# Global Environmental Flow Indicators

A GWSP Fast-Track Activity

## Introduction

The Global Environmental Flow Indicators project is one of the fast-track activities initiated at the first meeting of the Scientific Steering Committee of the Global Water System Project in February 2005. This document gives a brief description of the aims of the project and how it will be undertaken.

## Background

A major challenge for society is to satisfy the growing demands for food and water, without degrading natural ecosystems and the services they provide. River systems are regarded as the most threatened ecosystems on the planet and there is a need for robust measures of river ecological health to determine the effectiveness of management actions to protect them. Unfortunately, few datasets of direct measurements of aquatic ecosystem health are available to make global comparisons among basins or countries. In light of this, our long-term aim is to identify robust and defensible surrogates of river ecosystem health that can be reported at the global scale. Given the data issues, these are more likely to be based on drivers of ecosystem health than direct measures of it.

## Global indicators of environmental flow needs for rivers

There is no doubt that the modification of natural flow regimes is one of the major drivers of change in aquatic biodiversity and river ecosystem health[1]. In previous global river assessments, this is often included as simple measures of change in mean discharge. However, these do not reflect ecologically important components of the flow regime and are likely to understate the impacts of flow modification. For example, it is possible to deliver a % of the mean discharge as a fixed environmental flow allocation in many ways. However, significant ecological impacts can result because of shifts in the timing, seasonality, predictability etc of important flow attributes. In highly variable river systems, a small % of the mean discharge may in fact be a large proportion of the flow in many years, leading to significant impacts to river ecosystems. If allocations of water for extraction are fixed (e.g. as is often the case for licensed entitlements) irrespective of interannular variability, environmental allocations may not be available in many years. It is clear that we need measures of flow regime alteration that are ecologically relevant. These are likely to include attributes of variability, seasonality and spell duration and will need to take into account the likely differences among climatic regions.

## Ultimate Goal

This fast-track activity on environmental flow indicators and flow regime change is the first step of an expanded GWSP project that would also consider river ecosystem health indicators of land use impacts, barriers to dispersal and aquatic biodiversity.

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[1] Bunn, S.E. & Arthington, A.H. (2002). Consequences of altered hydrological regimes for aquatic biodiversity. *Environmental Management* **30**, 492-507.

## Implementation

The identification of environmental flow indicators is currently underway in collaboration with the Global Rivers Sustainability Project[2]. The GRSP/GWSP fast-track project aims to:

- Agree on a set of hydrological parameters that are ecologically relevant; and
- Identify which of these can be modelled at the global scale and report on changes to these parameters at river basin and/or country scales.

Two workshops have already been held and a conceptual paper has been prepared for submission to *Environmental Management*[3]. A list of potential environmental flow indicators will be reported from these workshops and a subset of these selected that can be modelled and reported at basin and country scales.

This fast-track activity will underpin a larger joint activity between the GRSP, GWSP and DIVERSITAS. The longer-term goals of this project include:

- Determine how much these flow variables can be modified without major degradation to river ecosystems; and
- Determine how this is likely to vary between biomes and climatic regions.

In addition to this project on environmental flow indicators, we also aim to develop additional indicators of river ecosystem health that will include measures of key drivers such as land use impacts and barriers to dispersal, as well as direct measures of aquatic biodiversity. An initial workshop was held in May 2005 at the Centre for Ecology and Hydrology, Wallingford (UK) with collaborators from the CGIAR Challenge Program on Water and Food. A report on the outcomes of this workshop will be produced shortly.

## Get Involved

If you are interested in getting involved in the development of global river ecosystem health indicators or if you have any questions related to this fast-track activity on environmental flows, please contact Professor Stuart Bunn (see contact information given below).

### Contact information

Professor Stuart E. Bunn
Director, Centre for Riverine Landscapes
Faculty of Environmental Sciences
Griffith University
Nathan, Queensland
Australia 4111

S.Bunn@griffith.edu.au
ph: (+61-7) 37357407
fax: (+61-7) 37357615

www.griffith.edu.au/centre/riverlandscapes

[2] This project is led by Professor LeRoy Poff at Colorado State University, in collaboration with Professors Arthington, Bunn, Naiman, Vörösmarty and others.

[3] Arthington, A.H., Bunn, S.E., Poff, N.L. & Naiman, R.J. (in prep). The perilous quest for simple environmental flow rules to sustain river ecosystems.