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Implication of environmental flows in river basin management

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Abstract

Consideration of environmental flows in river basin management poses great challenges. Environmental flows are interpreted as the natural or regulated releases of water needed in a river to maintain specified valued features of the river ecosystems. This has never been considered explicitly in water resources management of a river basin. An attempt is, therefore, made here to reflect the perception and implications of environmental flows in water resources management. Assessment approaches are reviewed in the context of flow characteristics of a river system and recommendations are put forward on what is to be done to adopt this new concept in practice.

Keywords: River basin management; River functions; Flow regime; Environmental flow; Assessment approaches; Overview

1. Introduction

Population growth coupled with rapid socio-economic and industrial development has imposed greater demand on water supply. Urbanization, increasing land development and industrial activities in the absence of adequate wastewater treatment have contributed to water quality deterioration. However, the available water resources that any country can economically develop on a long-term basis are finite. Most of the developing countries are now facing a daunting task of water resources management dealing with problems of equitable water allocation and conflict resolution, maintaining a healthy resource base in addition to coping with extreme natural events like floods and droughts. The river basin has long been acknowledged as the appropriate unit for water resources management. The multi-functional use of water resources under varying hydrological, environmental, socio-economic circumstances require an integrated approach to river basin management, and this is a major challenge. The concept of integrated river basin management requires a holistic approach that combines the management of the soils, forests, water and human activities with the objective of sustainable development and use of the water resources maintaining ecosystem integrity.

Traditionally, water has been managed from a supply perspective with an emphasis on maximizing short-term economic growth from the use of water. Apparently, no consideration has been given to the health of the resource itself and there is a poor understanding of the implications of overuse or declining river health. Maintaining ecosystem integrity implies that certain level of flow with acceptable level of water quality is there in the system and this is considered as environmental flow. Environmental flows are not empirically determined figures, but they are value judgements depending on what the aim of river management is. Environmental flows are often associated with dams, as dams are the most significant structures that change river flows. Dams can actually help in establishing environmental flows, depending on how much water is available downstream of the dam and how the releases are managed.

There is no simple figure that can be given for the environmental flow requirements of rivers. It very much depends on the specific physical situation and the expected state of the ecosystem. This can be done within the context of wider assessment framework that contributes to river basin planning. In spite of the increasing environmental pressure arising from economic growth, it is only through

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economic growth that the nations can reduce poverty and improve environmental management. Therefore, the challenge is not to limit the economic growth but to achieve that in an environmentally sustainable form. With an interpretation of river functions, the paper elaborates on the concept, what exactly is the environmental flow, what are the perceptions and implications of environmental flow in water resources management and how it can be assessed? Challenges and opportunities for adopting the concept of environmental flow in practice are then identified.

2. What are environmental flows?

2.1. What are costs of not maintaining environmental flows?

The International Water Management Institute (IWMI), in its Water Policy Briefing (International Water Management Institute, 2005), indicated that there is no universally agreed definition of environmental flows. Researchers refer to them using a variety of terms, including 'minimum flows', 'environmental demand', and 'in-stream flow requirements', each of which sometimes describe a slightly different concept. However, a good general definition describes environmental flow regimes as discharges of a particular magnitude, frequency and timing, which are necessary to ensure that a river system remains environmentally, economically and socially healthy. Environmental flows represent a compromise between water resources use and watershed development on one hand and keeping rivers in a healthy, or at least reasonable state on the other. But they do not just consist of set volumes of water flowing through a river. They have to be varied at different times of the year. This helps to keep the ecosystem in good working order by mimicking the natural variability seen in river flows. This variability is very important for the health of ecosystems. Low flows, for example, trigger migration and reproduction within different animal species. High flows, by the same token, help some riverside plants to reproduce and also ensure that river channels keep their shape and do not silt up.

By ignoring environmental demands may ultimately result in heavy medium- and long-term costs as indicated below (International Water Management Institute, 2005):

Public health risks – reduced river flows mean less availability of drinking water and more concentrated pollution.

Loss of food security and damage to livelihoods – a decrease in the amount of water available means less water for agriculture. It also reduces fish stocks, and damages both commercial and subsistence fishing. This has a direct impact on the poor who have few assets and rely on common property resources such as rivers and wetlands. Wild fish, for example, are often their only source of protein.

Loss of biodiversity and associated potential revenue – loss of biodiversity and resource degradation prevent countries from taking advantage of the revenue earning options offered by recreation and tourism.

Increased water-related conflict – resource degradation and loss result in conflict, as users compete to satisfy their needs.

3. Perceptions and implications for water resources management

A survey of 272 water professionals in 64 countries showed that a large majority (88%) agreed environmental flows are essential element of efforts to achieve sustainable water resources management. However, some respondents were concerned that allocating water for environmental purposes may increase water-related conflicts. Reasons for the failure to implement environmental flows in some areas were cited as (i) a general lack of awareness among stakeholders, (ii) insufficient policy guidance, and (iii) insufficient management capacity. Identifying the direct and indirect benefits of environmental flows and then communicating them effectively to communities and water users were seen as essential tasks (Moore, 2005).

Despite the recognition and understanding, to some extent, of the environmental needs of water systems, water resources continue to be depleted, rivers continue to show signs of drying up, and water use practices in agricultural, industrial and domestic sectors continue to be inefficient. Over-use and over-allocation of water for human purposes reduces the amount of water in rivers and other water systems resulting in decreased capacity of freshwater ecosystems to provide full range of goods and services and can result in irreversible degradation of the ecosystems. Environmental flows require certain flow regime to be maintained in rivers and the importance of the flow regime in maintaining ecosystems had been virtually ignored in management context. Furthermore, water quality aspect has not been taken into consideration seriously, even been neglected in management practices in most of the developing countries.

To address the need of long-term sustainable use of water resources maintaining the ecosystem integrity, the basic dilemma the planners and managers of water resources and water service sectors are facing is how to continue to provide water for human needs in the face of increasing population pressure, while at the same time taking into account the environmental needs of water. A further problem is that the human water needs follow a pattern that is often at odds with the natural patterns and variability of rivers and other water- courses. If water is reserved in some way for the environment, the availability of water for other human uses is reduced, thereby increasing competition and potentially leading to disputes and conflicts (Smakhtin et al., 2004).

The issue of water scarcity and environmental flows is a complex one. Some people see that water scarcity makes it very difficult to be able to consider the needs of the environment, particularly when there is shortage of water for basic human needs. This viewpoint is highlighted in a study on ''An assessment of hydrology and environmental flows