How are environmental flows adapted and reflected in global, regional and national policy frameworks. What are the demands from a policy perspective and how can science deliver what is needed?

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1. Introduction

Today many of the world's rivers are suffering from over-abstraction and parts of the world's greatest rivers are completely dry for periods of time. According to the Millennium Ecosystem Assessment freshwater ecosystems are declining at a fast rate and with them the ecosystem services they provide. The total value of freshwater ecosystem services, e.g. production of fish, retention of groundwater and climate regulation, can be hard to estimate but surveys done by Costanza et al (1997) estimates on values up to $ 5 trillion annually. It is now well established that freshwater ecosystems are of high value and extremely important in many parts of the world (Millennium Ecosystem Assessment 2005). About 50% of inland water systems have been lost during the twentieth century. Revenga et al (1998) estimated that 60% of the world's rivers are fragmented and today only 21 rivers longer than 1,000 km remain that retain a connection to the sea (WWF 2006). The over abstraction and fragmentation of water poses major social, economic and environmental challenges (Millennium Ecosystem Assessment 2005).

Environmental Flows can be defined as "*the water regime provided within a river, wetland or coastal zone to maintain ecosystems and their benefits*" (Dyson et. al 2003). The science of environmental flows is relatively new and the concept has developed during the last decades and provides a useful tool to balance the needs of the environment and other users in a river basin. The practical implementation of environmental flows includes doing an environmental flow assessment (EFA) and different methods have developed to estimate the specific flow regime for a defined ecological status. The first EFA:s mainly focused on single fish species but methods have developed into taking a holistic approach which includes assessment of the flow requirements of the whole ecosystem (Tharme 2003). Today it is argued that Environmental Flows should be a key element of Integrated Water Resources Management (IWRM) (Dyson et al 2003). An important part of IWRM is about balancing water between different users *"in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystem*" (GWP 2000). IWRM entails finding the balance between different users and between short time and long time sustainable use of water. Estimating and securing environmental flows can provide the tools to make those important trade offs (Koorsgard 2006).

Despite the growing recognition of the value and importance of environmental flows, assessment of flow requirements to sustain environmental needs still has a low priority in water management (Revenga et al 2000). A survey in 2004 stated that a major obstacle for implementation is lack of understanding among stakeholders for the socio-economic cost and benefits associated with its implementation and a lack of political will (Moore 2004).

To bridge the gap between knowledge and implementation, there is a need to raise awareness among politicians and water lawyers, as well as the other way around; a need for scientists and water professionals to analyze the socio-economic and political agenda and thereby being able to create a momentum for increased implementation (World Water Assessment Programme 2006).

This paper will outline some of the international and national water policies that reflect environmental flows, and which can be useful when developing advocacy strategies for the implementation of environmental flows. Three critical steps will be described and suggested as of paramount importance for scientists and water managers when advocating for the implementation of environmental flows.

2. Defining environmental flows

A range of environmental flows methods have been developed in various countries and a global review in 2003 revealed the existence of 207 individual methodologies (Tharme 2003). The different methods can be classified in four categories, look-up tables, desk top analysis, functional analysis and habitat modeling (Acreman and Dunbar 2004), and the type of method used will depend on a range of aspects such as time, money and available experts.

Regardless of what methods are used some overall key factors can be identified as important when embarking on a road to provide for environmental flow. The very first step should be to take an informed, negotiated decision (on a river basin scale) on the level of environmental flows. The degree of “good health” and what environmental values to secure need to be societal choices and will vary from country to country and region to re-

gion. In some regions it will be possible to preserve the river in a pristine condition while in other areas it needs to be a trade-off between other water use needs (Dyson et al 2003). However a participatory process is important when agreeing on what to preserve and also to gain the support needed for later implementation. A survey in the Murray Darling Basin found that 95% of those surveyed supported the principal of environmental flows, but without the community actively engaged it dropped to less then 40% (Murray Darling Discussion paper, cited in Scanlon 2002). Some regional and national water policies address the need of participatory process when planning and agreeing on a vision on river basin scale. One of the core principals in IWRM is a participatory approach, and real participation only takes place when stakeholders are part of the decision making process (GWP 2000). The Water Framework Directive specifies that the Member States shall encourage the active involvement of all interested parties in the implementation of the WFD and the development of river basin management plans. The European Commission has developed a set of guidance documents on public participation in relation to the water framework directive (European Commission 2002). In the implementation of the Water Framework Directive, the Ribble Basin in North West England has been recognized as an example of best practice in participatory processes. A shared vision for the basin and collaborative catchment planning has been developed (Environmental Agency 2007).

3. Identifying policy and legal framework which can support the implementation of environmental flows

3.1 Global and national policies addressing environmental flows

When developing a strategy for the implementation of environmental flows the first step should be to check if the country is party of any global multilateral environmental agreement. All parties to a convention have the responsibility to implement the agreed measures. Many river treaties contain provisions for the regulation of flows mainly for the purpose of navigation or electricity, however few address directly environmental flows for the protection and integrity of a river ecosystem (Scanlon and Iza 2003). Even though there are seldom unique provisions that directly address environmental flows, several international agreements have recognized the

need to protect and restore freshwater ecosystems (Dyson et al 2003, Katz 2006), and providing for environmental flows will be an important measure when working to restore and protect those freshwater ecosystems.

Three global river agreements are of relevance to environmental flows (Iza 2004)

- United Nations convention on the Law of Non-navigational Uses of International Watercourses - UN Convention, (UN General Assembly 21 May 1997)
- Convention relating to the Development of Hydraulic Power affecting more then one State and Protocol of Signature (UN General Assembly, 1923)
- Convention and Status on the Regime of Navigable Waterways of International Concern (Barcelona, 20 April 1921)

The UN Convention is of particular interest when it comes to environmental flow. It is the only global treaty that addresses rivers in purposes other than navigation, and it applies to transboundary freshwater systems, i.e. major watercourses, their tributaries, connected lakes and aquifers, accommodating competing users across international boarders (Loures and Dellapenna 2007). It aims to open up a framework of co-operation for the contracting parties regarding shared water resources and to give effective means to prevent and resolve water conflicts, including considering environmental conservation in the allocation of transboundary waters (Katz 2006). The provisions of utilizing the international watercourses in an "equitable and reasonable manner" and "the prevention of harm to other riparian states" are the cornerstones of the Convention. A failure to provide an adequate flow could be argued as being incompatible with the provision of the equitable and reasonable use of the water courses, and moreover, doing an environmental flows assessment could be a tool to determine the meaning and definition of "equitable utilization" (Scanlon and Iza 2003). The key argument for environmental flows can be found in Article 20, requiring the protection of ecosystems of international watercourses, combined with Article 5(1), which determines that an equitable and reasonable use of international watercourses must be consistent with its protection. These provisions imply that minimum environmental flows will have to be taken into account in the equitable and reasonable use of these resources (Tanzi and Arcari 2001).

The Convention still needs the ratification of 19 parties to enter into force (http://untreaty.un.org). Once ratified, it will constitute an important

convention providing a forum for dialogue on international management of shared water resources. It could provide the appropriate and necessary legal response for IRWM and the implementation of environmental flows.

The Convention relating to the Development of Hydrological Power obligates countries to enter negotiations with riparian states when planning for a Hydrological power project. *The Barcelona Convention regulates* States to refrain from all measures likely to affect the navigability of a water ways in any negative way (Iza 2004).

Several non-river treaties have recognized the need to protect freshwater ecosystems. The Convention on Wetlands of International Importance especially as waterfowl habitat, *the Ramsar convention*, is of special importance to environmental flows. When adopted, the primary objective of the Convention was to conserve the wise use of wetlands to provide habitat for waterbirds. The convention obliged parties to consider "the fundamental ecological functions of wetlands as regulators of water regimes and as habitats supporting a characteristic flora and fauna, especially waterfowl" (Ramsar 1971). Since it was drafted it has been developed to also include other species as well as broader aspects of water management (Dyson et al 2003). The Convention also adopted guidelines on "the allocation and management of water for maintaining the ecological function of wetlands" and countries are encouraged to adopt measures in relation to policy and legislation, valuation of wetlands and the determination of environmental flows (Iza 2004).

The Helsinki rules, in 1994 adapted into the Berlin rules of Water resources drafted by the International Law Association. Rules are not binding but are "instructive on emerging obligations" (Dyson 2007). They acknowledge the importance of environmental flows for ecological and other instream purposes (Articles 22 and 24) (Katz 2007). Some countries are attempting to apply these principles in specific international trans-boundary agreements (see below, regional agreements and policies).

The Convention on Biological Diversity (CBD) was adopted in Rio 1992 and has today 190 parties (CBD 1992). Each Party should develop national strategies for conservation and the sustainable use of biodiversity and should be adapted in to relevant programmes and policies (Lothigius and Rönnberg Galmor 2004). The Convention has adopted guidelines encouraging parties to address measures to manage environmental flows (CBD 1992) (Dyson et al 2003).

Several global non-binding instruments are also important in the context of environmental flows. *The Dublin principals* have gained global support as guiding principals for Integrated Water Resources Management (IWRM) implementation and are aiming to improve water resources management. They were formulated and agreed upon at the International Conference on Water and the Environment in Dublin 1992, and they later significantly contributed to chapter 18, on freshwater resources, of *Agenda 21* which was adopted in Rio 1992. Agenda 21 is not law in a strict sense, but the agreement is still relevant to the concept of environmental flows. The importance of managing environmental flows is specially addressed through pointing out the importance of maintaining river health for human health and quality of life (Agenda 21). On the World Summit of Sustainable Development, a Plan of Implementation was agreed upon which urged countries to develop integrated water resource management plans and water efficiency plans by 2005. It included the development of national and regional strategies for IWRM, developed supporting policy instruments, improve efficient use of water and programmes for the mitigation of extreme weather events (Dyson et al 2003).

The *Millennium Development Goals* was adopted in 2000, and includes eight goals for the global agenda to cut the worlds poverty by half until 2015. The MDG:s have been described as the most comprehensive and broadly supported targets that the world has ever established (WRI 2005). The goal to reduce poverty should include efforts to safeguard and ensure ecosystem health and integrity. The Millennium ecosystem assessment highlighted that the decline of ecosystem services fall heaviest on the poor and the degradation of ecosystems often results in an immediate decline in living standards and greater poverty (WRI 2005). Ecosystem services linked to freshwater are declining in a fast rate and these services are of uttermost importance for the livelihoods of the rural poor (MEA 2005). To be able to reach the MDG:s, it is therefore important for countries to give attention to ecosystem management and sustainable use of resources when working to reduce poverty. Environmental flows can act as an important tool when balancing the needs of different users and ensuring sustainable development without jeopardizing the livelihood of rural poor.

The seventh of the eight MDG goals commits nations to “ensure environmental sustainability” with a specific commitment to integrate the principles of sustainable development into country policy and programs, and reverse the loss of environmental resources (United Nations 2000). Target 10, the second MDG environmental target, commits nations by 2015 to

halve the proportion of people without sustainable access to safe drinking water and sanitation. At the World Summit on Sustainable Development in Johannesburg, the international community created additional targets related to environmental sustainability and water, the so-called MDG Plus. Paragraph 31, "*maintain and restore fish stocks to a level that can produce a sustainable yield by 2015*" and paragraph 26 *"develop integrated water resources management water efficiency plans by 2005"* is of most importance to environmental flows (WRI 2005).

Countries seeking debt relief or loans from the World Bank or the International Monetary Fund must prepare *Poverty Reduction Strategy Papers (PRSP*) which should deal with a country's strategy and plans to reduce poverty**.** They are important when guiding different countries' efforts to reduce poverty and influencing the directions of a country's future investments. Unfortunately many PRSP:s have shown a lack of integration of ecosystem values. The environmental department of the World Bank, have conducted several studies on environmental mainstreaming within PRSP:s. The authors found that the amount of environmental mainstreaming varies widely, but that overall it constitutes an improvement in addressing environmental issues from interim to full PRSP (Bojö and Reddy 2003).

3.2 Regional agreements and policies

In the European Union Water Framework Directive (WFD) all member states are required to monitor as well as take action to achieve "*good ecological status*" for all surface water bodies, or "*good ecological potential*" if designated as heavily modified. Annex V specially mentions the importance of the quantity and dynamics of water flow in rivers and other surface waters and the need to take into account natural flow conditions (Kratz 2007). Moreover, the appropriate river flow is an overall fundamental requirement for maintaining and achieving a healthy river system, and fundamentally important for achieving "good ecological status". Countries will need to develop environmental standards that reflect the maximum abstraction allowable from rivers to ensure the maintaining of healthy rivers (Acreman 2007).

The Convention on the Protection and Trans-boundary Water Courses and International Lakes (Helsinki Convention) is of relevance for environmental flows. It was negotiated under the United Nations Economic

Commission for Europe and has objectives to control pollution, further equitable use of trans-boundary waters, ensure sustainable use and conservation and, if necessary, restoration of transboundary waters (Dyson 2003)

Some regional agreements have attempted to apply the principals of the Helsinki rules, aforementioned, which acknowledge the importance of environmental flows. The Mekong River Agreement, signed between Cambodia, Lao PDR, Thailand and Vietnam, specifically requires minimum stream flows for the protection of ecosystems. The Agreement between Sweden and Finland concerning frontier water is also an early example on how to set up an agreement to regulate sustainable use of shared water resources (Iza 2004)

3.3 National water policies

On a national level, only a limited number of countries have recognized the importance of non-consumption use of water. The South African Water National Act as well as the Australian Water Reform Framework Agreement is often outlined as progressive legislation when it comes to covering environmental flow aspects (Kratz 2006). In the South African National Act, the environment is *"regarded as an automatic (priority) allocation as the resources base upon which other user depend, and therefore separated from other water users"* (RSA 1998). The Australian Water reform endorsed in 1994, outlined that priority should be given to formalizing allocations of water entitlements, calling for the environment to be a "legitimated user of water" (Dyson 2007). A Cap was also introduced in 1995 on total diversions to limit the total extraction from the Murray-Darling Basin (Scanlon 2002).

In many cases national legislation from environmental flows still need to be established. Some examples are given below on country specific legislative techniques that have been utilized to provide for environmental flows (for a more comprehensive list see Dyson 2003.). Some countries have required the provision of minimum flow, such as Sweden and Switzerland. Countries such as the USA, Canada, Australia and Sweden have all created legal protection for free-flowing rivers. The Unites States' Wild and Scenic River Act is one example, as well as the legislation concerning the four Swedish national rivers, Kalix, Torne, Pite and Vindel River. This involves the preservation of these unique rivers in their free flowing state.

4. Building capacity for implementation

Many global legal instruments listed in this article can be of relevance in the context of environmental flows and can be useful when advocating for policy change to support the implementation or restoration of environmental flows. Serious attempts to manage environmental flows will not happen before a policy decision has been made to support its implementation, and working for environmental flows will need to include serious analyses on what policy or legal framework exists that can support its implementation. Guiding documents can be found on how to plan and integrate multilateral agreements (UNEP 2007), and can also be a supportive tool when trying to influence on the international arena. However although international law gives broad guidance, national law will have the most impact on flow rate (Katz 2007), and the most advocacy for environmental flows will need to happen at a national as well as a local level to enforce its implementation. Listed are some key points of importance for water-managers and scientist when promoting and communicating environmental flows.

- *Understanding the problem*

Have clear understanding of the problem, the river basin that you are working in, and what the natural, but also man made, resources are (e.g. freshwater and other natural resources). Understand the socio economic context, what the main sources of income in the river basins are. Further, which are the main stakeholders and what natural resources are they dependent on. Have a clear understanding on the specific legislation you would like to influence.

- *Understanding the political agenda and who to talk to*

Identify what policy process that most likely can support your work and what political context lies behind this policy process. Who are the key decision makers and in what context are they working. What political trade-off do they need to do, and understand the decision making process.

- *Identify partners*

It will be inevitable and necessary to involve a range of actors to create necessary engagement and momentum. A careful stakeholder analysis should be done to identify who needs to be informed and engaged in the process. Which people and groups can support the work? What local

groups, such as fishing or farmer associations can and should be involved in your work?

- *Communicating your message*

Take time to develop and think through the key message. It should be simple but also include the basic information to support both future implementation and to help decision makers fully understand the problem. One of the challenges for river scientist is to help decision makers to understand the consequences of varying degrees of alteration, and what implications that will have for the environment and society (Acreman 2003). Moreover it is important to communicate and get decision makers to understand the different advantages of providing environmental flows. Decision makers need to better understand that providing for environmental flows will not only benefit the environment. A healthy functioning ecosystem will also attract investment and is thereby important for both people and the environment. (Dyson 2003, WWF 2005).

5. Conclusions

In September 2007, some of the world's leading experts on environmental flows gathered in Brisbane for the 10th International River symposium and International Environmental Flows Conference. The symposium declaration highlighted the still urgent need to considering environmental flows. Progress has been made but much more attention is still needed. Freshwater systems are seriously impaired and degrading at an alarming rate, and there is still a need for science and policy to move closer for better recognition of environmental flows in national and global policies. This article provides a short summary of existing global and national policy frameworks that recognize environmental flows. For a more comprehensive review of legal foundations for environmental flows see, Iza 2004, Scanlon and Iza 2003 and Dyson et al 2003. It also highlights some important points to consider when advocating for environmental flow, this to support scientist and water mangers to better influence the policy agenda. Key steps include

- A thorough stakeholder analysis and involvement when agreeing on environmental flows
- Identifying global or national policy instruments that can support the implementation

- Building capacity for its implementation including; a clear understanding of the problem and the political context, identifying partners, and developing a strong communication strategy

This will be important steps to consider in future efforts estimating environmental flows and integrating the concept into relevant laws, policies and programs.

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