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Green Water and Effective Legislation for Transboundary Water Management

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This article presents some of the emerging mechanisms related to transboundary water management. It presents ideas for conflict resolution on transboundary waters, addressing some of the principal driving forces for conflicts, mainly the insufficiency of available water resources, and the lack of effective legislative frameworks for sharing transboundary waters.
The article highlights the importance of "green" water assessment, and the importance of adapting the legislative frameworks to consider all forms of available water resources at the transboundary river basin level and at the national level to reduce chances of conflicts in transboundary river basins. It also emphasizes the notion of "no-harm" and protection of prior appropriation of water rights in transboundary water management.

Introduction

The potential for water conflicts over transboundary, shared or international waters (as some countries prefer to call them) is increasing as population, development and the demand for water increase. There are more than 300 major river basins, covering about 50% of the total land area of the earth. Many of these river basins cross country borders, even more as political developments lead to the break-up of nations such as the Soviet Union and Eastern Europe (Sherk et al, 1998). The number of countries sharing a transboundary river basin may be two or more. Examples of transboundary river basins are the Nile River, with 10 countries sharing the basin, and the Danube River, shared by 17 countries.
With rising prices of food all over the world, water productivity in agriculture will have to be improved for both irrigated agriculture using blue water, and rain-fed agriculture using green water. Blue water is defined as surface water or groundwater that is abstracted manually for the purpose of development or production. Green water is defined as the portion of beneficial abstractions of renewable water resources from green cover which comes from atmospheric water directly and is consumed by rain-fed agriculture, natural pasture, and forests.
Despite the dominant role of green water in rain-fed agriculture for food production, sustaining natural ecosystems, and relieving pressures on transboundary blue waters, the assessment of green water's potential is still unknown on the global scale. Green water constitutes the true potential for solving the food crisis and hunger in the world through rain-fed agriculture, which can fill the food gap at lower costs than irrigated agriculture.
The role of green water calls for looking beyond the transboundary river alone (blue water) to the transboundary river "basin" to capture the benefits of green water and blue water combined, for upstream and downstream riparian countries.

The Potential of 'Green' Water

Unlike blue water (groundwater, surface water), which generally has many alternatives for its development and use because of its flexible accessibility and transportability, green water (atmospheric water and soil moisture in the unsaturated zones) can only be taken up by local vegetation. The possibilities for alternative uses of green water in municipal, agricultural, or industrial uses are not always that obvious. How-

ever, green water has alternative uses in rain-fed natural cover and agriculture. This requires changes in crops or land use and will not usually change the water balance quantitatively but could make important differences in a qualitative sense (World Water Council, 2004). Green Water is also transformed daily into Blue Water by the effects of continuous urbanization or deforestation practices in green-covered lands (Abu-Zeid, K., 2001).

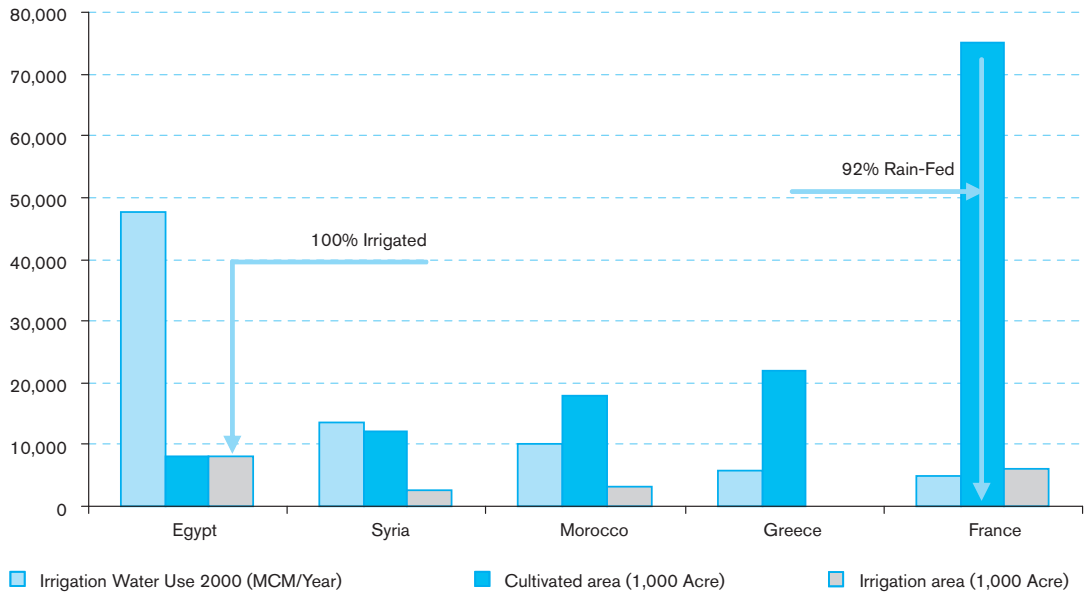
The direct beneficial use of rainfall is a substantial amount of water, which, if properly assessed, could significantly switch the balance of equitable utilization formulas. The World Water Council (WWC) defines this water as green water, or soil water, which is the portion of rainfall that is stored in the soil and then evaporates or is incorporated into plants and organisms. In its World Water Vision 2000, the WWC estimates the annual global green water to be 60,000 km^3, compared with only 40,000 km^3 of blue water, which is defined as the portion of rainfall that enters into streams and recharges ground water. It is apparent how significant green water can be in resolving water conflicts, not only because of its amount but also because of how much green water contributes to food production. 60% of global food production comes from green water (Cosgrove and Rijsberman, 2000).

A proper assessment of water resources is an essential step in the equitable utilization of shared water resources. It provides the opportunity for cooperation among riparian countries of a river basin to develop the untapped water resources in the basin rather than compete over already utilized water resources. It should define each country's actual utilized water as extracted surface and ground water as well as any beneficial evapo-transpiration resulting from rainfall on the river basin. It should account for all possible potential water resources in each country, within or outside the river basin, whether it is river runoff, ground water, direct rainfall (contributing to green water) or evaporation losses that could be saved (Abu-Zeid, K., 1997 & 2001).

Many discrepancies exist between different methodologies of water resources assessment due to the lack or extreme difficulty of accurate estimation of data, and different definitions and terminologies used in the field. Double counting of the commonly used term "internal renewable water resources" is a repeated feature, and the neglect of atmospheric water (green water) consumed by natural vegetation and forests is a persistent drawback in water resources assessments, especially in transboundary river basins and given the lack of basin-wide agreements in many river basins.

The soaring demand for fresh water, especially competing demands on transboundary waters, is putting high pressure on the effective consideration of other water resources like groundwater and direct fresh water use from green water. Of equal importance is consideration of the potential of non-conventional water resources. The need for a unified systematic approach towards the identification, compilation and processing of reliable data, and a consistent method-

CHART 10 **Water for Irrigated Land Compared with Rain-Fed Land**



ology for national and river basin water balance calculations is inevitable.

Chart 10 illustrates the water used for irrigated land compared with water used for rain-fed land for selected Mediterranean countries. It shows how some countries depend differently on blue water and green water in their agriculture. France, for example, which depends more on green water, cultivates about 80 million acres, 92% of which is rain-fed. Egypt cultivates 8 million acres, 99% of which is irrigated (Abu-Zeid, K., 2003). This shows the comparative advantage of green water in the north of the Mediterranean versus blue water in the south of the Mediterranean. This is also supported by the fact that a country such as Egypt, for instance, uses all its annual supply of the Nile river flow (55.5 BMC/year of blue water) due to the absence of green water, while a country such as France releases a similar amount of blue water (50 BCM/year) to the Mediterranean through the Rhone river, mainly due to the abundance of green water (in addition to other blue water resources).

Blue and Green Water in the Nile Basin

Similarly, the Nile river basin gives a very good example crossing a wide range of climates ranging from the rainy tropical regions upstream to the desert regions downstream of the Nile basin. Green water plays a very important role upstream in countries such as Burundi, Kenya, Eritrea, Ethiopia, Tanzania, Rwanda and Uganda, while Blue water plays the most important role downstream especially in Egypt and the northern part of Sudan.

While on average 7,000 Billion Cubic Metres (BCM)/year of precipitation falls on the Nile Basin Countries as a whole, the average annual precipitation on the Nile Basin is estimated at 1,660 BCM/year, where only 84 BCM/year of river flow (blue water) accumulates in the final reaches of the river, downstream of Khartoum/Sudan and on to Egypt. Most of the Nile basin's precipitation is used as "green water," except for Egypt's and Sudan's "blue water" use

MAP 4 **Nile Countries Average Annual Precipitation**

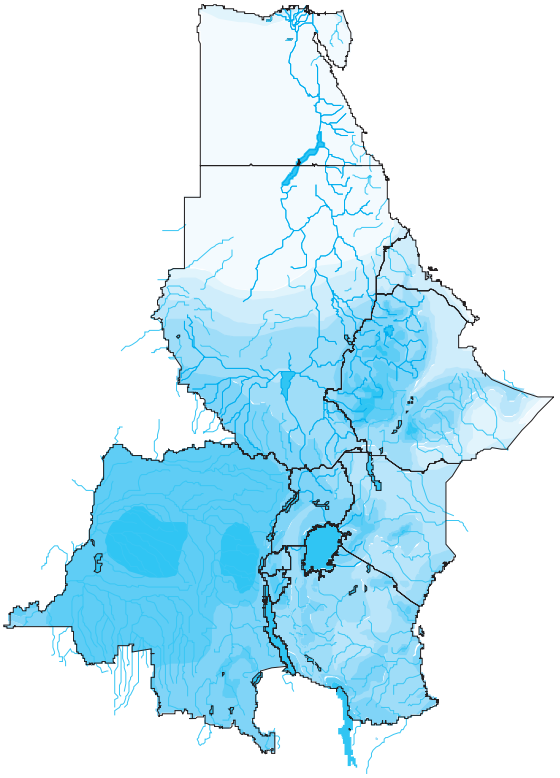
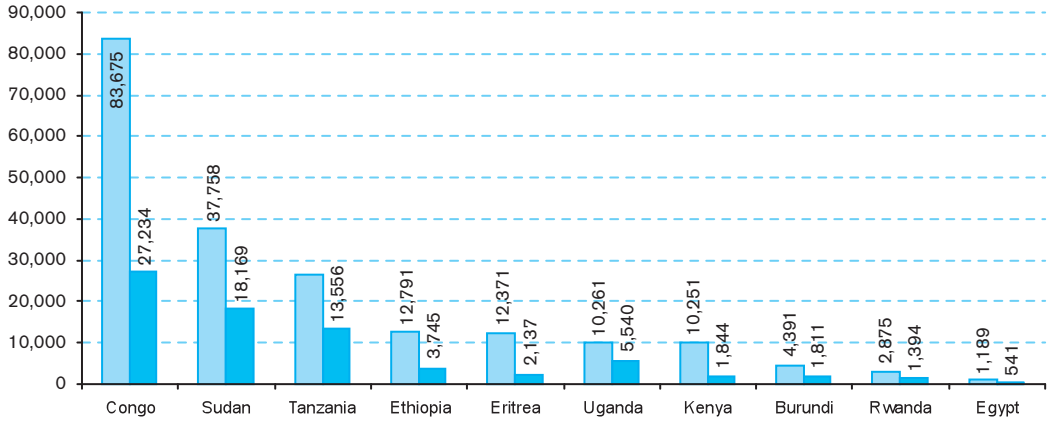


CHART 11 **Per Capita Share of Renewable Water Resources and Per Capita Share of Green Cover**



from the Nile, which is only about 55.5 BCM/year and 18.5 BCM/year respectively.

Map 4 shows the average annual precipitation over the Nile Basin countries, while Chart 11 shows the per-capita share of the renewable water resources (including blue and green water, calculated based on natural river flows and water sharing agreements) and the per-capita share of green cover (natural pasture, forests, rain-fed and irrigated agriculture) for each of the Nile countries. The country per-capita share of renewable water resources ranges from about 83 thousand m^3/capita/year in Congo to about one thousand m^3/capita/year in Egypt as of the year 1995.

When correlating the map to Chart 11, it is easy to notice that the per-capita share of green cover follows the same pattern as the average annual precipitation (providing blue and green water). The Chart also shows that the per-capita share of green cover (dark blue chart bars) follows the same pattern as the per-capita share of renewable water resources (light blue chart bars), in the sense that the areas benefiting from higher renewable water resources also benefit from a higher per-capita share of green cover. This is closely related to the consideration of green water in the assessment, and the associated green cover of natural pasture, forests, and rain-fed agriculture. Chart 11 shows that although a downstream country such as Egypt, which depends totally on the blue water of the Nile "river", may be consuming a large portion of the river's "blue" water that historically has been reaching its boundaries naturally, the upstream countries normally consume larger portions of the river basin's "green" water. This analysis shows the importance of considering green water, other available national water resources and population in assessing equitable utilization of transboundary waters.

Analysis of Existing Transboundary Water Legislations

The need for an international law to govern the equitable sharing of transboundary water resources between countries emerged a long time ago. Efforts on the professional, non-governmental, and intergovernmental levels resulted in two important outcomes reflected by the 1966 Helsinki Rules and the 1997 United Nations (UN) Convention.

Article IV of the 1966 Helsinki Rules (ILA, 1967) states that the equitable utilization principle should govern the use of international drainage basin waters. States refer to these guidelines to the present day and some countries have recommended that elements of the Helsinki Rules be incorporated into the UN's framework convention on international watercourses that was later developed in 1997.

A legislative framework for an international water law should be elaborated to fairly support the above-mentioned technical and legal aspects of transboundary water management

In May of 1997, after more than a quarter of a century of working on the topic, the UN General Assembly adopted a framework convention on the law of the Non-Navigational Uses of International Watercourses. The UN Convention (United Nations, 1997a) was adopted by a recorded vote of 103 in favour, 3 against, and 27 abstentions.

Thirty-three countries were absent during the convention's adoption and some countries that favoured the convention do not have any international watercourses within their territories. Irrespective of being upstream or downstream, countries within the same transboundary river basin did not have the same standpoint regarding the convention. For example in the Nile river basin, Sudan and Kenya were in favour, Burundi was against, Egypt, Ethiopia, Rwanda and Tanzania abstained, while Eritrea, Uganda and Zaire were absent.

The 37-article convention, including its 14-article annex, represents substantial progress in the development of international water law. It addresses issues such as the non-navigational uses of international watercourses; measures to protect, preserve and manage international watercourses; and flood control, water quality, erosion, sedimentation, salt-water intrusion, and living resources within the watercourses. However, country responses to these issues vary in accordance with their location —upstream or downstream— on the watercourse. States adopt positions that favour their particular interests. Upstream states support rules that give them control of the waters that originate in their territory, in line with the doctrine of absolute territorial sovereignty. In contrast, downstream states appeal to the doctrines of prior appropriation (vested rights) and, in some cases, absolute

territorial integrity, and embrace an approach that would provide them with unaltered flow (in terms of quality and quantity) of the waters that enter their territories. On the other hand, countries with no trans-boundary watercourses may adopt an environmental protection position, extending the principle of no harm to biological organisms and wildlife that may be affected by the upstream water users, and the impact on water quantity and quality downstream. To date, the Convention has not entered into effect as it has not received full ratification by the required number of countries.

The Helsinki Rules and the UN Convention are both framework documents that provide useful guidelines for future agreements and policies on the utilization of transboundary waters

Similar to the 1966 Helsinki Rules, the 1997 UN Convention offers principles—such as *equitable and reasonable use* and *no significant harm*—to which states sharing an international watercourse are to conform when using international waters. However, controversial issues have resurfaced relating to the use of the terms "watercourse" versus "drainage basin", and international water versus trans-boundary and "shared" water, as well as the countries' rights versus their obligations, the factors to be considered in the assessment of equitable and reasonable use, the priority weight that may be given to the equitable use factors, and the level of harm that may be considered significant. Questions that remain unanswered include whether upstream countries are entitled to use all of the water that originates on their territories, whether prior developments of downstream countries are protected against subsequent uses of their upstream neighbours, how water-use conflicts can be resolved, and should human water needs be favoured over other water needs including ecosystems.

In the light of the above-mentioned upstream/downstream differences and realizing the reasonable justifications that lie behind these differences, Abu-Zeid, K., (2001) provides a comparison between the Helsinki Rules and the UN Convention.

The main difference between the 1966 Helsinki Rules and the 1997 UN Convention is that the Helsinki Rules pertain to water in an "international drainage basin" while the UN Convention pertains to water in an "international watercourse". While the definition of the two terms "drainage basin" and "watercourse", may appear to be very similar, they are quite different when it comes to the use of the waters in a drainage basin versus the use of the waters in a watercourse. One major difference is that the Helsinki Rules would consider the water that falls on the drainage basin and is used before flowing into a common terminus as beneficial water use for the State in place, whereas the UN Convention would not consider any water use outside the watercourse as part of the water budget to be equitably utilized. Examples of beneficial unaccounted-for water uses in international river basins include rain-fed agriculture and natural forests (Abu-Zeid, 1997). The consideration of this issue has a very significant impact on states sharing rivers that traverse extremely different climate environments.

Falkenmark (1999) stated that it is becoming more and more evident that what has to be shared between those upstream and those downstream in a river basin is not the water currently going into the river as the UN Convention on Non-navigational Uses of International Watercourses suggests, but rather the rainfall over the river basin. Sustainable water-dependent socio-economic development will simply not be possible without taking an integrated perspective on all water-dependent and water-impacting activities in a river basin and their relative upstream/downstream relations (Falkenmark, 1999). The relevant "factors" for the "reasonable and equitable utilization" of international watercourses as stated in the UN Convention (Article 5) may appear similar to those stated for the reasonable and equitable utilization of the waters of international drainage basins, in the Helsinki Rules (Article V, II). However, some of them are significantly different.

The UN Convention de-emphasized the drainage area's extent in basin states as a geographical factor. It also de-emphasized the contribution of water in each state as a hydrological factor.

Although the population factor is mentioned in the Helsinki Rules and the UN Convention, its application is different because the Helsinki Rules talk about the population dependent on the waters of the basin, which may be different from the population dependent on the watercourse as mentioned in the UN Convention.

The UN Convention de-emphasized, in the article on equitable utilization, the compensation factor and the prevention of substantial injury to co-basin States. It gen-

erally stated the factor as being the effect of the watercourse's use in one watercourse state on other watercourse states. However, the UN Convention included the "No Harm" obligation and possible discussion of compensation, as one of the factors to be considered in the overall assessment, and not under equitable utilization. This distinction is important since, under the Helsinki Rules, it is clear that a use which causes significant harm could be justified under the principle of equitable utilization. The same is not quite so evident in the approach adopted in the 1997 UN Watercourses Convention. Although States could argue that articles 5 to 7 of the UN Convention mean the same thing, in practice adopting equitable use, compared with no significant harm, as the governing rule can yield quite different results. The no significant harm rule acts as a veto on future development and tends to protect the status quo (i.e., the prior appropriations of the State first to develop) (Sherk et al, 1998).

The UN Convention eliminated "past utilization of waters of the basin" as a factor, and maintained "existing utilization of the watercourse" as a factor. The UN Convention also added "potential uses" to the "existing utilization" factor, which may have added ambiguity to the factor, as there is no common standard for assessing ever increasing future or potential water uses. The UN Convention may have limited the satisfaction of economic and social needs of each watercourse state to the watercourse water only, without considering other water resources within the watercourse States. This issue is even more amplified in the UN Convention by the fact that the "reasonable and equitable utilization" factor addressing the "availability of other water resources" either in the river basin or in the state as a whole, mentioned in the Helsinki Rules, was eliminated in the UN Convention.

Whereas the Helsinki Rules address the availability of other water resources, the UN Convention addresses the availability of other uses. One looks at alternatives on the supply side while the other considers alternatives on the demand side. The UN Convention, by eliminating the possibility of looking at "other available water resources" within the basin and the state as a potential relief to water conflicts over limited water resources, may be seen as defeating the objective of its development. This relates back to the scope of the convention, which does not consider the waters of the basin but rather the waters in the watercourse, in which case direct beneficial use of rainfall (green water) may not be considered in the water budget assessment of the watercourse states.

Conclusions and Recommendations

In transboundary water management it is important to look beyond the watercourse and towards the river basin to capture the benefits of other available water resources beyond the water in the river. Green water provided by direct use of rainfall and atmospheric water should be an integral element in the assessment of potential renewable water resources. Enhancement of rain-fed agriculture, groundwater use, and use of non-conventional water resources such as re-use of wastewater are essential elements to consider for providing food security and conflict resolution on transboundary water basins.

Reasonable and equitable utilization of transboundary basin waters should consider factors such as available water resources at the basin level and at the national level, and the number of population depending on the transboundary water resource in each country. The obligation of no harm to riparian states on transboundary waters should be emphasized, and prior, historical, or existing uses on transboundary waters should be protected and maintained.

In transboundary water management it is important to look beyond the watercourse and towards the river basin to capture the benefits of other available water resources beyond the water in the river

A legislative framework for an international water law should be elaborated to fairly support the above-mentioned technical and legal aspects of transboundary water management. It should reflect proper water resources assessment and consideration of consumptive and non-consumptive uses and benefits of water at the national level within the riparian states sharing a transboundary water basin.

The Helsinki Rules and the UN Convention are both framework documents that provide useful guidelines for future agreements and policies on the utilization of transboundary waters. However, the scientific community in the engineering and legislative fields need to contribute more to the enhancement and elaboration of a comprehensive, reasonable and scientific international water law.

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