of the fact that Ethiopia has a significant geopolitical role in the Horn of Africa and especially in the Nile Basin. Sino-Ethiopian relations have tightened in recent years, not only in economic but also in diplomatic terms. Ethiopia is considered "a unique partner" to China, as a result of which China offered Ethiopia various bilateral benefits, including "a zero tariff for Ethiopian goods (which increased Ethiopian exports), debts cancellation and joint infrastructure projects" (Thakur 2009, 7). The bilateral trade between China and Ethiopia had a volume of $860 million in 2007 and, within the first half of 2008, had already reached $638 million. Regarding debt relief, China canceled all of Ethiopia's debts—$122 million for the period 2002–06.

Due to Chinese support, Ethiopia has been able to start several new projects, mainly in the transport, communication, and power sectors. Within these sectors, road construction and hydroelectric power generation projects have primarily benefited. Where western donors do not support large infrastructure projects, China does not hesitate to step in and finance projects that might have uncertain long-term impacts. While China has moved ahead, other donors are still often focusing more on potential long-term adverse impacts of development rather than the short- and long-term welfare impacts for poor upstream populations. As demonstrated earlier, however, donors have a significant role in supporting regime formation in a timely manner and can do so by offering incentives and presenting advantages of mutual cooperation.

The crucial point with Chinese financial support is that it is apparently not linked to certain objectives or standards that have to be met, like those of Western donors, and the financial support can be accessed much faster than that of Western donors. It may be argued that Ethiopia, which is eager to develop, does not want to wait for Basin-wide agreements in order to start development of water resources; therefore it welcomes the emerging hand of China as a powerful alternative to "traditional" Western donors. The sustainability of such projects may be doubtful, —not only in economic terms—as they may have negative impacts in the long run. International donors have been hesitant to finance large hydropower projects in Ethiopia, particularly on the Blue Nile, perhaps because they fear an adverse

reaction and wide criticism by NGOs and the civil society, and, until recently, Egypt still had the veto power on such upstream projects.

Another factor, whose impact remains unclear and which has not been analyzed earlier is the present and future role of the Sudan. As mentioned earlier, the Sudan does not use its entire legal share, granted by the 1959 agreement. Thus, Egypt was able to use more than its actual 55.5 km3 share of water in recent years. Sudan, which was almost always Egypt's downstream partner, is facing severe conflicts, and its future policies are therefore quite uncertain. Regarding South Sudan, a referendum on its independence is expected in 2011, and its outcome will also influence the hydropolitical situation in the Nile Basin, as it may produce a new riparian. However, the role of the Sudan will not be outlined further here. However, additional research on this topic is recommended.

Current Development and Assessment of Cooperation under the Impact of Global Change

As shown in previous sections, conflict in the Nile Basin is basically related to the allocation and uses of water among the riparian states. The challenge for regime formation in the Nile Basin is especially difficult, due to historic water sharing agreements. Most of the existing agreements between the Nile riparian states were made under the rule of colonial powers, and until now, there has been no legal agreement between all Nile riparians, since the NBI, founded in 1999, does not yet have legal status. As a consequence of global change and the subsequent demand for more fresh water, it is expected that tensions over water allocation will increase in the future. However, since the NBI is trying to bring all riparian states in the Basin into one regime and consequently a new organization, we will assess cooperation within the NBI in the following section.

In order to approach the possibilities for cooperation under the impact of global change and in line with the developed framework, we will begin with a closer look at problem factors and their roles in regime formation in the Nile Basin.

The distinction between collective and problems related to the upstream-downstream relation should be considered here. Climate change is by definition a collective problem because it is expected that its impacts will inflict costs on all riparians and that every riparian will be adversely affected by it. Hence, the interest in adapting to this problem should be homogeneous because every riparian has an interest in solving it.

Population growth is at first glance neither a collective problem nor an external one because population growth takes place inside territories. At second glance, we find that population growth in the Nile Basin with regard to water use is also a collective problem. However, it is important to stress that "[the] key variable is…not population growth itself but water availability per capita. The states that have an insufficient amount of water to meet their populations' demands will be pressured to secure access to freshwater sources, including international rivers, both in terms of quantity and quality of the water that could be extracted" (Tir and Ackerman 2009, 629).

Next, factors with an international context are taken into account in analyzing possibilities for regime formation. The influence of third parties can be classified as "problems" or rather issues, because they help to encourage hydro-hegemony and as such can be major obstacles to regime formation.

Regarding large foreign direct investments in land, or so-called land grab, it is important to create awareness on this issue and to generate solutions within the NBI or other institutions to regulate the competing demands for water resources. Participation of the civil society and farmers must be guaranteed in order to create transparency. Consequently, traditional land use systems, existing land rights, and local knowledge must be taken into consideration in order to protect the rural population and even to prevent a loss of biodiversity. In situations of food and water insecurity, domestic supplies must have priority over foreign investments. A stronger institutional context within the Nile Basin could be able to accompany or supervise negotiations on such processes in order to not neglect the rural population's interests and needs.

In most cases, the "financial support from multilateral funding agencies (for example, World Bank) [for Ethiopia] is, however, made dependent on agreement by all riparians involved" (Arsano 2007,

221). Thus, riparians fear that others might prevent them from getting international funding (Stroh 2010, 304). In the hegemonic discourse, it appears that Egypt still uses its diplomatic influence and its position as a stakeholder for the western interests in the Middle East/North Africa (MENA) region to limit the international support for Ethiopia. Because Egypt has maintained a veto power, the World Bank and other international donors may fear to grant financial support for solutions that would threaten Egypt's acquired rights. Is Egypt then using its role as a hegemon to maintain the status quo or does "the World Bank need Egypt more than Egypt needs the World Bank?" (Allan quoted in Zeitoun and Warner 2006, 450). Anyway, "most donors appear either unable or unwilling to fund projects that might challenge the hegemony, hydro or otherwise" (Zeitoun and Warner 2006, 454).

Yet, after reviewing the current situation, it seems that convincing Egypt that multilateral agreements are far more sustainable than maintaining the status quo is needed. This is due because of current drivers of global change that are threatening the downstream water security and because people in upstream countries desperately need their water for economic development. Hence, refuting financial assistance to Ethiopia and the other upstream countries, is not in the common sense of sustainable development or development first.

Until recently, the NBI has been unsuccessful in establishing its Shared Vision Programs throughout the Nile Basin riparian states. Instead of moving forward with basin-wide projects, only a "few cooperative facts-on-the-ground" (Cascao and Conway 2009, 4) have been established, as for example enterprises in the ENSAP, where "Egypt, Ethiopia, and Sudan are currently preparing investments in irrigation, hydropower, watershed management, and flood mitigation and have begun to identify a longer-term program of major, cooperative, multipurpose development of the river" (World Bank 2006, 13). These kinds of projects, however, are still rather technically oriented and do not touch on the negotiations needed for a legal framework. Nevertheless, it can be said that the NBI has not totally failed. Another indicator of this is that it has been able to facilitate meetings and establish a Nile Secretariat based in Entebbe, Uganda. Ongoing measures, such as the Nile 2002 conference series, helped to build trust and to strengthen the understanding of IWRM among the riparians. However, even after such a long period of politicized negotiations, the NBI has still failed to reallocate the Nile waters: today, Egypt and Sudan still refer to the 1959 agreement.

When in May 2010, five upstream countries, namely Ethiopia, Kenya, Rwanda, Tanzania, and Uganda, finally took the step and signed the "upstream version" of the new agreement, the situation in the Nile Basin changed immediately. It is important to note, however, that no hard numbers and provisions on water allocations have been made within the CFA. All riparians agreed on their shared "desire to strengthen their cooperation in relation to the Nile River, a great and vital natural resource which binds them together, and in relation to the sustainable development of the Nile River Basin" (CFA 2009, Preamble). This is all determined by the principles of "integrated management, sustainable development, and harmonious utilization of the water resources of the Basin, as well as their conservation and protection for the benefit of present and future generations" (CFA 2009).

As already mentioned, a specific article in the CFA is disputed: this is article 14b. Apart from this single paragraph, which is still not finally agreed on - all riparian states have agreed on the current draft of the CFA. Article 14b is to be "resolved by the Nile River Basin Commission within six months of its establishment." The dispute has its root in the formulation of the article. The favored upstream version reads as follows: "not to significantly affect the water security of any other Nile Basin State" and all upstream riparians have agreed to this proposal except Egypt and Sudan. Egypt, however, proposes that Article 14b should be replaced by the following wording: "not to adversely affect the water security and current uses and rights of any other Nile Basin State."

During the negotiation process, it was decided by the Nile Council of Ministers that the CFA's ratification with a two-thirds majority would suffice to establish the NRBC. Those riparians who would not ratify the agreement at this point could still join the NRBC later if they so wished (Cascão 2009b, 66).

And yet, the historic water agreements remain the primary obstacle to sustainable cooperation in the Nile Basin, because the version favored by the upstream countries is considered a threat to maintaining the status quo, and Egypt and Sudan have refused–until now–to sign the upstream version.

Therefore, preexisting regimes remain as the major obstacle for new regime formation. However, in "the absence of a partner with whom to form a more cooperative approach, this may result in the weaker states taking further actions to hedge their bets, reducing their reliance on the hegemonical regimes and perhaps attempting to set up alternative arrangements of their own" (Zeitoun and Warner 2006, 454).

In accordance with this, it could further be argued that under the impact of global change in the Nile Basin, the phenomenon of the so-called "counter-hydro-hegemonic-moment" is a form of political mechanism that has the ultimate quality to persuade other riparians to cooperate. The refusal to join the offered cooperation and the attempt to maintain the status quo could result in immense costs and far-reaching consequences. However, incentives have to be adjusted in order to convince Egypt that there is in the long run no alternative to cooperation. Therefore, the best negotiating strategy toward Egypt would be to stress these problem factors. It must be clear that sustaining the status quo, in hydrological and political terms, is not feasible. Hence, it can be said that there is still hope for long-term cooperation in the Nile Basin. According to the World Bank, "the Nile has the potential to catalyze sustainable economic growth for all 10 countries with benefits far beyond those that can be derived from the river itself" (World Bank 2010b) The concept of benefit sharing means that transboundary water management can generate multiple benefits for all riparians (Sadoff and Grey 2002) and this has already been integrated into the NBI approach (Cascão 2009b, 33).

A form of benefit sharing for the Nile riparians could be the following thought experiment (referring to Stroh 2010, 294). We can assume that all riparians would welcome economic development in their country as well as in the region. Hydropower could help Ethiopia to generate and export water electricity in order to obtain foreign exchange. Irrigation purposes, as outlined previously, would not be hindered by such a development, as the quantity of runoff is not affected. Further, downstream countries would be able to benefit from dams on the upper Nile in multiple ways. First, flood regulation could be an advantage for Sudan as the country does have seasonal but not multiannual storage and is therefore vulnerable to changes in runoff. This was demonstrated in the summer of 1988, when, after an eight-year-long drought, the massive flow of water resulted in severe floods in Khartoum. In addition, the storage reservoir in Sudan would be less affected by silting up. The crucial benefit is that more water becomes available for all riparians. In Aswan, 10 to 15 percent of the Nile's water gets lost due to evaporation. In Ethiopia, as shown earlier, evaporation losses would be a great deal smaller, as the climatic and topographic conditions are more promising there than in Aswan. Hence, if the Nile was regulated upstream, the Aswan High Dam could be run at a lower level, which in turn would reduce evaporation losses. Accordingly, the current inefficient use of the Nile waters makes a new understanding of Basin-wide policies urgent.

It is important to bear in mind that there is no ultimate solution for solving these problems. For example, "trade" with virtual water "has always been feasible, primarily because it has been invisible. Like many other states around the globe, Sudan and Egypt have become dependent on global trade to solve their water and food supply problems" (Zeitoun, Allan, Mohieldeen 2010, 12). Yet the food price crisis of 2007/08 reduced trust in global food markets, and for this reason, many countries increased national food self-sufficiency policies by increasing agricultural input subsidies. Especially in the MENA region, the principles of self-sufficiency and self-supply are significant values: thus, being dependent on food imports from other countries might not be appreciated. In any case, without strong institutional arrangements, nation states might fear food and water insecurity if they were dependent on other states. And yet the general question of sustainable agricultural production in Egypt is at stake: "Egypt's future has to lie in the non-agricultural sector and the exports of manufactured goods and of services" (Waterbury and Whittington 1998, quoted in Stroh 2010, 297).

Emerging Scenarios

It may be argued that under recent developments, there are several possibilities for further cooperation and regime formation. Under global change, due to international factors and the increased political

stability in the upstream countries, the Nile Basin is probably facing a counter-hydro-hegemonic moment. This moment is the upstream countries' signing of the Cooperative Framework Agreement.

From this point on, the following possibilities for cooperation emerge (Cascão 2009b, 71):

1. Ratification of CFA and all-inclusive NRBC
2. Partial ratification of CFA and not-all-inclusive NRBC
    a. Approval by Egypt and Sudan
    b. Disapproval by Egypt and Sudan
3. No ratification, no NRBC, but multilateral cooperation
4. No ratification, no NRBC, only partial or noncooperation

The best-case scenario is scenario 1, as it assumes that all riparians, including Egypt and Sudan, will ratify the CFA, and the NRBC will be established as its outcome. All riparians will be members of the Commission, and the NBI is replaced by the new organization. This means that Egypt and Sudan agree to ratify the agreement as suggested by the upstream countries. International donors would welcome this development and grant financial support.

Scenario 2 assumes that Egypt and Sudan would not ratify the CFA in the near future, but the NRBC might be established with a two-third majority. Yet, Egypt and Sudan would have the opportunity to join the NRBC later if they wish to. At this point, we have to distinguish two more possibilities: the approval or disapproval by Egypt and Sudan. Scenario 2a assumes that Egypt and Sudan would both approve the NRBC and support it independently. Here, technical projects might be implemented between up- and downstream states, without touching the sensitive historic agreements. This scenario seems the most likely at present, yet international financial support might be the limiting factor, as the World Bank, for example, favors an inclusive Basin-wide organization funded around a shared vision, including Egypt and Sudan, while nevertheless granting some support for the "upstream NRBC."

Scenario 2b assumes that Egypt and Sudan would not approve the CFA and would withhold any support for the NRBC. Here, the kind of projects that might be implemented is questionable, and it is also interesting to take a look at future financial support. Egypt might try to use its hegemonic position to influence western donors so that they would withdraw their support. Implementing projects might become critical because Egypt and Sudan would still insist on the 1929 and 1959 agreements. Moreover, upstream countries might undertake bilateral cooperation or unilateral projects with the continuing support of China.

With regard to scenarios 1 and 2, where the NRBC would be established, the following points are important. The Nile Secretariat, as the executive agency, will play the key role as a central implementing organ in the formation of the new regime. The required mandate lies in the CFA, which states in article 15, that if a ratification of the CFA is successful, the NRBC is to be established by the Nile River Basin states. The most important point, however, is that national water policies must be harmonized and coordinated in order to create a foundation for Basin-wide policy. The challenge for the years to come lies therefore in guiding the NBI and NRBC through the transformation process, to safeguard a framework for a sound use of water resources, and to finally use the overall potential for economic and ecological development. In order to address collective problems and impacts, policymakers in their countries first have to identify national and Basin-wide factors. Second, they must consider them in the context of the NBI. As cooperative action might in the end be the most appropriate and effective measure, cooperation within the future NRBC should be much higher and more sustainable than relying on unilateral or bilateral agreements, because it would generate win–win situations for all riparians. The NRBC could be a commission that fulfils both integrated and specific approaches—on the one hand, having a legal framework and an organization and, on the other hand, guiding specific approaches by analyzing and adapting to specific collective problems.

In scenario 3, the CFA would not be ratified in the short term, nor would the NRBC be established. Alternative cooperative arrangements, as suggested in scenario 2b, are a possibility, and unilateral movements are also likely. The worst-case scenario obviously is scenario 4, as the CFA would

not be ratified, and there would be no commission. Further, it is assumed that a cooperative, inclusive approach is no longer possible. This scenario includes several options from unilateral developments to bilateral, yet they all might be short term and focused only on acute projects. If this case should become a reality, the efforts of recent years would have been in vain. It would be a shame if the NBI lost its raison d'être and if the region's potential was not realized. It would be even worse with regard to the efforts to build mutual trust and cooperation among the riparians because there is still a risk that tensions might escalate in the region if such integrating projects break down. This is especially the case in a weak institutional context.

6. CONCLUSIONS AND RECOMMENDATIONS

"Everything flows and nothing abides, everything gives way and nothing stays fixed"
(Heraclitus).

In this paper, we have shown that drivers of global change will have a strong impact on current water availability in the Nile Basin and have the potential for altering the status quo of hydropolitics in the future. Due to the entrance of new actors, such as China, the political situation in the Nile Basin has been redefined. Based on these changing international conditions, Egypt's hydro-hegemonic position is being challenged. On the one hand, support from alternative sources has become available for upstream riparians and, on the other hand, underlying global drivers of change, including population and economic growth upstream and also climate change, are gradually eroding the long-held "hydropower" of Egypt. This shows that international structures are not rigid but extraordinarily flexible: neither the status quo of current water allocation, nor that of legal–political aspects can be maintained on a long-term basis.

To avoid new conflict, a sound strategy will be required to satisfy the water needs and demands of all riparians. Thus, the need for action is acute to prevent tension and conflicts in the future. Egypt and Sudan have the most to lose under these changes and thus the most to gain from cooperation. These countries still insist on the validity of the 1929 and 1959 agreements, which make efforts to establish an inclusive Basin-wide organization more difficult. For too long, Egypt and Sudan have relied on the convenient position of wide support from western donors and the fact that upstream riparians—especially Ethiopia—did not have a chance to develop the Nile water resources. Yet, with the support of other donors, especially China, interests in the Eastern Nile Basin have diversified, creating both opportunities for peaceful cooperation and threats for increased tension and conflict. We find that a multilateral agreement would be more sustainable for addressing the Basin's future water supply and demand challenges.

If an international water regime were formed in the Nile Basin, and current developments point in this direction, there are still some issues that raise concern. As outlined previously, balancing of incentives is important for forming a regime, as well as for safeguarding a nation's welfare. If the CFA were ratified, it might provoke fear and concern in downstream countries, because the costs of regime formation would be projected onto Egypt and Sudan; the status quo would not be maintained and existing structures would have to be changed. It should be mentioned here that within a strong institutional context the mutual trust among regime members facilitates mechanisms of benefit sharing and principles of integrated water resource management among the riparians. It is advisable in any case to acknowledge first the urgent need for water for development by upstream riparians.

We recommend that the riparian countries make an additional effort in the form of accepting incentives and regional benefit-sharing to eventually ratify the CFA inclusively. Probably the only effective long-term answer to the water conflict in the Nile Basin is to create a new international water regime. This regime promotes the transformation of national water policies into a joint strategy for transboundary river management. The overarching conclusion is that IWRM used as a tool for transboundary water management has indeed great potential to produce a peaceful and secure environment. The ratification process of the CFA consequently represents a window of opportunity for creating cooperation and overcoming conflict in the Nile Basin. Thus, the formation of a new regime is not only the ultimate goal but even more an imperative for the equitable and cooperative use of the Nile's waters:

"[If only the Nile Basin's] full multiple use potential could be developed and exploited in a cooperative manner, the Basin's water resources could become the foundations for great economic prosperity and well-being in all the riparian states, both in the short run and the long run" (Elhance 1999, quoted in Stroh 2010, 306).

This complex situation reflects however the fact, that there is no simple zero-sum situation in the discourse on Nile Basin cooperation. It demonstrates further that conflict solutions are quite multilayered. Dichotomies such as "conflict versus cooperation" or "upstream versus downstream" are too short-sighted and do not incorporate the complex behavior of states and the international system.

REFERENCES

Agreement. 1929. Exchange of Notes regarding the use of waters of the Nile for irrigation purposes between Egypt and the United Kingdom. Cairo.

Agreement. 1959. Agreement between the Republic of the Sudan and the United Arab Republic for the Full utilization of the Nile waters. Cairo.

Arsano, Y. 2007. Ethiopia and the Nile: Dilemmas of national and regional hydropolitics. Thesis (PhD). Center for Security Studies, Swiss Federal Institute of Technology. Zürich, Switzerland.

Arsano, Y., and I. Tamrat. 2004. Ethiopia and the Eastern Nile Basin. *Aquatic Sciences* 67 (1): 15–27.

Bates, B. C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 2008. Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva.

Boko, M., I. Niang, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha, R. Tabo and P. Yanda. 2007. Africa. Climate change: Impacts, adaptation, and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), eds. M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson. Cambridge: Cambridge University Press.

Braun, J. von, and R. Meinzen-Dick. 2009. "Land grabbing" by foreign investors in developing countries: Risk and opportunities. Policy Brief 13. Washington, D.C.: International Food Policy Research Institute.

Cascão, A. E. 2008a. Ethiopia – Challenges to Egyptian hegemony in the Nile Basin: *Water Policy* 10 (2): 13–28.

_____. 2008b. Negotiations for a new Nile treaty. Rapport de Forces. Presentation delivered at Hydro-Hegemony 4 Workshop May 2008. London. <http://www.slideshare.net/ana.cascao/cascao-london-cooperative-framework-agreement-nile-presentation>. Accessed April 26, 2010.

_____. 2009a. Changing power relations in the Nile River Basin: Unilateralism vs. cooperation? *Water Alternatives* 2 (2): 245–268.

_____. 2009b. Institutional analysis of the Nile Basin Initiative: What worked, what did not work and what are the emerging options? Report submitted to International Water Management Institute as a part of Nile Basin Focal Project, International Water Management Institute.

_____. 2009c. Political Economy of Water Resources Management and Allocation in the Eastern Nile River Basin. Thesis (PhD). Department of Geography. King's College of London, University of London.

Cascão, A. E., and D. Conway. 2009. Double-faced hydropolitical cooperation in the Nile Basin. Presentation delivered at World Water Week 2009, Stockholm. <http://www.slideshare.net/ana.cascao/cascaoconway-stockholm-double-faced-cooperation-nile-basin< Accessed April 26, 2010

CFA (Agreement on the Nile River Basin Cooperative Framework) Signature in Process. Entebbe, Uganda.

Conway, D. 2005. From headwater tributaries to international river: Observing and adapting to climate variability and change in the Nile Basin. *Global Environmental Change* (15): 99–114.

Egypt, Arab Republic of, Ministry of Water Resources and Irrigation. 2005. Integrated water resource management plan. Cairo.

Elhance, A. 1999. Hydropolitics in the Third World: Conflict and cooperation in international river basins. Washington, D.C.: US Institute of Peace Press.

Ethiopia, Ministry of Water Resources. National Meteorological Agency. 2007. Climate change national adaptation programme of action (NAPA) of Ethiopia. Addis Ababa.

FAO (Food and Agricultural Organization of the United Nations.) 2010a. Areas of Physical and Economic Water Scarcity. <http://www.fao.org/nr/water/art/2007/scarcity.html> . Accessed March 22, 2010.

_____. 2010b. Aquastat Database. <http://www.fao.org/nr/water/aquastat/dbase/index.stm> . Accessed April 2010.

Homer-Dixon, T. 1991. On the threshold. Environmental changes as causes of acute conflict. *International Security* 16 (2): 76–116.

_____. 1994. Environmental scarcities and violent conflict: Evidence from cases. *International Security* 19 (1): 5–40.

IFPRI (International Food Policy Research Institute). 2008. Global hydrologic model simulations. Washington, D.C. IFPRI.

IWMI (International Water Management Institute. 2009. Presentation delivered in Chiangmai, 9/19/2009. <http: //www.slideshare.net/cpwfbfp/nile-basin-focal-project.> Accessed 03/24/2010.

_____. 2010. Research themes. Theme 1: Water availability and access. <http://www.iwmi.cgiar.org/research_impacts/Research_Themes/Theme_1/index.aspx. < Accessed 03/29/2010.

Jønch-Clausen, T. 2004. Integrated Water Resources Management (IWRM) and water efficiency plans by 2005. Why, what, and how? Sweden: Global Water Partnership.

Krasner, S. 1983. International Regimes. Ithaca, (New York). Cornell University Press.

Lindemann, S. 2005. Explaining success and failure in international river basin management – Lessons from Southern Africa. Paper presented at the Open Meeting of the Human Dimensions of Global Environmental Change Research Community, "Global Environmental Change, Globalization, and International Security: New Challenges for the 21st century," October 9–13, Bonn, Germany.

Marty, F. 2001. Managing international rivers: Problems, politics and institutions. European University Studies 31, Political Sciences 421. Bern: Peter Lang.

Mason, S. A. 2004. From conflict to cooperation in the Nile Basin. Interaction between water availability, water management in Egypt and Sudan and international relations in the Eastern Nile Basin. Conflict sensitive interviewing and dialogue workshop methodology. Thesis (PhD). Swiss Federal Institute of Technology, ETH, Zürich, Switzerland.

NBI. 2010. Objectives of the Nile Basin Initiative. <http://www.nilebasin.org/index.php?option=com_content&task=view&id=13&Itemid=42>. Accessed March 2010.

OECD (Organization for Economic Co-Operation and Development). 2004. Development and climate change in Egypt: Focus on coastal resources and the Nile. Environment Directorate Environment Policy Committee. Paris.

Sadoff, C., and D. Grey. 2002. Beyond the river: The benefits of cooperation on international rivers. *Water Policy* 4: 389–403.

Schüller, M., and H. Asche. 2008. China's engagement in Africa – Opportunities and risk for development. Eschborn, Germany: Deutsche Gesellschaft für technische Zusammenarbeit (GTZ).

Sterman, D. 2009. Climate change in Egypt: Rising sea level, dwindling water supplies. <http://www.climate.org/topics/international-action/egypt.html.> Accessed March 18, 2010.

Stroh, K. 2010. Der Konflikt um das Wasser des Nils. In Friedens- und Konfliktforschung. Eine Einführung, ed. P. Imbusch and R. Zoll. Wiesbaden, Germany: VS Verlag für Sozialwissenschaften.

Svendsen, M., M. Ewing, and S. Msangi. 2009. *Measuring irrigation performance in Africa*. IFPRI Discussion Paper No. 894. Washington D.C.: International Food Policy Research Institute.

Thakur, M. 2009. *Building on progress? Chinese engagement in Ethiopia*. Occasional Paper 38. South African Institute of International Affairs (SAIIA). <http://www.saiia.org.za/images/stories/pubs/occasional_papers/saia_sop_38_thakur_20090723_en.pdf?> Accessed May 10, 2010.

Tir, J. and J. T. Ackerman 2009: Politics of Formalized River Cooperation. *Journal of Peace Research* 46 (5): 623-640.

UNEP (United Nations Environment Program). 2009. Assessment of Transboundary Freshwater Vulnerability in Africa to Climate Change. <http://www.unep.org/dewa/assessments/Ecosystems/water/assessment_of_transboundary_freshwater_vulnerability.pdf.> Accessed 04/28/2010.

United Nations, Population Division. 2010. Database on World Population Prospects 2008: The 2008 Revision Population Database. <http://esa.un.org/unpp/index.asp> Accessed March 22, 2010.

Waterbury, J. 1979. Hydropolitics of the Nile Valley. New York, Syracuse University Press.

Waterbury, J. and Whittington, D. 1998. Playing chicken on the Nile? The implications of micro dam development in the Ethiopian highlands and Egypt‘s new valley project. *Natural Resources Forum* 22 (3): 155-163.

Water Footprint Network 2010. Water Footprint Gallery. <http://www.waterfootprint.org/?page=files/productgallery&product=beef.> Accessed October 2010.

Wolf, A. T. 1998. Conflict and cooperation along international waterways. *Water Policy* 1: 251-265.

World Bank. 2006. Ethiopia: Managing water resources to maximize sustainable growth. A World Bank water resources assistance strategy for Ethiopia. Washington D.C.

_____. 2008. Socioeconomic Development Indicators.

_____. 2010a. World Development Report 2010: Development and Climate Change, Washington D.C.

_____. 2010b. Nile Basin Initiative. <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/EXTREGINI/EXTAFRNILEBASINI/0, menuPK: 2960057~pagePK: 64168427~piPK: 64168435~theSitePK: 2959951, 00.html.> Accessed March 18, 2010.

Stockholm International Water Institute. 2009. World Water Week. Overarching conclusions, responding to global changes: Accessing water for the common good with special focus on transboundary waters. Stockholm.

Zeitoun, M., and J. Warner. 2006. Hydro-hegemony: A framework for analysis of transboundary water conflicts. *Water Policy* 8: 435–460.

Zeitoun, M., J. Warner, and Y. Mohieldeen. 2010. Virtual water ‘flows’ of the Nile Basin, 1998-2004: A first approximation and implications for water security. *Global Environmental Change* 20(2): 229-242.

RECENT IFPRI DISCUSSION PAPERS

For earlier discussion papers, please go to http://www.ifpri.org/publications/results/taxonomy%3A468. All discussion papers can be downloaded free of charge.

1051. *Estimating the role of spatial varietal diversity on crop productivity within an abatement framework: The case of banana in Uganda*. Norman Kwikiriza, Enid Katungi, and Daniela Horna, 2010.

1050. *Strengthening innovation capacity of Nigerian agricultural research organizations*. Catherine Ragasa, Suresh Babu, Aliyu Sabi Abdullahi, and Baba Yusuf Abubakar, 2010.

1049. *Asset dynamics in northern Nigeria*. Andrew Dillon and Esteban J. Quiñones, 2010.

1048. *Review of agricultural extension in India: Are farmers' information needs being met?* Claire J. Glendenning, Suresh Babu, and Kwadwo Asenso-Okyere, 2010.

1047. R*ecent findings on trade and inequality.* Ann Harrison, John McLaren, and Margaret S. McMillan, 2010.

1046. *An analysis of institutions and policy processes for selected antipoverty interventions in Bangladesh*. Akhter U. Ahmed and Mubina Khondkar, 2010.

1045. *Clustering as an organizational response to capital market inefficiency: Evidence from handloom enterprises in Ethiopia*. Merima Ali, Jack Peerlings, and Xiaobo Zhang, 2010.

1044. *Access to improved water source and satisfaction with services: Evidence from rural Ethiopia*. Degnet Abebaw, Fanaye Tadesse, and Tewodaj Mogues, 2010.

1043. *Valuing the environment in developing countries: Modeling the impact of distrust in public authorities' ability to deliver public services on the citizens' willingness to pay for improved environmental quality*. Ekin Birol and Sukanya Das, 2010.

1042. *Climate change impacts on food security in Sub-Saharan Africa: Insights from comprehensive climate change scenarios*. Claudia Ringler, Tingju Zhu, Ximing Cai, Jawoo Koo, and Dingbao Wang, 2010.

1041. I*n-depth assessment of the public agricultural extension system of Ethiopia and recommendations for improvement.* Kristin Davis, Burton Swanson, David Amudavi, Daniel Ayalew Mekonnen, Aaron Flohrs, Jens Riese, Chloe Lamb, and Elias Zerfu, 2010.

1040. *Do geese migrate domestically? Evidence from the Chinese textile and apparel industry*. Ruan Jianqing and Xiaobo Zhang, 2010.

1039. *In pursuit of votes: The capture of the allocation of local public goods by the central state in Ghana*. Leah Horowitz and Nethra Palaniswamy, 2010.

1038. *An econometric investigation of impacts of sustainable land management practices on soil carbon and yield risk: A potential for climate change mitigation*. Edward Kato, Ephraim Nkonya, Frank Place, and Majaliwa Mwanjalolo, 2010.

1037. *Effects of inclusive public agricultural extension service: Results from a policy reform experiment in Western China.* Ruifa Hu, Yaqing Cai, Kevin Z. Chen, Yongwei Cui, and Jikun Huang, 2010.

1036. *Food as the basis for development and security: A strategy for Yemen*. Clemens Breisinger, Olivier Ecker, Jose Funes, and Bingxin Yu, 2010.

1035. *Purpose and potential for commodity exchanges in African economies*. Shahidur Rashid, Alex Winter-Nelson, and Philip Garcia, 2010.

1034. *Investigating economywide and household-level impacts of sector-specific shocks in a poor country: The case of avian flu in Ethiopia*. Gezahegne Ayele, Ekin Birol, Xinshen Diao, Dorene Asare-Marfo, Devesh Roy, and Marcelle Thomas, 2010.

1033. *Market and climatic risks and farmers' investment in productive assets under the Second Fadama Development Project in Nigeria*. Hiroyuki Takeshima and Futoshi Yamauchi, 2010.

1032. *Factors affecting the choices of coping strategies for climate extremes: The case of farmers in the Nile Basin of Ethiopia.* Temesgen Tadesse Deressa, Claudia Ringler, and Rashid M. Hassan, 2010.

1031. *Intellectual property rights, private investment in research, and productivity growth in Indian Agriculture: A review of evidence and options*. Deepthi Kolady, David J. Spielman, and Anthony J. Cavalieri, 2010.

1030. Examining relationships between customary and state institutions in Ghana's decentralized system. Cory Belden, 2010.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

www.ifpri.org

IFPRI HEADQUARTERS

2033 K Street, NW
Washington, DC 20006-1002 USA
Tel.: +1-202-862-5600
Fax: +1-202-467-4439
Email: ifpri@cgiar.org

IFPRI ADDIS ABABA

P. O. Box 5689
Addis Ababa, Ethiopia
Tel.: +251 11 6463215
Fax: +251 11 6462927
Email: ifpri-addisababa@cgiar.org

IFPRI NEW DELHI

CG Block, NASC Complex, PUSA
New Delhi 110-012 India
Tel.: 91 11 2584-6565
Fax: 91 11 2584-8008 / 2584-6572
Email: ifpri-newdelhi@cgiar.org