WWF

ANALYSIS

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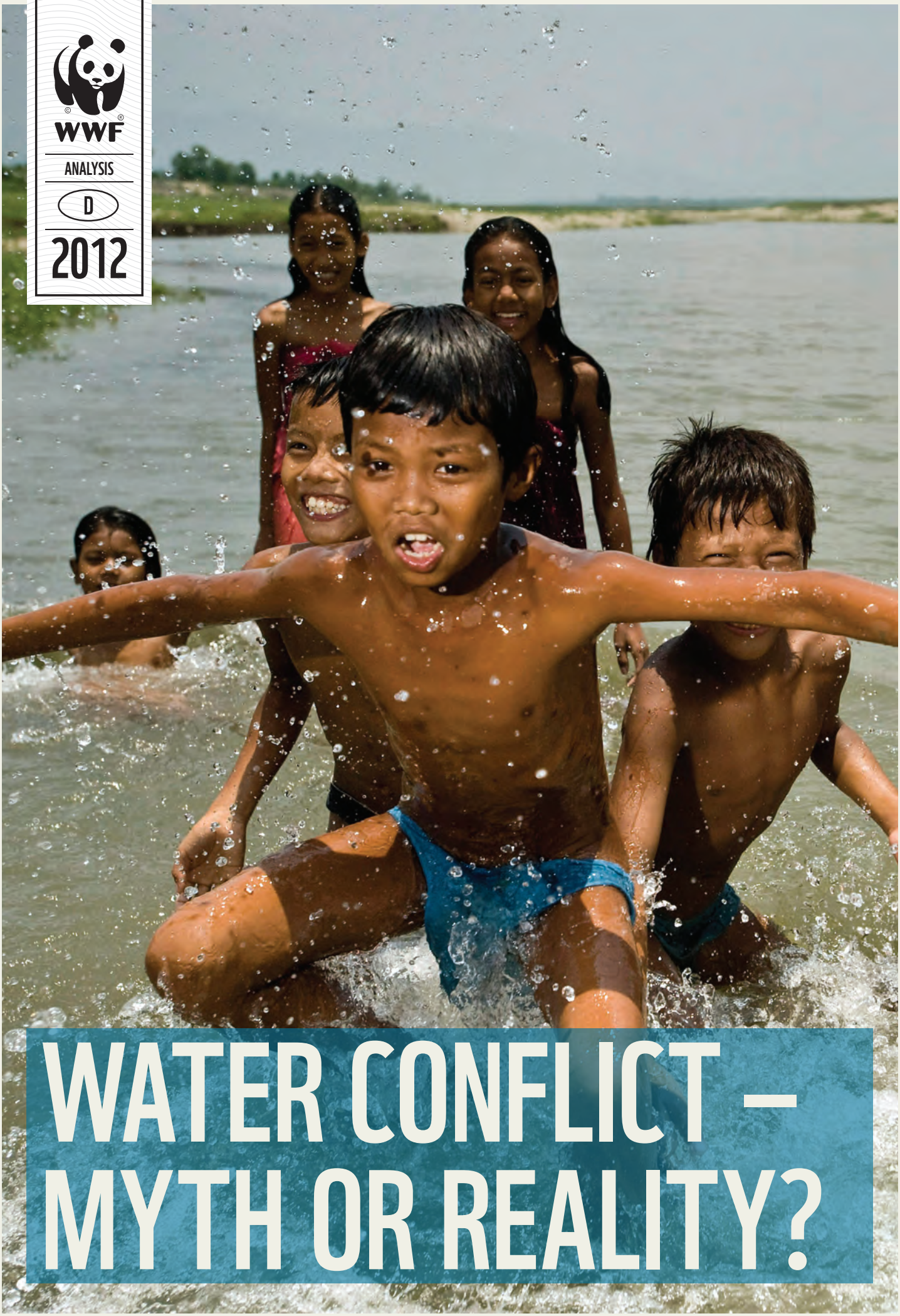

WATER CONFLICT – MYTH OR REALITY?

Executive Summary

While seemingly abundant, only 0.3% of the world's water is readily available as a freshwater resource and 60% of this is found in nine of the world's 196 countries. As the global population continues to grow, demand from agriculture, industry, and household use is placing unsustainable stress on freshwater systems. Climate change only exacerbates this further, making water availability more unpredictable and causing more frequent, widespread droughts and floods.

Is it inevitable that the future will be marred by global, regional / transboundary, national, and/or sub-national/-basin and local conflicts over increasingly scarcer water resources? Not necessarily. While there have been instances of conflict arising at the various geographical scales over a shared water source, history reveals that cooperation is the predominant response. Securing water resources that can meet growing human needs, safeguard fragile ecosystems, and maintain economic prosperity is a key issue confronting the global community. To ensure that water resources are equitably distributed and conflict is avoided, some examples of approaches that can be employed at the different levels are:

GLOBAL – *International Law / Treaty / Convention*. International treaties are the most important and prevalent source of international legal rights and obligations; they are the primary instruments of cooperation. The UN Convention on the Law of Non-navigational Uses of International Watercourses represents the key agreement on the management of transboundary rivers; however, the Ramsar Convention, UN Convention on Biological Diversity (CBD), and the UN Convention to Combat Desertification (UNCCD) all include freshwater issues within their mandate, thereby providing additional tools at the global scale to avoid conflict. Additionally, the Millennium Development Goals (MDGs) include a target on access to safe drinking water and basic sanitation, and the UN Human Rights Council affirmed the right to water and sanitation as legally binding.

REGIONAL / TRANSBOUNDARY – *Multi-/ Bi-lateral (transboundary) Agreements & Transboundary Committees.* Freshwater resources do not adhere to geo-political boundaries, thus transboundary agreements, committees like the UN Economic Commission for Europe (UNECE), Southern African Development Cooperation (SADC), bi-lateral agreements or River Commissions like on the Mekong (MRC), and regional instruments, like the EU Water Framework Directive, are key.

NATIONAL – *Water Allocation Plans.* When demand exceeds supply, economic development is limited by water availability, and ecosystem integrity is declining due to over allocation or abstraction, water allocation plans offer an integrated solution by incorporating economic, social, and environmental demands. Though each water allocation plan is dependent on the local context, history, natural conditions, economy, and institutions, a set of "10 Golden rules" for water allocation has emerged (WWF, 2012). In many countries, there are also water use or management plans.

SUB-NATIONAL / -BASIN & LOCAL – *Water Resource Users Association*. Ultimately, conflicts are most likely to occur at the sub-national/-basin and local level – thus by empowering communities and water users in managing freshwater resources, water security trickles from the bottom-up and conflicts are avoided.

These various approaches are highlighted through WWF case studies focusing on avoided conflict through water resource management at different geographical scales. Both WWF Spain and the WWF Mediterranean Programme are engaged in supporting transboundary management that demonstrates while regional dialogs are time- and resource-consuming, they are essential if consensus is to be built and water management solutions identified. At the national level, WWF Mexico developed a water reserve program in collaboration with the national water authority. By including the maintenance and restoration of environmental flows, the prioritization and conservation of critical water resources was catalyzed, which ultimately reduced the risk of conflicts. WWF Kenya engaged with local Water Resource Users Associations in the Lake Naivasha basin once stakeholders realized the shared responsibility in conserving resources following a catastrophic drought. A favorable political and legal environment for local governance further facilitated this process.

In the future, a challenge in avoiding conflict will be ensuring that whatever global conventions, transboundary agreements, and functioning river commissions are in force, are respected in regards to procedures of notification and negotiation. Thus far, only few developing countries and emerging economies have established regulations on the maintenance of environmental flows or modern water allocation approaches in their constitution and water laws (like Australia, Mexico, Spain, and South Africa). However, in practical water management terms, unless different sectors change their procedures and planning frameworks accordingly to reflect the needs and requirements from other sectors, nothing will change. Sub-national / -basin and local level actors are both impacted by national or provincial level planning as well as triggering water conflict situations themselves through illegal abstraction, pollution, and regulating water courses or lakes. In countries where both laws and institutional structures are robust, they can provide the ingredients to come up with solutions like local water allocation plans or environmental flows arrangements. It is important to note that groundwater, which is a resource widely and extensively used and very often over-abstracted, will probably continue to lack proper management planning and resource use allocation.

Key to conflict prevention and resolution at all levels is a sound, comprehensive, and participatory river or lake basin planning at the basin, sub-basin, and local level that involves all relevant stakeholders. Pre-condition to any planning exercise is a comprehensive assessment of the water resources available over time, their status and trends, and data gathering / analysis / interpretation that includes an understanding of current water use and development in the future. Another precondition is an appropriate and modern legislative water framework at all relevant levels. Institutional capacity at the local, river basin, and national level is then essential for both carrying out the necessary assessment, steering the planning process, and guiding and controlling implementation. Though this might all sound quite obvious, together these different elements form the basis to manage water resources and services wisely and equitably and to develop and agree upon water allocation plans for the various users in the respective basins.

While some suggest that water conflicts are our guaranteed destiny as freshwater resources become more stressed and scarcer, history repeatedly demonstrates that cooperation is reality. Water conflicts cannot be avoided *if* the demand is not addressed while supply continues to diminish; however, through proactive and targeted global, regional / transboundary, national, and sub-national/-basin and local approaches towards managing freshwater resources, water conflicts should remain a myth.

With the primary aim to prevent or resolve conflicts, key recommendations and proposed actions for each of the relevant actors are provided below.

MULTI-LATERAL ORGANIZATIONS:

- Multilateral organization, in particular the Secretariats of the water related conventions, should continue to closely follow-up with signatories concerning the proper implementation of the environmental conventions, highlighting any deviations or weaknesses. Appropriate sanctioning mechanisms need to be explored and implemented. In the absence of a specific watercourses related global convention in force, they should promote, as far as possible, adherence to the principle of notification on infrastructure, flow, or regulation development for neighboring countries.

- UN Water, as the umbrella of all UN organizations concerning water, should intensify its promotion of the UN Watercourses Convention's ratification.

- The European Commission should, similar to the Espoo Convention, provide for a block ratification of the UN Watercourses Convention.

GOVERNMENTAL INSTITUTIONS AND PARLIAMENTS:

- Countries and respective administrations that have signed on to multilateral environmental conventions like Ramsar, Espoo, CBD, or have entered into regional agreements with other basin countries in transboundary river basins, or are responsible for implementing the WFD, should honor their commitments with regard to these conventions or legal frameworks, implement them, and periodically report on their implementation. In the spirit of existing customary law, countries and respective administrations should respect and honor equitable and reasonable utilization, protection of ecosystems, notification and consultation on planned measures, exchange of data and information, third party fact-finding and other dispute settlement mechanisms.

- Countries that are planning to establish infrastructure or installations in a transboundary river basin or aquifer which potentially impact neighbor states should inform them on these plans and their expected impacts well in advance so as to allow them to voice their views and opinions. This should include a Strategic Environmental Assessment (SEA) to allow neighboring countries to see how alternative options have been explored and valued.

- Mega-cities and in general large-scale cities[1] should assess potential risk and conflict areas related to water supply and sanitation. The impact of virtual water flows between cities and surrounding rural areas should be further highlighted and risks identified. Ideally, water allocation plans and conflict risk mitigation strategies should be developed and implemented between the peri-urban and urban areas to avoid conflicts. Water must be an integral element in any future city planning, thus avoiding conflicts between sectors and providing the basis for cost-effective synergies.

- Countries that have not yet signed the UN Watercourses Convention should ratify the Convention as soon as possible, in particular those within transboundary basins or aquifers (e.g. European member and candidate states like Austria, Italy, Croatia, Turkey, Serbia; Parana River countries like Brazil, Argentina, Paraguay; or Nile River countries like Egypt, Sudan). Until the Convention enters into force, countries should also sign the Espoo Convention, which governs major infrastructure development in a transboundary context beyond watercourses.

- As required by national laws, Strategic Environmental Assessments (SEA) and Environmental Impact Assessments (EIAs) should be conducted wherever appropriate not only as a management and planning tool, but also to highlight potential conflict and risk areas, develop mitigation measures or alternatives, and come up with planning and implementation options.

[1] Due to their sheer population size, some mega-cities and large-scale cities can be considered ‚a nation in a nation' (e.g. Australia's population = 22,852,798 on March 7, 2012 vs Shanghai's metropolitan population = 23,019,148 (2010 Census))

- Countries should continue to invest in access to safe drinking water and sanitation, build up the necessary institutional capacity, and establish and strengthen water management systems and utilities ensuring that the rural and urban poor are favored.

PRIVATE SECTOR:

- The private sector, at multi-national, national, and local levels should lobby and engage respective governments to promote proper water resource governance and management, to provide them (the private sector) with a stable and forward looking legal framework, to assess water risks related to business development, and to facilitate the application of water risk mitigations solutions.

- Businesses in various sectors can reduce their risk of exposure to water conflict by integrating sustainable water management into their business association meetings and gatherings and developing sector guidelines together with the governments that aim at reducing potential risks and conflicts arising from water use.

- Businesses should assess water risks, potential conflicts with other users, and future trends, and develop environmental management plans with solutions and risk mitigation options.

LOCAL USERS, LOCAL GOVERNMENTS, AND MUNICIPALITIES:

- Local people should organize themselves into water users associations. If a law does not yet provide for this opportunity, local users should lobby local and national parliaments that such a stipulation is developed and integrated in improved water acts and regulations.

- Employees of factories and businesses should promote the development of water strategies within their firms as this is the basis for sustainable business and job security.

- Wherever regional or national level water management or infrastructure planning is taking place that might negatively impact local interests and delivery of ecosystem services, local people should try to raise their voices and communicate their concerns to relevant government bodies and “their” parliamentarians.

- Municipalities are equally responsible in ensuring that various interest groups are brought together in terms of wise, responsible, and efficient water use. Additionally, they are primarily responsible in ensuring access to safe water is secured through their water utilities, particularly for the urban and rural poor (so-called *bottom billion*), by applying tariff systems which are cost-recovering and continue to secure access for the poor. Innovative concepts, like the program Water and Sanitation for the Urban Poor (WSUP)[2], should be further promoted, in particular with regards to sanitation.

[2] http://www.wsup.com/

INTRODUCTION

BACKGROUND

Readily available freshwater is confined to a mere fraction of the world's 2.5% freshwater supply; additionally, this unevenly distributed global resource is facing intense pressure though over-extraction and unsustainable practices. Water conflicts can arise through inequitable sharing and has been witnessed at various geographical scales – local & sub-basin/-national, national, regional / transboundary, and global. The characteristics that make water likely to be a source of strategic rivalry are: (1) the degree of scarcity, (2) the extent to which the water supply is shared by more than one region or state, (3) the relative power of the basin states, and (4) the ease of access to alternative fresh water sources (Gleick, 1993). However, history has demonstrated that cooperation is the predominant response towards resolving and/or avoiding water conflicts.

This report is intended to provide a background on freshwater conflicts –> do they really exist and/or will they become reality as the world's growing population of 7 billion people places increasing demands on this stressed resource? The availability and consumption of freshwater resources is reviewed before exploring the types and sources of water conflict. Challenges, solutions, and WWF case studies are presented at the global, regional/transboundary, national, and local scale, before concluding with possible future scenarios and recommendations to avoid freshwater conflicts.

FRESHWATER AVAILABILITY, DISTRIBUTION, & CLIMATE IMPACTS

While it may seem that the earth has an abundance of water, only 2.5% is freshwater, and a mere 0.3% of that is readily available for human use (the majority stemming from groundwater aquifers, followed by lakes, reservoirs, rivers, and wetlands) (Vörösmarty et al., 2005). On top of that, water is unequally distributed throughout the world – nine countries – Brazil, Russia, China, Canada, Indonesia, U.S., India, Columbia and the Democratic Republic of Congo – possess 60% of the world's available freshwater supply (WCSBD, 2005).

Rain and snowfall constantly renew freshwater ecosystems, which in turn provide society with provisioning (i.e. food, water), regulating (i.e. regulation of floods, drought, land degradation, and disease), supporting (i.e. soil formation, nutrient cycling), and cultural (i.e. recreational, spiritual, religious, and other nonmaterial benefits) services when sustainably used (Vörösmarty et al., 2005; TEEB, 2010). The precipitation absorbed by ecosystems is either processed and transferred back to the atmosphere as "green water" (through evapotranspiration drawn from soils and plant canopies in natural ecosystems and rain-fed agriculture) or runs off as "blue water," which is what is available to downstream users—both aquatic ecosystems and humans (see Table 1 for an overview of available water distribution by ecosystem and region).

The implication of climate change is that all elements of the water cycle, including precipitation, evapo-transpiration, soil moisture, groundwater recharge, and runoff may be modified. Additionally, it may change the timing and intensity of precipitation, snowmelt, and runoff (Vörösmarty et al., 2005). It has already been observed that mountains are experiencing shortened and earlier snow and ice melt, leading to related changes in flooding (UN WWAP, 2009). The IPCC estimates that by 2050 annual average runoff will have increased by 10%-40% at high latitudes and decreased by 10%-40% over some dry regions at mid-latitudes and semi- arid low latitudes (Bates et al., 2008). Globally, the number of great inland flood catastrophes was twice as large per decade between 1996 and 2005 as between 1950 and 1980, and economic losses were five times as great. The dominant drivers of these upward trends are socioeconomic factors, such as population growth, land use change, and greater use of vulnerable areas[3] (UN WWAP, 2009).

[3] i.e. increased construction in floodplain areas.

System[1] or Region	Area (million km²)	Total precipitation	Total Renewable Water Supply, Blue Water Flows (thousand km³/yr) [% global runoff]	Renewable Water Supply, Blue Water Flows, Accessible to Humans[2] [% of Total Renewable Water Supply]	Population Served by Renewable Resource[3] (billion) [% of world population]
Forests	41.6	49.7	22.4 [57]	16.0 [71]	4.62 [76]
Mountains	32.9	25.0	11.0 [28]	8.6 [78]	3.95 [65]
Drylands	61.6	24.7	3.2 [8]	2.8 [88]	1.9 [31]
Cultivated[4]	22.1	20.9	6.3 [16]	6.1 [97]	4.83 [80]
Islands	8.6	12.2	5.9 [15]	5.2 [87]	0.79 [13]
Coastal	7.4	8.4	3.3 [8]	3.0 [91]	1.53 [25]
Inland Water	9.7	8.5	3.8 [10]	2.7 [71]	3.98 [66]
Polar	9.3	3.6	1.8 [5]	0.3 [17]	0.01 [0.20
Urban	0.3	0.22	0.062 [0.2]	0.062 [100]	4.3 [71]
Asia	20.9	21.6	9.8 [25]	9.3 [95]	2.56 [42]
Former Soviet Union	21.9	9.2	4.0 [10]	1.8 [45]	0.27 [4]
Latin America	20.7	30.6	13.2 [33]	8.7 [66]	0.43 [7]
North Africa / Middle East	11.8	1.8	0.25 [1]	0.24 [96]	0.22 [4]
Sub-Saharan Africa	24.3	19.9	4.4 [11]	4.1 [93]	0.57 [9]
OECD	33.8	22.4	8.1 [20]	5.6 [69]	0.87 [14]
World Total	133	106	39.6 [100]	29.7 [75]	4.92 [81]

[1] Note double-counting for ecosystems under the MA definitions.
[2]Potentially available supply without downstream loss.
[3] Population from Vorosmarty et al. 2000.
[4] For cultivated systems, estimates are based on cropland extent from Ramankutty and Foley 1999 within this MA reporting system.

Table 1. Estimates of Renewable Water Supply, Access to Renewable Supplies, and Population Served (taken from Vörösmarty et al., 2005)

CONSUMPTION & WATER FOOTPRINT

Water use has been growing at more than the rate twice of population increase in the last century; in 60% of European cities with more than 100,000 people, groundwater is being used at a faster rate than it can be replenished (WBCSD, 2005).

The IPCC identifies the most important drivers of water use as population and economic development, and changing societal views on the value of water, which refers to the prioritization of domestic and industrial water supply over irrigation water supply and the efficient use of water, including the extended application of water-saving technologies and water pricing (Bates et al., 2008). Vörösmarty et al. (2005) estimated that 5 - 25% of global freshwater use exceeds long-term accessible supply.

By calculating the water footprint (WF), which measures the total volume of water used to produce goods and services that we consume and accounts for the volume of rainwater (green WF) and ground and surface water (blue WF) consumed in the production of agricultural goods from crops and livestock – the major uses of water – as well as the volume of water polluted (grey WF) by agriculture and from household and industrial water use, a better understanding emerges of water use patterns. As Hoekstra et al. (2011) explain, the "water footprint is a geographically explicit indicator, showing not only volumes of water consumption and pollution, but also the locations."

The countries with the largest total water footprints are China, India, and the United States – 38% of the global production water footprint stems from these three countries; India and China are simultaneously experiencing moderate to severe water stress (Hoekstra & Mekonnen, 2011).
The global water footprint is comprised of 92% agriculture, 4.4% industrial production, and 3.6% domestic water supply; additionally, 20% of the global water footprint is related to production for

export (Hoekstra & Mekonnen, 2011; Mekonnen & Hoekstra, 2011). Though different for each country, the water footprint related to agricultural production dominates the greatest share of nations' total water footprint.

WATER SCARCITY / WATER STRESS

The concept of *water stress* applies to situations where there is not enough water for all uses, whether agricultural, industrial, or domestic; it is related to over- allocation of water, degradation of water quality and uneven utilization between riparians (Pegasys, 2010). In terms of resource management, this should not be confused with *basin complexity*, which is "related to the number of riparian countries, the lack and/or unevenness of national institutional capacity (development), the presence of uncooperative riparians, and political tensions between riparians (Pegasys, 2010).

As global exploitation and demands on freshwater resources increase, biodiversity and the services that rivers provide are being degraded and becoming ever more scarce. In fact, *water scarcity* is one of the key challenges facing the world in the 21st century. The latest research reveals that at least 2.7 billion people live in basins that experience severe water scarcity during at least one month of the year (Hoekstra et al., 2012). With an increase in the world's population by about 80 million people a year, the resulting freshwater demand increases by about 64 billion m^3/year (UN WWAP, 2009). By 2025, 1.800 million people will be living in countries or regions with absolute water scarcity, and two-thirds of the world population could be under stress conditions (FAO).

As depicted in Figure 1, the per capita annual renewable freshwater will decrease considerably in many African, Middle East, and Asian countries by 2050; additionally, the percentage of the annual per capita freshwater remaining for aquatic ecosystems after accounting for human demands will diminish significantly in these areas.

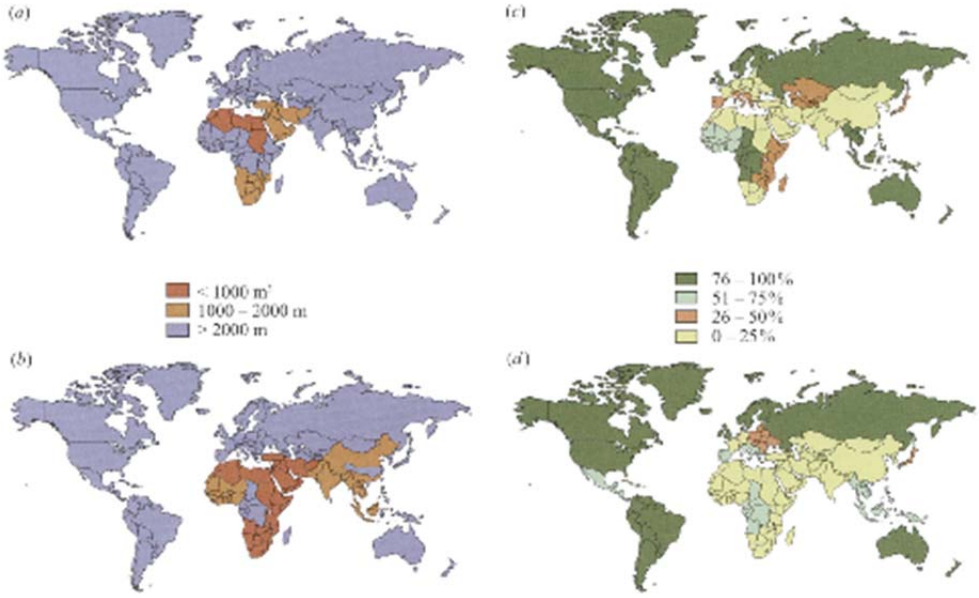

Figure 1. Per capita annual renewable freshwater in a) 2003 and b) in 2050; & percentage of this left for aquatic ecosystems after meeting all human needs in c) 2003 and d) 2050 (from Wallace et al., 2003)

The discrepancy between freshwater availability and demand has resulted in water stress and scarcity, which can eventually lead to conflict.

DEFINITION OF CONFLICTS

As outlined by Phelps (2007), water conflicts are "really an issue of allocation and equitable sharing more than anything else. Virtually all societies, cultural groups, populations, etc., are willing to abide with a larger or smaller share of the water available as long as it is an equitable sharing of the resource. Drought alone does not start conflicts. It is the lack of equitable allocation during droughts that creates conflict."

Water plays different roles in conflict – either as the "object" (i.e. states quarrel over scarce resources, water pollution), "instrument" (i.e. states are in conflict over another issue and an the upstream state threatens to divert an international river as a way to harm or exert pressure on the downstream state), or "catalyst" (e.g. water shortages create political instability in turn increasing international instability) (Mostert, 2003). Transboundary water disputes occur whenever demand for water is shared by any sets of interests (i.e. political, economic, environmental, or legal) (Wolf, 2003).

The degree of seriousness ranges from *competition* to *tension* to *conflict* to *dispute* and finally *armed conflict* (Cosgrove, 2003). The level and scale of water conflicts can also vary greatly – disputes at the village level, within national political sub-divisions, border disputes between two nations, or tension involving many nations that do not necessarily share borders. Furthermore, these conflicts may be political or economic; they may be diplomatic or violent (Gleick, 1993).

MYTHS AND REALITY OF WATER CONFLICTS

Where water is scarce, competition for limited supplies can lead nations to see access to water as a matter of national security (Gleick, 1993). Competition over the finite resource has led to conflict as evidenced by decades-long tensions between India and Pakistan (Indus River), Egypt and Sudan (Nile River), or Turkey and Syria (Euphrates River). Furthermore, water conflicts are common at the inter-sector, inter-community, inter-farm, inter- (and intra-) household level (Orr et al., 2009).

However, the myth that these tensions eventually erupt into "water wars" has been proven incorrect – "countries do not go to war over water, they solve their water shortages through trade and international agreements" (Barnaby, 2009). From 1948 – 1999, 1,831 "international interactions" regarding international freshwater resources were recorded– 67% were cooperative, 28% were conflictive, and the remaining 5% were neutral or insignificant (see Figure 3; Wolf et al., 2003).

For over 4,000 years, nations have observed fundamental ground rules governing water use. The history of international water treaties dates as far back as 2500 BC when the two Sumerian city-states of Lagash and Umma drafted an agreement ending a water dispute along the Tigris River - often said to be the first treaty of any kind[4]. In 1790 BC, the Code of Hammurabi, which is considered the first document on basic rules governing the use of water in agriculture, was written for the country of Sumer. Many of the Code of Hammurabi's tenets have been integrated into current legal institutions around the world (Phelps, 2007). According to the Food and Agriculture Organization (FAO), more than 3,600 treaties related to international water resources have been drawn up since 805 AD. While the majority deal with navigation and boundary demarcation, the focus has shifted in the last century towards the use, development, protection and conservation of water resources[5] (see Figure 2).

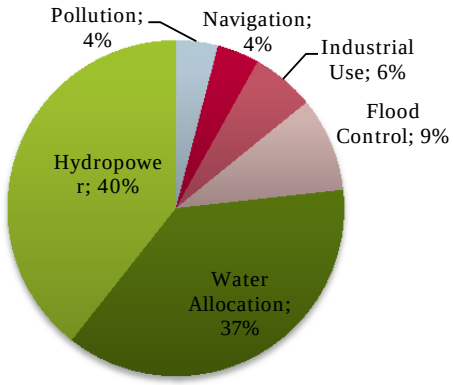

Figure 2. Primary Focus of Transboundary Water Agreements Adopted during the 20th Century (from *Cooley et al., 2009*)

[4] Water Conflict Chronology available at http://www.worldwater.org/conflict/list/

[5] http://www.un.org/waterforlifedecade/transboundary_waters.shtml

SOURCES OF CONFLICT

While resource and environmental factors are playing an increasing role in water conflicts, it is difficult to disentangle the many intertwined causes of conflict (Gleick, 1993). The characteristics that make water likely to be a source of strategic rivalry are: (1) the degree of scarcity, (2) the extent to which the water supply is shared by more than one region or state, (3) the relative power of the basin states, and (4) the ease of access to alternative fresh water sources (Gleick, 1993). As Orr et al. pointed out "the outcome of local conflicts tends to reflect societal problems. Those who are marginalized in society tend to lose most in water conflicts, for example the rural poor in Chile and Mozambique, and the urban poor in Mexico and South Africa" (2009).

Some sources of water conflict are:

- **Excessive withdrawal from surface waters / underground aquifers:** Due to rapid population growth, water withdrawals have tripled over the last 50 years, which is largely explained by the rapid increase in irrigation development stimulated by food demand in the 1970s and by the continued growth of agriculture-based economies (UN WWAP, 2009).
- **Pollution of freshwater resources (downstream / up-stream):** Pollution and water quality degradation are key issues affecting water use globally. More than 80% of sewage in developing countries is discharged untreated, polluting rivers, lakes and coastal areas; more than 5 billion people – 67% of the world population – may still not be connected to public sewerage systems in 2030 (UN WWAP, 2009). Moreover, due to inadequate water, sanitation, and hygiene, 1.7 million deaths and the loss of at least 50 million healthy life years occur annually (Vörösmarty et al., 2005).
- **Inefficient Use:** Poor irrigation practices, leakage in water delivery systems, inefficient use by industry and excessive consumption by individuals can all contribute to water stress (WBCSD, 2005).
- **Inequitable distribution:** 85% of the world's population resides in the drier half of the Earth; more than 1 billion people living in arid and semi-arid parts of the world have access to little or no renewable water resources (UN WWAP, 2009). An estimated 90% of the 3 billion people who are expected to be added to the population by 2050 will be in developing countries, many in regions where the current population does not have sustainable access to safe drinking water and adequate sanitation (UN WWAP, 2009). While regional disparities might lead to potential conflict due to migration patterns in the longer run, a more relevant key factor is the inequitable distribution amongst the rural/urban and rich/poor paradigm.
- **Lack of control, law enforcement and sanctions applied:** Despite the existence of various regional and international legal mechanisms on water-related issues, they have not received the support or attention necessary to resolve many of the water conflicts (Gleick, 1993). Many transboundary freshwater resources are being significantly degraded through poor and uncoordinated management (UN Water, 2008).
- **Water development (hydropower plant construction, infrastructure, irrigation) and downstream effects:** Water development schemes (irrigation facility, hydroelectric developments, flood-control reservoirs) often displace large local populations, have adverse impacts on downstream water users and ecosystems, change control of local resources, and result in economic dislocation (Gleick, 1993).

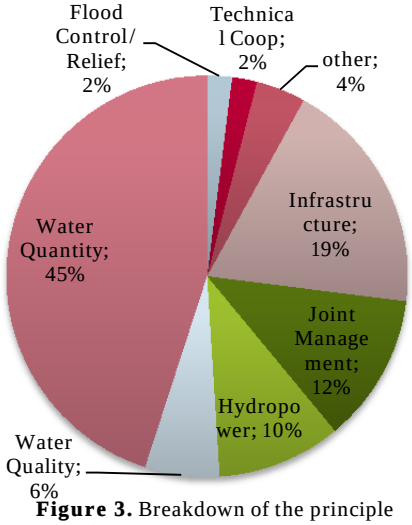

Figure 3. Breakdown of the principle issue for 1,831 "international interactions" regarding international freshwater resources between 1948-1999 (Wolf et al., 2003).

In the following section, freshwater resource management is broken down at various geographical scales: global, regional/transboundary, national, and sub-national/ -basin & local. Problems / challenges/ limitations, solutions, and a case study on conflict resolution approaches are presented at each level.

GLOBAL FRESHWATER RESOURCE MANAGEMENT

GLOBAL PROBLEMS, CHALLENGES, LIMITATIONS

In 2000, 189 nations made a pledge, otherwise known as the Millennium Development Goals (MDG), „to free people from extreme poverty and multiple deprivations," by 2015[6]. One Target within the MDGs is to „ reduce by half the proportion of people without **sustainable access to safe drinking water and basic sanitation**."[7] In 2010, the UN Human Rights Council affirmed by consensus that the **right to water** and sanitation is derived from the right to an adequate standard of living, which is contained in several international human rights treaties, and thus makes it legally binding[8]. Even though the human right to water and the MDG target are not fully synonymous, for simplicity reasons in this report, we assume that by achieving the MDGs, a majority of human rights can be resolved.

Currently there is only one convention that codifies international law of water resources (UN Convention on the Law of the Non-Navigational Uses of International Watercourses, or the UN Watercourse Convention) and the effort in even achieving this was substantial. Almost 30 years after discussions began, it was still uncertain whether or not states could find agreement and adopt a universal convention until the very last deliberations – "seemingly irreconcilable views on the nature and extent of a state's right to use transboundary water resources that had divided upstream and downstream countries in the past resurfaced during the debate" (Cosgrove, 2003).

International treaties are the most important and prevalent source of international legal rights and obligations; they are the primary instruments of cooperation in the field of water resource utilization as well as the most important source of international water law (Cosgrove, 2003). Though there are more than 3,600 international agreements (bilateral and multilateral) that deal with water-related issues, they lack workable monitoring provisions, enforcement mechanisms, and specific water allocation provisions that address variations in water flow and changing needs.

UN Water points out that by consensus among experts, "international watercourse agreements need to be more concrete, setting out measures to enforce treaties made and incorporating detailed conflict resolution mechanisms in case disputes erupt. Better cooperation also entails identifying clear yet flexible water allocations and water quality standards, taking into account hydrological events, changing basin dynamics and societal values."[9]

GLOBAL SOLUTIONS

At the global scale, the overarching, global legal framework provided by the **UN Convention on the Non-Navigational Uses of International Watercourses** establishes basic standards and rules for cooperation between watercourse states on the use, management, and protection of international watercourses (Loures et al., 2009). Unfortunately, this Treaty has not yet come into force due to insufficient signatories (as of January 2012, Status: Signatories=16; Parties=24; 35 Contracting States required for Convention to come into force); however, once in force, countries must themselves define what exactly these terms imply in their own watersheds they share with others.

[6] http://www.undp.org/content/undp/en/home/mdgoverview.html
[7] http://www.undp.org/content/undp/en/home/mdgoverview/mdg_goals/mdg7.html
[8] http://www.ohchr.org/en/NewsEvents/Pages/DisplayNews.aspx?NewsID=10403&LangID=E
[9] http://www.un.org/waterforlifedecade/transboundary_waters.shtml, accessed January 2012.

Though they do not exclusively focus on water issues, the following global agreements provide an important support framework for cooperation:

- **Ramsar Convention.** The Convention on Wetlands, signed in Ramsar, Iran is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.[10] The Ramsar Convention requires cooperation between Parties on matters of mutual interest and highlights the urgent need to improve the allocation and management of water within transboundary inland water systems; it has adopted important guiding tools dealing specifically with interstate cooperation for managing transboundary wetlands (Brels et al., 2008).

- **UN Convention on Biological Diversity (UN CBD**) is a comprehensive, binding agreement covering the use and conservation of biodiversity.[11] Under the CBD, the program of work on Inland Water Ecosystems includes numerous goals and activities that refer to water allocation and management, directly or indirectly, in addition to addressing transboundary waters. Though the CBD promotes international cooperation as a crucial prerequisite for Parties to achieve their goals, it lacks specific rules and principles governing cooperation between watercourse States and promoting the equitable and reasonable use and management of international watercourses (Brels et al., 2008).

- **UN Convention to Combat Desertification (UNCCD)** requires states to promote the restoration, conservation, and sustainable management of land and water, and to cooperate with each other for the protection of those resources. The UNCCD also requires neighboring countries to work together in developing action programs, which may include the joint sustainable management of transboundary water resources (Loures et al., 2009).

In the analysis *International Architecture for Transboundary Water Management,* three broad lessons for treaty effectiveness were identified (i) process legitimacy in bringing a treaty into force; (ii) institutional arrangements and responsibilities for the treaty implementation are fundamental to its ongoing effectiveness and adaptability (flexibility); and (iii) mechanisms for monitoring and even enforcement need to be in place to facilitate the dialogue around compliance (Pegasys, 2010).

There are also global institutions and groups that specifically focus on freshwater resources:

- **UN-Water** is the United Nations inter-agency mechanism for all UN agencies, departments, and programs involved in water-related issues. It is responsible for follow-up to the water-related decisions reached at the 2002 World Summit on Sustainable Development and the Millennium Development Goals (MDGs). It supports Member States in their efforts to achieve water- and sanitation-related goals and targets. UN-Water acts at the global, national and regional levels, creating added value to the work and expertise of separate United Nations agencies and programs (UN Water, 2008).

- **Global Water Partnership (GWP)**: Founded in 1996 by the World Bank, United Nations Development Programme (UNDP), and Swedish International Development Cooperation Agency (SIDA), the GWP fosters integrated water resource management (IWRM). Developed and developing country government institutions, agencies of the United Nations, bi- and multi-lateral development banks, professional associations, research institutions, non-governmental organizations, and the private sector involved in water resources management are all welcome to join.[12]

- **UN Food and Agricultural Organization (FAO)**: The FAO has a fundamental enabling mandate through its Development Law Service: it helps member countries sharing a transboundary river, lake, or aquifer to establish a legal and institutional environment conducive to be stable and mutually beneficial.

[10] http://wwf.panda.org/what_we_do/how_we_work/policy/conventions/ramsar/
[11] http://wwf.panda.org/what_we_do/how_we_work/policy/conventions/cbd/
[12] http://www.gwp.org/en/About-GWP/

REGIONAL / TRANSBOUNDARY FRESHWATER RESOURCE MANAGEMENT

REGIONAL / TRANSBOUNDARY PROBLEMS, CHALLENGES, LIMITATIONS

There are 263 transboundary lake and river basins worldwide that cover nearly half of the Earth's land surface, 145 nations, and account for an estimated 60% of global freshwater flow (see Table 2; Cooley et al., 2009). Though the majority of transboundary freshwater river basins cross just two nations, there are 21 river basins that are shared by five or more countries (see Table 2). The majority (about 70%) of transboundary basins are located between developing and emerging economies, often with extremely variable intra- and inter-year hydrology, which is compounded by constraints on water-related institutional capacity and infrastructure resources (particularly given the requirements of other social and developmental priorities) at a national level (Pegasys, 2010).

	Number of Transboundary River Basins	% of Area in International Basins	>5 nations Transboundary Freshwater Rivers & Aquifers (no. of nations)	Area of >5 nations Transboundary Freshwater Rivers & Aquifers (km²)
Africa	**59**	**62**	Congo/Zaire (13)	3,691,000
			Niger (11)	2,113,200
			Nile (11)	3,031,700
			Zambezi (9)	1,385,300
			Lake Chad (8)	2,388,700
			Volta (6)	412,800
Asia	**57**	**40**	Aral Sea (8)	1,231,400
			Jordan (7)	42,800
			Ganges-Brahmaputra-Meghna (6)	1,634,900
			Kura-Araks (6)	193,200
			Mekong (6)	787,800
			Tigris-Euphrates/ Shatt al Arab (6)	789,000
			Tarim (5/6)	1,051,600
			Indus (5)	1,138,800
Europe	**69**	**55**	Danube (18)	790,100
			Rhine (9)	172,900
			Neman (5)	90,300
			Struma (5)	15,000
			Vistula/Wista (5)	194,000
North & Central America	**40**	**37**	--	--
South America	**38**	**59**	Amazon (9)	5,883,400
			La Plata (5)	2,954,500
Global Total	**263**	**48**		

Table 2. The number and percentage of Transboundary River Basins per Continent & Freshwater Resources that cross >5 Nations (from Cooley et al., 2009)

By crossing political and jurisdictional lines, managing these freshwater resources through national laws and frameworks often becomes a challenge. This is particularly poignant when recognizing that no one national government has authority over any other. There are four types of institutions that have a role in promoting, supporting, and enabling transboundary management (text exert from Pegasys, 2010):

- **Water (basin) infrastructure authorities** responsible for the development, financing and/or operation of joint water resources infrastructure between two of more countries, typically established under treaty between the parties.
- **Bilateral issue based bodies created by agreement** (or Memorandum of Understanding, MOU) between two countries to engage a water issue of common concern, such as water sharing, infrastructure planning, aquifer management, hydropower, water quality and/or flooding.
- **Multi-lateral basin committees** created by agreement (or MoU) to advise the parties on a range of transboundary water management issues and priorities, including the development of a basin agreement/plan concerning the allocation of water, transboundary objectives and institutions to be established to foster cooperation in the basin.
- **Multi-lateral basin organizations** established with a permanent secretariat by transboundary agreement, in order to advise the parties on water resources related issues of common concern at a transboundary level.

Transboundary water agreements typically take two forms: 1) general principles of international behavior and law and 2) specific bilateral or multilateral treaties negotiated for particular river basins (Cooley et al., 2009). Though many transboundary water management agreements exist, 158 of the world's 263 lack a legal framework for cooperation and sufficient legal protection (UN Water, 2008). Without such protection, watercourse states cannot cope cooperatively with existing and future threats from human pressure and environmental change (Loures et al., 2009).

REGIONAL / TRANSBOUNDARY SOLUTIONS

The UN Water program's report on "Transboundary Water: Sharing Benefits, Sharing Responsibilities" (2008) outlines seven key components to ensure effective transboundary cooperation (text extracted and condensed below):

1. **Legal Framework:** There is a consensus among the majority of riparian countries that transboundary agreements need to be concrete and to set out institutional arrangements for cooperation, measures for management and protection of water resources and related ecosystems as well as enforcement. Agreements must take into account water quantity and quality, hydrological events, changing basin dynamics and societal values as well as all potential impacts of climate change. They should also incorporate dispute resolution mechanisms and identify clear yet flexible means to share the benefits of water, water allocations and water-quality standards. Provisions for joint monitoring, information exchange and public participation as well as mutual assistance in case of extreme events are also crucial.

2. **Institutional Structures and Capacity Development**: A clear mandate for the different national and transboundary organizations is an important prerequisite for the formation of strong governing bodies. Effective transboundary water management starts at the national level, where coordination and cooperation between different ministries and water- related institutions is needed, as are sufficient financing and political commitment. At the transboundary level, the formation of joint bodies with strong enforcement capacity, such as river, lake and aquifer commissions, is fundamental to ensuring cooperation between the various governmental entities and good management of shared resources. Enforcement can only be achieved if these bodies possess strong mandates and political support from the various Governments. A variety of actors – local stakeholders, non-governmental organizations (NGOs), research institutions, private sector participants and donors – must all be involved. Vertical and horizontal integration is a necessity, and the joint bodies are the framework where such integration takes place.

3. **Integrated Approach**: Transboundary as well as national water development and management are strongly linked to sustainable and responsible growth. Management approaches should be based on regional cooperation principles, focusing on river basins and aquifer systems; thereby requiring a coordinated approach by industry, agriculture, water-supply infrastructure, etc. It calls for a holistic management of surface and groundwater, implemented with the entire river basin in mind. Integrated Water Resources Management (IWRM) is a process that promotes coordinated and efficient development and management of water, land and related resources to maximize the economic and social welfare without compromising the sustainability of vital ecosystems.

4. **Exchange of Information and Joint Monitoring and Assessment:** Information based on well-organized measurement networks and monitoring programs is a prerequisite for accurate assessments of water resources and problems. Assessment is essential for making informed decisions and formulating policy at the local, national and transboundary levels.

5. **Participatory Approach**: Public participation is fundamental to maximize agreement, enhance transparency and decision-making, create ownership and facilitate the acceptance and enforcement of decisions and policies. It is also a mechanism for gaining a better or common understanding between the various stakeholders on the nature of a given problem and the desirability of specific outcomes. Stakeholder participation strengthens integration, thereby contributing to conflict prevention, and risk reduction.

6. **Benefits and Costs-sharing:** Riparian countries should first focus on optimizing the generation of basin-wide benefits, and secondly on sharing those benefits in a manner that is agreed as fair. The perception by all countries that a cooperative basin development and management plan that maximizes overall benefits is “fair” is essential to motivating and sustaining cooperation. It is therefore important that consensus over basic entitlements is reached and that attention is paid to the differential distribution of costs resulting from the use of the water resources of the entire water body in question. It should be recognized, however, that due to the limited amount of overall available water in some cases, such decisions sometimes involve very difficult trade-offs and choices.

7. **Financing**: A mixture of financing mechanisms and various sources of financial resources is typically used for transboundary water management cooperation: national budgets, external bilateral or multi- lateral donors funded projects,or more strategic programmes, funds, private public partnerships. International development banks or specialized development funds can leverage significant additional investments through strategic partnerships comprising regional funds; additional funding options are e.g. regional revolving funds, Payment for Environmental Services (PES), inter-riparian financing and cost recovery of water services.

In the UNESCO sponsored *Potential Conflict -> Cooperation Potential* series, negotiation was identified as the most often employed method of dispute resolution over international transboundary water resource conflict at any stage (Cosgrove, 2003). Additionally, transboundary water conflicts were often found to be resolved through the support of various international organizations and bodies (e.g. river basin commissions established by multilateral or bilateral agreements).

Some examples of regional / transboundary agreements and commissions are:

- **UN Economic Commission for Europe (UNECE)**. The major aim of UNECE is to promote pan-European economic integration by bringing together the 56 countries located in the European Union, non-EU Western and Eastern Europe, South-East Europe and Commonwealth of Independent States and North America. The **Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention)** was adopted by UNECE Member States and is intended to strengthen national measures for the protection and ecologically sound management of transboundary surface waters and groundwaters, and entered into force in 1992, 26 Signatories/ 38 Parties.[13] The **Espoo Convention**[14] sets out the obligations of Parties to assess the environmental impact of certain activities at an early stage of planning and to notify/consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries. It entered into force in 1997 and has 30 Signatories / 45 Parties.

- **European Union Water Framework Directive (WFD)**. In 2000, the European Union adopted the WFD, which introduces a legislative approach to managing and protecting water, based not on national or political boundaries but on natural geographical and hydrological formations: river basins. It also requires coordination of different EU policies, and sets out a precise timetable for action, with 2015 as the target date for getting all European waters into good condition.[15]

- **Southern African Development Cooperation (SADC)**. With 15 member states, SADC's vision is of a "future within a regional community that will ensure economic well-being, improvement of the standards of living and quality of life, freedom and social justice and peace and security for the people of Southern Africa". Drawing heavily on the language contained in the UN Watercourses Convention, SADC established the **Protocol on Shared Watercourses**; the revised protocol from 2003 is currently in force and has the objective "to foster closer cooperation for judicious, sustainable and coordinated management, protection and utilization of shared watercourses".[16]

- **United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)**. The regional development arm of the United Nations for the Asia-Pacific region, ESCAP is comprised of 62 Governments and is the founder of the Mekong Committee, which is now the **Mekong River Commission (MRC)**.

- **Nile Basin Initiative (NBI)**. An inter-governmental organization comprised of nine countries and one observer (Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda; Eritrea – observer), NBI's shared vision is "to achieve sustainable socio-economic development through the equitable utilization of and benefit from the common Nile Basin water resources."[17] Currently, negotiations are underway to redistribute resources more equitably under the **Cooperative Framework Agreement (CFA)**, which would reduce Egypt and Sudan's 90% current share, and establish a permanent, inclusive legal and institutional framework to manage and ensure equitable allocations of the Nile. Thus far, six countries have signed the agreement; once the CFA is ratified, the **Nile River Basin Commission (NRBC)** would replace the NBI.

- In 2008, the UN General Assembly (UNGA) adopted the Resolution on the "**Law of Transboundary Aquifers."** The Resolution encourages States concerned 'to make appropriate bilateral or regional arrangements for the proper management of their transboundary aquifers' and to use it as a basis for the elaboration of a convention. UN resolutions are formal expressions of the opinion or will of United Nations and generally consist of two clearly defined sections: a preamble and an operative part.

[13] for more information: http://www.unece.org/env/water/text/text.html
[14] http://www.unece.org/env/eia/eia.html
[15] from http://ec.europa.eu/environment/pubs/pdf/factsheets/water-framework-directive.pdf
[16] http://www.sadc.int/index/browse/page/159
[17] www.nilebasin.org

REGIONAL / TRANSBOUNDARY WWF CASE STUDY
Guadiana River Basin, Portugal & Spain – Implementing the E.U. Water Framework Directive (WFD)

Eva Hernandez, WWF Spain

Spain and Portugal share the Guadiana river basin. The river is born in Spain, then forms the border between the two countries, flows into Portugal, and forms again the border in its lower stretch until it reaches the sea. Both countries have historically come to agreements on how to distribute the water of the river basins they share, the Albufeira Convention being the last one in 1998. Previous conventions dating between 1964 and 1968 only referred to equal sharing of the river's hydroelectrical potential, with some reference in the latter to the need for maintaining minimum water flows during the summer and to conserve fish species while respecting national regulations.

The 1990s marked a shift in the focus of the Convention, which was especially influenced by the imminent approval of the European Union's Water Framework Directive (WFD) and its resulting ramifications for the implementation of the bilateral agreement in the two countries. Under the Albufeira Convention and the WFD, Spain and Portugal have started to work jointly in the Guadiana.

Despite the WFD's requirements, provided tools, and regulations, steps towards the integrated management of the basin are being taken slowly and shyly. WWF is working jointly in the Guadiana basin on both sides of the border, developing restoration activities and working with farmers to improve water use in the field, and fostering the proper implementation of the WFD, commenting on plans, proposing new calculations of environmental flows, participating in the public fora, and communicating a new way of understanding water and its values in its offices.

KEY CONCLUSION:
In order to magnify lessons learned towards a real integrated transboundary water management, nations, local authorities, and water authority administrators need to accelerate their efforts.

REGIONAL / TRANSBOUNDARY WWF CASE STUDY
Hutovo Blato – Reconciling Nature, Water, and Energy Needs Through Integrated Transboundary River Basin Management

Angela Klauschen WWF International, Mediterranean Programme

© Angela Klauschen

Hutovo Blato is a wetland protected under the Ramsar Convention and a national nature park. It is located in the Neretva-Trebisjnica river basin, a transboundary catchment spanning over Bosnia and Herzegovina and Croatia. Tensions continue to exist between these two countries since the end of the war, but even more so between the two entities within Bosnia and Herzegovina – Republika Srpska and the Federation of Bosnia and Herzegovina, which are partially covered by the catchment. These tensions are reflected in the management of the basin's water resources, especially with regard to the share of water for hydropower and agriculture, which has lead to increased pressure on the Hutovo Blato wetland. The reduced water intake of Hutovo Blato is demonstrated and began when hydropower plants were built in the 1970s. More hydropower plants are currently in the pipeline and would worsen the situation even further.

Bosnia and Herzegovina has a complex political structure. It is a federal state, which is subdivided into two entities: Republika Srpska, mostly composed of Serbs, and the Federation of Bosnia and Herzegovina, of which the population mainly consists of Bosniaks, Serbs, and Croats. This distribution of ethnicities reflects the complexity of the political situation and legacy of the war. Adding to this is the fact that the entities have *de facto* more power in numerous fields, including the energy sector, which has lead to a fragmentation of competences and to random enforcement of legislation adopted by the Federal State, including international commitments, and alignment with EU legislation.

The country's energy sector is in the hands of each entity's power utility or "Elektroprivreda". Due to the relative independence in the operations of their hydropower plants, their decisions could affect transboundary waters and not necessarily reflect the country's international commitments. Moreover, until the war, the two utilities were part of one sole company, the Yugoslav power utility, and so were those of Croatia, Montenegro and Serbia; today, managers still tend to communicate, cooperate, and negotiate directly with their counterparts from the respective "Elektroprivreda" of each entity/country.

As a result, there is a strong horizontal –or sectoral- coordination, while the vertical governance axis is seriously ignored and thus important decision-making processes, including at the diplomatic level, are skipped. The energy sector acting in isolation has also led to an exclusion of civil society, both in the national and international context, from participating in decision-making processes with regard to new infrastructure development and environmental protection. The enforcement of the country's commitments under the Espoo and the Aarhus Conventions, as well as the EU Water Framework Directive, is thus significantly jeopardized.

For the past 5 years, WWF has therefore dedicated intensive efforts to find solutions based on extensive dialogues with key stakeholders – including the energy sector, NGOs, nature park managers, water basin agencies, municipalities, the cantonal government, and others – on both sides of the border. This dialogue is based on an open attitude that recognizes the needs of all parties, but advocates recognition and respect for nature's water needs. The dialogue with the many stakeholders was prompted by scientific information gathered on Hutovo Blato's degradation, which proved how the hydropower plants have deprived the wetland of crucial water for its ecosystem, thus resulting in the loss of biodiversity.

The open attitude of listening and discussing everyone's needs and requests has led to the recognition of responsibilities in the degradation of the wetland and to a collaborative approach towards finding solutions to restore the wetland. Different solutions are currently under scrutiny, they range from the provision of more water for Hutovo Blato to mitigating the impacts through a fund that would allow for the tight management of the park.

KEY CONCLUSION:

Before constructing major water infrastructure on transboundary waters, countries should enter into an open and fair dialogue process related to environmental and social impacts and agree upon prevention and/or mitigation measures early in the process, involving all stakeholders. Only engaging in this upon completion of the project is too late and is a grave shortcoming in matters of governance.

Despite transboundary agreements, such as the Espoo and Aarhus Conventions, as well as progressive alignment with EU legislation, covering the construction of hydropower plants in Bosnia and Herzegovina, the political context in the country remains incredibly complex as a result of the ethnic war between the former Yugoslavian states. An active and well-trained civil society can raise the awareness on such issues and help promote the dialogue between different stakeholders on both sides of the borders. However, for more effectiveness, transboundary dialogues would gain in being fostered by governmental players. These dialogues are time- and resource-consuming, but essential if consensus is to be built and water management solutions identified.

NATIONAL FRESHWATER RESOURCE MANAGEMENT

NATIONAL PROBLEMS, CHALLENGES, LIMITATIONS

Ultimately, the management of water – from ensuring the delivery of basic services for citizens, for economic growth, and for maintaining healthy environments – is the responsibility of governments; however, as is often the case, water management is a low priority and poorly coordinated, which leads to water resources being over-committed and undervalued (Orr et al., 2009). Rather than focusing on long-term planning, governments tend to respond with expensive "quick fixes" – the construction of water supply infrastructure, inter-basin transfers, water trucks, or desalinization schemes – that seldom generate sufficient revenue to cover their cost (Orr et al., 2009; Pittock et al., 2009).

National level institutions responsible for water management are (text exerted from Pegasys, 2010):

- **Ministries/Departments responsible for Water** have a mandate to manage water resources and water supply & sanitation in terms of policy and legislation, with intent outlined in national water strategies.
- **Other Sector Departments** are critical in terms of setting national and even regional development objectives around energy, agriculture, industry, etc., thereby complicating cooperation and alignment at the national level.
- **Infrastructure and development agencies** are established in many countries to develop, finance and operate water resources (and energy) infrastructure.
- **Interest, sector, and stakeholder groups** engage national institutions on water policy, strategy and implementation.
- **National education and research institutions** provide important capacity within countries to support national water management.

An increasing number of countries have enshrined the right to water within their national constitutions or have framed the right explicitly or implicitly within national legislation. In the following regions the right to water is covered in national legislation: 15 in Africa, 5 in Asia, 2 in the Middle East, 15 in Latin America, and 4 in Europe[18]. Some nations that declared a right to water are still struggling with the practical implementation because it implies changes in providing access, securing necessary financial resources, and building up the institutional and managerial capacity to secure access to safe drinking water and sanitation, particularly for the poor.

In regards to achieving the MDG drinking water target, UNICEF and the World Health Organization (WHO) report that the target was met in 2010; however, 783 million people still lack access to safe water (UNICEF & WHO, 2012). Additionally, the world is still far from meeting the MDG target for sanitation and is unlikely to do so by 2015. Only 63% of the world has improved sanitation access, a figure projected to increase only to 67% by 2015, well below the 75% aim in the MDGs.[19]

NATIONAL SOLUTIONS

To ensure the long-term viability of a country, governments should plan and institutionalize competent responses to scarcity with robust demand management, a sound regulatory system, and efficient and flexible infrastructure (Orr et al., 2009). By focusing on restoring river flow through a multi-disciplinary and multi-stakeholder process of managing water withdrawal, water allocation mechanisms need to be developed that manage the use of the scarce resources (Le Quesne et al., 2007). Water allocation is a mechanism that determines who / how / where / when / why users can take water.

[18] http://www.righttowater.info/progress-so-far/national-legislation-on-the-right-to-water/

[19] http://www.unicef.org/media/media_61922.html and http://www.unicef.org/media/files/JMPreport2012.pdf

In WWF's Primer on "Scarce Water", water allocation is described as "a process whereby an available water resource is distributed to legitimate claimants and the resulting water rights are granted, transferred, reviewed, and adapted. Hence, water allocation processes generate a series of water rights governing the use of water within a catchment" (Le Quesne et al., 2007). There is no one-fit-all allocation process; however 10 "Golden Rules" on water basin allocation have been formulated (WWF, 2012):

1. In basins where water is becoming stressed, it is important to link allocation planning to broader social and economic development planning.
2. Successful basin allocation processes are fundamentally dependent on the existence of adequate institutional capacity.
3. The degree of complexity in any allocation plan should reflect the complexity and challenges in the basin.
4. Considerable care is required in defining the amount of water available for allocation.
5. Environmental water needs provide a foundation on which basin allocation planning should be built.
6. A number of water needs should be recognized as prior rights before water is allocated among competing economic users.
7. In stressed basins, water efficiency assessments and objectives should be developed within or alongside the allocation plan.
8. Allocation plans need to have a clear and equitable approach for addressing variability between years.
9. Allocation plans need to be able to incorporate flexibility and change over the medium to long term.
10. A clear process is required for converting basin scale allocations into local and individual allocations and for the development of clear annual allocations.

Complementing the various social and political systems that help determine an allocation plan, environmental considerations must also be embedded in a national prioritization process for high conservation river areas. In WWF's 2011 Guide *Rivers for Life*, an overview is provided on the identification of priorities for freshwater conservation. Pointing out that "areas and river stretches of interest need to be evaluated according to their functions and values... for good and credible decision-making," the report goes on to highlight how this can be done, which outputs are produced, and how these processes can ultimately be integrated into effective and sustainable freshwater management (Meng et al., 2011).

The European Union's Water Framework Directive is a methodological example of a national level, step-wise management approach. Once the Directive was in force, Member States began by defining their river basin districts geographically and identifying the responsible water management authorities. This was followed by a joint economic and environmental analysis of these areas' characteristics and water bodies at risk of not achieving the 2015 target (countries must ensure that their waters are in 'good ecological and chemical status,' which requires both low levels of chemical pollution and "sustaining healthy aquatic ecosystems"). Countries then launched water monitoring networks and had to develop a river basin management plan with a 'programme of measures' that met the WFD's objectives and included a comprehensive, three-stage consultation process with the public and interested parties in water management. Water-pricing policies that provided incentives for sustainable water use and took into account local economic, social, and environmental conditions, had to be introduced. The final two stages required that programs of measures were operational and by 2015 (the end of the first management cycle), river basin management plans are delivering their objectives in addition to the second round of management and flood risk management plans being put in place (steps adapted from European Commission, 2010).

In regards to achieving the MDGs, nations must increase efforts on sanitation must with particular focus given to the poorest and most disadvantaged people across the world.

NATIONAL WWF CASE STUDY: Establishing a National System of Water Reserves in Mexico

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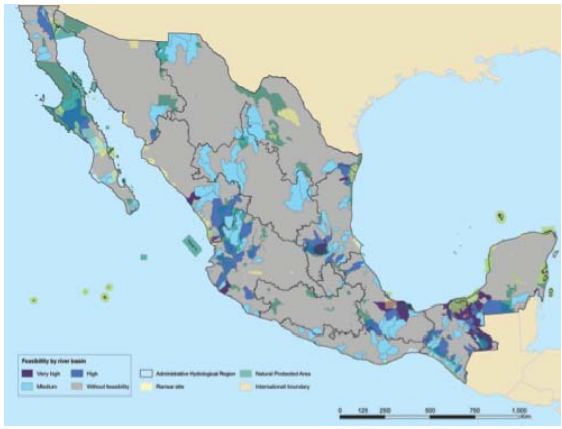

Figure 4. The study identified 189 basins where water reserves could be established and are nominated to be included in the National Water Reserves Program.

WWF–FGRA (Fundación Gonzalo Río Arronte I.A.P.) Alliance, in collaboration with the National Water Commission (CONAGUA), conducted a scoping study that identified potential water reserves throughout Mexico to ensure environmental flows as stated under the National Water Law. These water reserves are defined as watersheds with favorable conditions – high biological richness and high conservation values, availability of water, and low pressure for water users. The reserves could be wetlands or river stretches (upper to lower basins) and selected aquifers.

The benefits of water reserves are that they:

- Define sustainable limits on water availability, which fosters the principle of saving water and managing the demand placed on this resource, thus reducing risk from water scarcity and conflicts.
- Guarantee the connectivity of the entire basin; conserve ecosystems; and maintain environmental services such as storing, conducting, and supplying water, improving water quality, and providing protection from extreme events.
- Introduce integrated planning and management of both subterranean and surface water, especially in regions with little surface water.
- Preserve or control peak flow release to prevent river channel interruption and riverbed invasion; thereby, diminishing the risk against extreme events.
- Reinforce the conservation strategy for the nation's most important ecosystems and their environmental benefits: 97 Natural Protected Areas, 55 Ramsar sites, and an additional 78,500 km^2 of river basins.

The joint Alliance / CONAGUA initiative's goals were to:

- Establish a national system of water reserves;
- Demonstrate that water reserves ensure a healthy functioning of the water cycle, as well as the environmental services they provide;
- Build capacity in the implementation of environmental flows backed by official national guidelines throughout the country.

This new integrated system of water reserves includes representation of all hydrological zones types, terrestrial ecoregions, and freshwater ecosystems in order to guarantee resilience of ecosystems and society, prevent water shortages, and create a dedicated strategy on climate change adaptation. Currently, the Mexican government via CONAGUA, the Inter-American Development Bank, and the WWF-FGRA alliance are working together in implementing the national Water Reserve Program.

KEY CONCLUSION:

Including the maintenance and restoration of environmental flows as a guiding principle in national water laws provides the foundation for new and innovative solutions. By doing so, it catalyzes the prioritization and conservation of critical water resources, thereby securing the steady delivery of ecosystem services which ultimately reduces the risk of conflicts.

SUB-NATIONAL/ -BASIN & LOCAL FRESHWATER RESOURCE MANAGEMENT

SUB-NATIONAL / -BASIN & LOCAL PROBLEMS, CHALLENGES, LIMITATIONS

Gleick found that when conflicts arise, they are "more likely to occur on the local and regional level and in developing countries where common property resources may be both more critical to survival and less easily replaced or supplemented" (1993). Cosgrove also found that water-related conflicts tended "to be at their most intense at the local level, between different sectors and stakeholders in direct competition over inadequate water supplies" (2003). Additionally, conflicts often arise when local communities and water users are insufficiently engaged in formulating water management decisions – thus disregarding local rights and practices (Carius et al., 2004).

Access to safe drinking water is still a key challenge and a huge potential source of conflict at the sub-basin or local level, despite the fact the considerable progress has been made at the global level with regard to the MDGs. The lack of sanitation, related health problems, and water pollution is also very critical, in particular as progress with this MDG target is slow.

SUB-NATIONAL / -BASIN & LOCAL SOLUTIONS

At this point, the "Tragedy of the Commons," which argues that users of a common-pool resource (in this case, water) will inevitably overuse the resource upon which they depend to the point of destruction, has been proven false, most notably by the work of Elinor Ostrom who has found that "successful management involves resources that are effectively managed by small to relatively large groups living within a single country, which involve nested institutions at varying scales" (Ostrom & Field, 1999).

Ostrom has identified what attributes of the resource itself and the appropriators affect the likelihood of successful self-organization to manage local common-pool resources (text adapted from Ostrom, 2002):

1. **Feasible improvement:** Resource units are not at a point of deterioration such that it is useless to organize or so underutilized that there is little advantage from organizing. Normally, the improvement of a resource is not considered if it is not at risk; however, once a threat emerges, the resource begins to get attention. There is a curvilinear relationship between resource condition and the stimulus to get organized and respond.

2. **Indicators:** Reliable and valid indicators of the condition of the resource system are available at a relatively low cost.

3. **Predictability:** The flow of resource units is relatively predictable.

4. **Spatial extent**: The resource system is sufficiently small, given the transportation and communication technology in use, that appropriators can develop accurate knowledge of external boundaries and internal microenvironments.

In addition to characteristics of the resource required for effective self-governance, there are at least seven prerequisite attributes of the appropriators:

1. **Salience:** Appropriators are dependant on the resource system for a major portion of their livelihood or value it highly for other purposes.

2. **Common understanding:** Appropriators have a shared image of how the resource system operates and how their actions affect each other and the system.

3. **Discount rate:** Appropriators use a low discount rate in relation to future benefits to be achieved from the resource. Appropriators who use a low discount rate, who see a long time into the future as being relevant, are more likely to organize for the future.

4. **Distribution of interests:** Appropriators with higher economic and political assets are adversely affected by a lack of coordinated patterns of appropriation and use. This is a complex issue. There are very few resources where everyone is homogeneous. If there is a substantial difference in the economic interest, and if the people who do have greater economic and political assets are those who are interested in the long-term sustainability of the resource, the likelihood of self-organization is higher.

5. **Trust:** Appropriators trust one another to keep promises and relate to one another with reciprocity. One of the key factors in the evolution of rules, especially when it is necessary to cut back on resource use, is that participants trust others to follow the agreed-upon rules.

6. **Autonomy:** Appropriators are able to determine access and harvesting rules without external authorities countermanding them.

7. **Prior organizational experience:** Appropriators have learned at least minimal skills of organization through participation in other local associations or learning about ways that neighboring groups have organized.

Larger-scale governance can authorize local control, help it, hinder it, or override it (Dietz et al., 2003); at the same time, local governance often relies on larger regimes to (i) provide accurate third-person information; (ii) provide arenas in which participants can engage in discovery, debate, and conflict resolution; and (iii) provide mechanisms for backing up local monitoring and sanctioning (Ostrom, 2002).

"Glocalization" refers to the increased role of local communities in global politics; it assumes both horizontal interaction among states and territories in addition to vertical interaction from village to international community (Hassan et al., 2003). In fact, "formal and informal ties among regional and local public and private organizations may be more powerful than traditional state authorities" (Hassan et al., 2003). Local rules that focus on time and not quantity allocations, clearly defined areas of priority use, and protecting downstream and minority rights have been shown to be important for avoiding and resolving conflict as well as creating some system of local justice (Hassan et al., 2003). Empowering local communities and water users promotes social and environmental accountability and enables *all* stakeholders to participate in the decision-making process. Moreover, widespread active participation of and cooperation between stakeholders at the local level has also been shown to have a "trickle-up" effect in enhancing security throughout a river basin (Cosgrove, 2003).

Improving access to drinking water and sanitation requires prioritization, investments, and the establishment of sufficient institutional capacity. An example is provided in the following case study that highlights how ownership can be built regarding sustainable water management at the local level.

SUB-NATIONAL / -BASIN & LOCAL WWF CASE STUDY
Strengthening Local Management by Establishing Lake Naivasha Water Resources User Associations (WRUAs)

Batula Awale, WWF Kenya

Lake Naivasha, an internationally renowned Ramsar Site, has a complex hydrology rich in biodiversity in addition to being home to the largest hippo population density in Kenya. The Lake Naivasha area contributes significantly to Kenya's socio-economic development and is world famous for its cut-flower production that accounts for 2.1% of the national economy and 10% of the foreign exchange earnings (Pegram, 2011). Water remains the single most important resource that the Basin's economy depends on. The drought in 2009 set alarm bells among Naivasha Basin's stakeholders; it became clear that all have a shared responsibility to conserve the ecosystem. Additionally, it was established that the long-term sustainability of the lake and the agriculture- and tourism-based industries it supports were all at serious risk if the ecosystem were to collapse.

Kenya's progressive water resource legislative framework, the "Water Act 2002", recognized that water management needed to be locally driven. Accordingly, the Act provides for every sub-catchment area to have a range of Water Resources User Associations (WRUAs) that collaborate with Kenya's Water Resource Management Authority (WRMA) in managing water resources in a harmonized and co-operative manner. WWF has worked with the Lake Naivasha Growers Group (LNGG), a horticultural farmer association, the WRMA, and the Water Services Trust Fund to support the formation of WRUAs.

A Water Resources Users Association is an association of water users, riparian land owners, and other stakeholders who have formally and voluntarily come together and are registered by law for the purposes of cooperatively sharing, managing, and conserving a common water resource. The ongoing interaction between WRMA and the WRUA (the primary beneficiaries of the water resource) seeks to enhance the participatory management of water resources and conflict resolution.

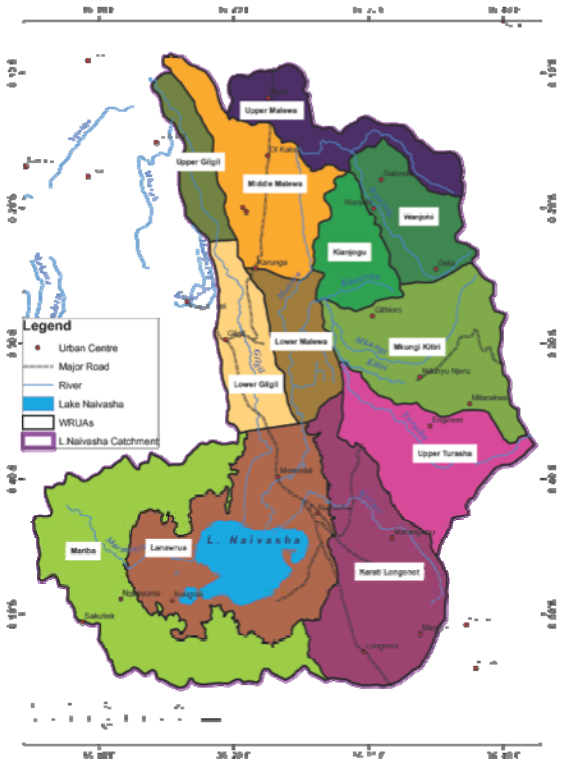

Figure 5. Map of the 12 Lake Naivasha Basin Water Resource Users Associations (WRUAs) that cooperatively share, manage, and conserve common water resources.

WRUA membership is comprised of all water users in an area that includes commercial and small-scale farmers, pastoralists, fishermen, industrial users, landowners, and domestic users. A typical WRUA in Kenya manages the water resources in an area of 200km^2 (or about a 10-20km stretch of river). There is a legal and formal registration processes that needs to be completed before a WRUA can work with the WRMA.

There are currently 12 WRUAs in the Naivasha catchment with varying degrees of capacity. The Lake Naivasha Water Resources User Associations are probably some of the most developed WRUAs in Kenya. Along with various partners, the Naivasha WRUAs have undertaken the following activities towards contributing to the sustainable management of water within the basin:

Equitable Payment for Watershed Services

This pilot project jointly facilitated by CARE and WWF linked commercial water users around the lake with 565 smallholder farmers via the WRUAs. The LANAWRUA represented by the LNGG provided the incentives to Wanjohi and Upper Turasha WRUAs for setting aside land for conservation through rehabilitating and protecting riparian zones; planting high value agro-forestry trees, fruit trees, and fodder crops; and reducing fertilizer use. The upper catchment WRUAs identified 565 farmers to undertake these activities who were then each rewarded with $17 vouchers per year (for 2 years), which were redeemed through acquiring agricultural inputs. Although this project is still in its pilot phase, it is an example of how different water users can manage water resources from the top of the catchment to the end-user through effective coordination.

Lake Naivasha Basin Water Abstraction Survey Led by WRMA

The abstraction survey's objectives were to capture all water abstraction points, capture the actual abstraction amount, understand the level of permit coverage and compliance (permit, meters, paying for water-use), cluster surveyed abstractors into specific WRUAs, obtain information on water balance to improve the Lake Naivasha Water Allocation Plan, determine the community's level of understanding of the water legislative framework, and develop a GIS database. The abstraction survey revealed that 185,000 m^3 is from the lake and the aquifer connected to it, while 100,000m^3 is abstracted from rivers, dams, and groundwater in the upper catchment. A key lesson learned is that a water abstraction survey is mandatory if valid information for water resource management is to be obtained. It is not a simple exercise, and requires committed and experienced staff, resources (funds & equipment), and proper planning. Another big lesson learned was that only having water rules in place is not enough – sensitizing and having strategies on how to implement these rules on the ground-level are essential.

Gazettement of Lake Naivasha as a Protected area, its Aquifer as Groundwater Conservation Area and define its Reserve.

In collaboration with Lake Naivasha WRUAs, WWF decided to walk down a path of uncertainty – to introduce new regulations relevant to water resource management in the Lake Naivasha Basin. Motivated by passion and perseverance, the partnership, decided to embark on a tireless and seemingly endless journey – to gazette Lake Naivasha Basin as a protected area and a ground water conservation area and to impose certain requirements, regulations, and prohibitions. These special measures were introduced through a legal notice in the Kenya Gazette. In Kenya, gazettement is primarily a process whereby the government officially brings new laws into force. The new laws pertain to:

- Curbing illegal water abstractions and regulating licensed users
- Defining the reserve (water for basic human needs and nature) requirement
- Defining agency arrangements between WRUAs and WRMA
- Restoring rivers' and the lake's riparian zones

Lake Naivasha Water Allocation Plan 2011 -2014

A Water Allocation Plan (WAP) is a legally binding document whose formulation was led by the Water Resource Management Authority in consultation with all stakeholders. The Naivasha WAP details methodologies, concepts, and a water balance analysis to address the water scarcity, balance, and inherent possible conflicts between various water users. Similarly, the WAP provides clear guidelines on how to bring water users' abstractions in compliance with the amounts allocated in their permits and abstraction conditions that all parties are required to adhere to. The development of the plan was supported by LNGG, with WWF and WRMA finalizing the plan, making it the first of its kind in Kenya.

KEY CONCLUSION:

Unfortunately commitment to change current water use practices needs a drastic catalyst such as the drought experienced in Kenya. Additional necessary conditions are a favorable political and legal environment for local governance. Ultimately such processes are not just dialog-driven, but rights and responsibilities must also be clearly defined in jointly agreed formally binding documents and plans like Kenya's Lake Naivasha Water Allocation Plan.

FUTURE SCENARIO

GLOBAL AND TRANSBOUNDARY

Hopefully within the next three years, 11 remaining countries will ratify the UN Watercourses Convention at which point, a global convention would be in force that specifically covers transboundary watercourses according to international law. A Secretariat would then need to be set up to promote and facilitate the implementation of the Convention, which would take a minimum of two years due to the need to gather sufficient medium-term funding and arranging co-locations of the Convention with existing international agencies like UN Water, UNEP, or others, before full implementation could start. As a logical consequence, until 2017 at the earliest, the prevailing instruments for transboundary water management will be the existing agreements for 105 of the 263 international waters and the Espoo Convention and UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (limited to Europe and Central Asia; in addition to the US for Espoo and the Russian Federation for the UNECE Watercourses Convention). As the majority of these countries are European Commission member states, the governing legal document for them is in any case the EU Water Framework Directive rather than the Espoo and UNECE Conventions.

Considering the growing pressures on water resources, transboundary watercourses will continue to experience more infrastructure development and regulation and changes to flow regimes where other basin states have limited information and influence, no formal international legal arrangement to refer to, and would solely rely on diplomatic dialogues at the political level. Even with a Global Convention in force, transboundary agreements in place, and functioning river commissions, the challenge will remain that they are respected in regards to procedures of notification and negotiation.

NATIONAL

The competition for ground and surface water resources will intensify significantly in the future. Irrigation areas will expand, more biofuel crops will be grown, and hydropower development will surge. So far, only few developing countries and emerging economies have established regulations on the maintenance of environmental flows or modern water allocation approaches in their constitution and water laws (like Australia, Mexico, Spain, and South Africa). New policy trends like the Energy-Water-Food Nexus discussion will certainly contribute to a cross-sectoral dialogue on future water challenges. However, in practical water management terms, it will not solve the challenges ahead unless the different sectors change their procedures and planning frameworks accordingly to reflect the needs and requirements from other sectors. Environmental Impact Assessments (EIAs) are now widely accepted to screen infrastructure development projects in many developing countries, but the relevant processes with regard to public participation, transparency, and independency of the assessment are still not adhered to in many countries.

SUB-NATIONAL/-BASIN AND LOCAL

The closer one gets to the local level, the more prominent the conflicts will be intertwined with the social web and particular competing interests of local people, businesses, and other stakeholders. Sub-national / -basin and local level actors are both impacted by national or provincial level planning as well as triggering water conflict situations themselves through illegal abstraction, pollution, and regulating water courses or lakes. In many developing countries, there is not only a weak legal water management framework, but also a lack of water governance, control, and enforcement. Under such conditions, local conflicts will continue to thrive, even if individual stakeholders are interested in longer-term solutions and water use sustainability. In countries where both laws and institutional structures are robust, they can provide the ingredients for solutions like local water allocation plans or environmental flows arrangements.

GROUNDWATER MANAGEMENT TRENDS

Groundwater is in many regions of the world a resource widely and extensively used and very often over-abstracted, but groundwater aquifer management and basic monitoring is not really implemented in most of the developing world and even the developed one. Downward trends are recorded at the local and even regional levels where groundwater resources are used. However, because many groundwater systems have not been explored and assessed sufficiently and systematically and variations in time of the groundwater conditions are monitored only occasionally, there is no basis for proper management planning and resource use allocation. Very likely, the situation will only improve gradually over time and much more emphasis will be given to surface waters despite groundwater use being as essential in many regions of the world.

ACHIEVING HUMAN RIGHT TO WATER / MILLENNIUM DEVELOPMENT GOALS (MDGS)

Achieving the human right to water and the MDG water and sanitation targets will continue to be a serious challenge in many regions of the world. Sub-Saharan Africa, with its continuously growing population and urbanization will require special attention. While the international community will continue to debate financial resource mobilization so that efforts can be increased, at least the sanitation target will not be achieved in the coming years and many of the poor will continue to be deprived of safe drinking water, resulting in health problems and increased costs of access.

RECOMMENDATIONS

Key to conflict prevention and resolution at all levels is a sound, comprehensive, and participatory river or lake basin plan at the basin, sub-basin, and local level that involves all relevant stakeholders. Pre-condition to any planning exercise is a comprehensive assessment of the water resources available over time, their status and the trends, and data gathering / analysis / interpretation that includes an understanding of current water use and development in the future. Another pre-condition is an appropriate and modern legislative water framework at all relevant levels. Institutional capacity at the river basin, national, and local level is then essential for both carrying out the necessary assessment, steering the planning process, and guiding and controlling implementation. Though this might all sound quite obvious, together these different elements form the basis to manage water resources and services wisely and equitably and to develop and agree upon water allocation plans for the various users in the respective basins.

With the primary aim to prevent or resolve conflicts, key recommendations and proposed actions for each of the relevant actors are provided below.

MULTI-LATERAL ORGANIZATIONS:

- Multilateral organization, in particular the Secretariats of the water related conventions, should continue to closely follow-up with signatories concerning the proper implementation of the environmental conventions, highlighting any deviations or weaknesses. Appropriate sanctioning mechanisms need to be explored and implemented. In the absence of a specific watercourses related global convention in force, they should promote, as far as possible, adherence to the principle of notification on infrastructure, flow, or regulation development for neighboring countries.

- UN Water, as the umbrella of all UN organizations concerning water, should intensify its promotion of the UN Watercourses Convention's ratification.

- The European Commission should, similar to the Espoo Convention, provide for a block ratification of the UN Watercourses Convention.

GOVERNMENTAL INSTITUTIONS AND PARLIAMENTS:

- Countries and respective administrations that have signed on to multilateral environmental conventions like Ramsar, Espoo, CBD, or have entered into regional agreements with other basin countries in transboundary river basins, or are responsible for implementing the WFD, should honor their commitments with regard to these conventions or legal frameworks, implement them, and periodically report on their implementation. In the spirit of existing customary law, countries and respective administrations should respect and honor equitable and reasonable utilization, protection of ecosystems, notification and consultation on planned measures, exchange of data and information, third party fact-finding and other dispute settlement mechanisms.

- Countries that are planning to establish infrastructure or installations in a transboundary river basin or aquifer which potentially impact neighbor states should inform them on these plans and their expected impacts well in advance so as to allow them to voice their views and opinions. This should include a Strategic Environmental Assessment (SEA) to allow neighboring countries to see how alternative options have been explored and valued.

- Mega-cities and in general large-scale cities[20] should assess potential risk and conflict areas related to water supply and sanitation. The impact of virtual water flows between cities and surrounding rural areas should be further highlighted and risks identified. Ideally, water allocation plans and conflict risk mitigation strategies should be developed and implemented between the peri-urban and urban areas to avoid conflicts. Water must be an integral element in

[20] Due to their sheer population size, some mega-cities and large-scale cities can be considered ‚a nation in a nation' (e.g. Australia's population = 22,852,798 on March 7, 2012 vs Shanghai's metropolitan population = 23,019,148 (2010 Census))

any future city planning, thus avoiding conflicts between sectors and providing the basis for cost-effective synergies.

- Countries that have not yet signed the UN Watercourses Convention should ratify the Convention as soon as possible, in particular those within transboundary basins or aquifers (e.g. European member and candidate states like Austria, Italy, Croatia, Turkey, Serbia; Parana River countries like Brazil, Argentina, Paraguay; or Nile River countries like Egypt, Sudan). Until the Convention enters into force, countries should also sign the Espoo Convention, which governs major infrastructure development in a transboundary context beyond watercourses.

- As required by national laws, Strategic Environmental Assessments (SEA) and Environmental Impact Assessments (EIAs) should be conducted wherever appropriate not only as a management and planning tool, but also to highlight potential conflict and risk areas, develop mitigation measures or alternatives, and come up with planning and implementation options.

- Countries should continue to invest in access to safe drinking water and sanitation, build up the necessary institutional capacity, and establish and strengthen water management systems and utilities ensuring that the rural and urban poor are favored.

PRIVATE SECTOR:

- The private sector, at multi-national, national, and local levels should lobby and engage respective governments to promote proper water resource governance and management, to provide them (the private sector) with a stable and forward looking legal framework, to assess water risks related to business development, and to facilitate the application of water risk mitigations solutions.

- Businesses in various sectors can reduce their risk of exposure to water conflict by integrating sustainable water management into their business association meetings and gatherings and developing sector guidelines together with the governments that aim at reducing potential risks and conflicts arising from water use.

- Businesses should assess water risks, potential conflicts with other users, and future trends, and develop environmental management plans with solutions and risk mitigation options.

LOCAL USERS, LOCAL GOVERNMENTS, AND MUNICIPALITIES:

- Local people should organize themselves into water users associations. If a law does not yet provide for this opportunity, local users should lobby local and national parliaments that such a stipulation is developed and integrated in improved water acts and regulations.

- Employees of factories and businesses should promote the development of water strategies within their firms as this is the basis for sustainable business and job security.

- Wherever regional or national level water management or infrastructure planning is taking place that might negatively impact local interests and delivery of ecosystem services, local people should try to raise their voices and communicate their concerns to relevant government bodies and “their” parliamentarians.

- Municipalities are equally responsible in ensuring that various interest groups are brought together in terms of wise, responsible, and efficient water use. Additionally, they are primarily responsible in ensuring access to safe water is secured through their water utilities, particularly for the urban and rural poor (so-called *bottom billion*), by applying tariff systems which are cost-recovering and continue to secure access for the poor. Innovative concepts, like the program Water and Sanitation for the Urban Poor (WSUP)[21], should be further promoted, in particular with regards to sanitation.

[21] http://www.wsup.com/

GLOSSARY

ECOSYSTEM SERVICES – The benefits people obtain from ecosystems:

- **Provisioning services** – The ecosystem services that describe the material outputs from ecosystems. They include food, water and other resources (TEEB, 2010).
  - *Food*: Ecosystems provide the conditions for growing food – in wild habitats and in managed agro-ecosystems.
  - *Raw materials*: Ecosystems provide a great diversity of materials for construction and fuel.
  - *Fresh water:* Ecosystems provide surface and groundwater.
  - *Medicinal resources:* Many plants are used as traditional medicines and as input for the pharmaceutical industry.

- **Regulating services** – The services that ecosystems provide by acting as regulators, e.g. regulating the quality of air and soil or by providing flood and disease control (TEEB, 2010).
  - *Local climate and air quality regulation:* Trees provide shade and remove pollutants from the atmosphere. Forests influence rainfall.
  - *Carbon sequestration and storage:* As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues.
  - *Moderation of extreme events:* Ecosystems and living organisms create buffers against natural hazards such as floods, storms, and landslides.
  - *Waste-water treatment:* Micro-organisms in soil and in wetlands decompose human and animal waste, as well as many pollutants.
  - *Erosion prevention and maintenance of soil fertility:* Soil erosion is a key factor in the process of land degradation and desertification.
  - *Pollination:* Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee.
  - *Biological control:* Ecosystems are important for regulating pests and vector borne diseases.

- **Supporting service, or habitat service** – Services that underpin almost all other ecosystem services and without which these services' could not occur. Ecosystems provide living spaces for plants or animals; they also maintain a diversity of different breeds of plants and animals (TEEB, 2010).
  - *Habitats for species:* Habitats provide everything that an individual plant or animal needs to survive. Migratory species need habitats along their migrating routes.
  - *Maintenance of genetic diversity:* Genetic diversity distinguishes different breeds or races, providing the basis for locally well-adapted cultivars and a gene pool for further developing commercial crops and livestock.

- **Cultural services** – The non-material benefits people obtain from contact with ecosystems; they include aesthetic, spiritual and psychological benefits (TEEB, 2010).
  - *Recreation and mental and physical health*: The role of natural landscapes and urban green space for maintaining mental and physical health is increasingly being recognized.
  - *Tourism*: Nature tourism provides considerable economic benefits and is a vital source of income for many countries.
  - *Aesthetic appreciation and inspiration for culture, art and design*: Language, knowledge and appreciation of the natural environment have been intimately related throughout human history.
  - *Spiritual experience and sense of place:* Nature is a common element of all major religions; natural landscapes also form local identity and sense of belonging.

ENVIRONMENTAL FLOW (E-FLOW) – An amount of water that is kept flowing down a river in order to maintain the river in a desired environmental condition (O'Keefe & LeQuesne, 2009).

FRESHWATER – Water with less than 0.5 parts per thousand of dissolved salts (as compared to

seawater or *Brine* which has more than 50 parts per thousand). The ultimate source of freshwater is rain and snow; it provides water for drinking, sanitation, agriculture, transport, electricity generation and recreation. It also creates habitats for a diverse range of animals and plants. The earth is comprised of 2.5% freshwater, and 0.3% of that is readily available for human use.

FRESHWATER SYSTEMS – The rivers, streams, lakes, ponds, groundwater, cave water, springs, floodplains, and wetlands (bogs, marshes, and swamps).

INTEGRATED RIVER BASIN MANAGEMENT (IRBM) – The process of coordinating conservation, management, and development of water, land, and related resources across sectors within a given river basin in order to maximize the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems (Williams, 2003).

INTEGRATED WATER RESOURCES MANAGEMENT (IWRM) – A process that 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 (GWP, 2000).

PRIORITIZATION – The process of setting priorities; also referred to as “feasibility categories” or “potential of protection”. For good and credible decision-making, areas and river stretches of interest need to be evaluated according to their functions and values. Such evaluation-based prioritization processes feed into integrated river basin planning and management to ensure the conservation and sustainable use of freshwater resources.

STAKEHOLDER – Any group or individual who is interested in, affected by, or can affect an activity or process. Based on the definitions of UNEP, “Any group or individual who can affect, or is affected by, an organization or its activities. Also, any individual or group that can help define value propositions for the organization”

TRANSBOUNDARY – There are 263 transboundary lake and river basins worldwide that cover nearly half of the Earth’s land surface, 145 nations, and account for an estimated 60% of global freshwater flow. The majority (about 70%) of transboundary basins are located between developing and emerging economies, often with extremely variable intra- and inter-year hydrology, which is compounded by constraints on water-related institutional capacity and infrastructure resources (particularly given the requirements of other social and developmental priorities) at a national level. Many of the most stressed of these transboundary water resources are associated with a large portion of the global population, food production, industrial / goods manufacture, and energy generation, which contributes to significant utilization of the water resources (Pegasys, 2010).

TRANSBOUNDARY AGREEMENTS – Any bi-lateral or multi-lateral agreement related to transboundary water resources, including those related to joint water management aspects and/or those related to the specific institutions to be established (Pegasys, 2010).

TRANSBOUNDARY INSTITUTIONS – All institutions established by two or more countries to jointly advise, plan or manage a transboundary water resource, and may range from a permanent technical committee, through to a water infrastructure authority, or formal basin commissions with a permanent secretariat (Pegasys, 2010).

WATER ALLOCATION – A process whereby an available water resource is distributed to legitimate claimants and the resulting water rights are granted, transferred, reviewed, and adapted (Le Quesne et al., 2007).

WATER RESOURCE USERS ASSOCATION – An association of water users, riparian land owners, and other stakeholders who have formally and voluntarily come together and are registered by law for the purposes of cooperatively sharing, managing, and conserving a common water resource.

WATER STRESS – Areas with between 500 and 1000 m3 of water per year per capita. By 2025, two-thirds of the world population could experience water stress conditions (FAO).

WATER SCARCITY – Areas with <500 m^3 of water per year per capita. By 2025, 1800 million people are expected to be living in countries or regions with "absolute" water scarcity (FAO).

WATER FOOTPRINT – Total volume of water used to produce goods and services that we consume and accounts for the volume of rainwater (green WF) and ground and surface water (blue WF) consumed in the production of agricultural goods from crops and livestock – the major uses of water – as well as the volume of water polluted (grey WF) by agriculture and from household and industrial water use. "A geographically explicit indicator, showing not only volumes of water consumption and pollution, but also the locations" (Hoekstra et al., 2011).

ACRONYMS

CFA	Cooperative Framework Agreement
CONAGUA	National Water Commission (*Comisión Nacional del Agua)*
EIA	Environmental Impact Assessments
EU	European Union
FAO	Food and Agriculture Organization (UN)
GWP	Global Water Partnership
IPCC	Intergovernmental Panel On Climate Change
IRBM	Integrated River Basin Management
IWRM	Integrated Water Resource Management
LNGG	Lake Naivasha Growers Group
MDG	Millennium Development Goals
MOU	Memorandum of Understanding
MRC	Mekong River Comission
NBI	Nile Basin Initiative
NGO	Non-Governmental Organization
NRBC	Nile River Basin Commission
PES	Payment for Environmental Services
SADC	Southern African Development Cooperation
SEA	Strategic Environmental Assessment
TEEB	The Economics of Ecosystems and Biodiversity
UN CBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nation Environmental Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNGA	United Nations General Assembly
WAP	Water Allocation Plan
WF	Water Footprint
WFD	Water Framework Directive (EU)
WHO	World Health Organization
WRMA	Water Resources Management Authority
WRUA	Water Resource Users Association
WWAP	World Water Assessment Program (UN)
WWF	World Wide Fund for Nature
WWF-FGRA	World Wide Fund for Nature - Fundación Gonzalo Río Arronte
ZMVM	Metropolitan Mexico City (Zona Metropolitana Valle de Mexico)

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