



An ecological economics framework for assessing environmental flows: the case of inter-basin water transfers in Lesotho

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Abstract

This paper used the Lesotho Highlands Water Project (LHWP) that transfers water from the Orange River Basin in Lesotho to the Vaal River Basin in South Africa as a case study to show how environmental sustainability aspects can be integrated into economic development planning. Using the Ecological Social Accounting Matrix (ESAM) for Lesotho that integrates ecological implications of the LHWP with economic benefits of the project, the paper analysed the impact of lost ecological services downstream the LHWP dams in Lesotho on the well-being of households directly affected by the project (riparians) and the general economy of the country. The results revealed that despite significant economic benefits, the project has unintended impacts on ecological resources and services with resultant deleterious well-being implications for riparians. The results from the ESAM analysis indicated that not only the income of riparians is likely to suffer, but also that of other households and social groups, as well as the general economy of Lesotho. While results of the ESAM analysis did not indicate large income impacts on the economy at large, they were significant for riparians. The importance of integrating ecological consequences into impact assessment of IBWT before such transfers can be implemented to ensure sustainable development and considering economy-wide impacts associated with IBWT was proven necessary for a holistic impact assessment of IBWT. © 2005 Elsevier B.V. All rights reserved.

Keywords: sustainability; Ecological Social Accounting Matrix (ESAM); inter-basin water transfers (IBWT); human well-being; Lesotho Highlands Water Project (LHWP)

1. Introduction

Water is scarce in many regions of the world. But even in countries with an overall abundance of water,

demand exceeds supply in many areas. To overcome water deficits, water is often imported through inter-basin water transfers (IBWT) at international, national, regional and local levels to meet increasing off-stream demands in agriculture, industry, hydro-power and household for economic and social development. However, offstream gains from IBWT are achieved at high ecological costs downstream. This is because transferring water from one basin to

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the other can enormously reduce water required for instream uses leading to negative impacts on ecological resources and processes, which provide direct and indirect benefits to riparians.

Environmental Impact Assessments (EIAs) for inter-basin transfer projects usually leave out instream ecological effects of such projects. The assessments are also often done after important projects' elements have been designed (Hirji, 1998). The Lesotho Highlands Water Project (LHWP) that transfers water from the Orange River in Lesotho to the Vaal River Basin in South Africa is one good example. Recently, the Lesotho Highlands Development Authority (LHDA) commissioned a study to determine Instream Flow Requirements (IFRs) necessary to sustain riverine ecology of rivers downstream the dams of the project in Lesotho (LHDA, 2002a). However, this was done after important elements of the project had been implemented, e.g. part A of the first phase of the project had already been completed and part B had already commenced. It is important that instream impacts of IBWT are measured and included in IBWT impact assessments before such projects are implemented, and that mitigation and compensation measures against possible losses are put in place to ensure sustainable flow of instream benefits to riparians. Otherwise, IBWT may result in unintended negative impacts that threaten the sustainability of such projects in the long run.

The major objective of this paper is to develop and apply an ecological economics framework that integrates ecological considerations into economic assessments models to enable more comprehensive evaluation and analysis of the sustainability of IBWT. The LHWP is used as a case study to empirically apply the developed model. The paper is divided into five sections. The next section gives a brief background to the case study area. The analytical framework for assessing economic and ecological impacts of IBWT is discussed in Section 3. Section 4 presents the data and results of the study and conclusions are drawn in Section 5.

2. Background to case study area

The prime objective of the LHWP is to abstract water from rivers in the Highlands of Lesotho, store

it in reservoirs and transfer it, through gravity, to the water deficient Vaal region in SA. Before transferred, the water is used to generate hydropower in Lesotho. The transferred water is aimed at augmenting water supply for industrial and residential use in the Vaal region. SA pays for the full cost of the project except the hydropower component and also pays US\$45–47 million annually in royalties for the water delivered (World Bank, 1998). The royalties bring valued foreign earnings to Lesotho. Fig. 1 shows the location of the project in Lesotho including the main dams and rivers supplying the dams. The figure also shows sites where populations deriving livelihoods from the LHWP Rivers downstream the project dams reside. These are marked as IFR sites in the figure.

In the IFR sites reside 150 000 riparians who depend on a host of ecological resources found within the reaches of the affected rivers for livelihoods (LHDA, 2002b). These resources depend on the flows of the river system (streamflows) and include wild vegetables, medicinal plants, crafts grass, fire wood, fish, sand deposits and forage for grazing. The rivers are also the source of drinking water for riparians and their livestock. They also provide cultural/recreational/religious services to riparians. All these benefits were estimated to value 45 million Maloti at 2000 prices² (LHDA, 2002c). LHDA (2002c) also estimated that, due to the modification of streamflows downstream the LHWP dams, availability of aforementioned ecological resources and services will decline with deleterious impacts on the welfare of riparians. However, these were not included in the EIA of the scheme.

Because inter-basin water transfers affect many sectors of an economy, a social accounting matrix (SAM) framework is considered most appropriate for assessing impacts of inter-basin water transfers. Also, the SAM is an important tool for analysing social concerns (e.g. welfare implications of an exogenous change in institutional income) because it emphasises origins and distribution of income, as well as distribution of expenditure (Adelman, 1975; Pyatt and Round,

² Maloti (M) is the local currency of Lesotho which is pegged on SA Rand (R) on par basis. The M/R value in the year 2000 in relation to the US dollar was US\$1 \approx M12.00.

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