Calculation of the secondary effects of floods in the lower Orange River area - A GIS approach

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Abstract

This article forms part of a series published in *Water SA* (commencing in Vol. 23 No. 3, July 1997 and Vol. 24 No. 3, July 1998) and builds on the information contained in the previous articles. Construing loss functions and flood damage simulation models as well as the assessment of the total direct flood damage have already been discussed in the mentioned articles. From the above-mentioned knowledge, it is possible to estimate the secondary effects of floods with different probabilities of occurrence. For this purpose damage is considered and assessed from a regional and national point of view. In the economy of a country there are forward and backward linkages between different sectors. This implies that the real impact of floods has wider implications than the merely direct and this is one of the reasons why the secondary effects of floods are assessed.

The flood plain of the Orange River, downstream from the Gifkloof Weir up to the Manie Conradie Bridge at Kanoneiland was used as study area for the research.

The aim of the article is to determine the secondary effects of floods from a regional and national point of view. First of all a methodological review is provided, after which the secondary effects of floods for the studied area are indicated.

Introduction

Once the total direct flood damage has been determined (Du Plessis and Viljoen, 1998), it is possible to calculate the secondary effects of floods from a regional and national point of view. The total direct impact of floods is discussed and assessed from the point of view of the farmer. As a result of forward and backward linkages between different sectors, the real impact of floods has wider implications than in a mere direct sense and this is one of the reasons why secondary effects of floods are estimated.

The items that are regarded as flood damage and the extent of the damage will differ depending on the point of view from which it is approached. Thus, for example, a loss in turnover for the agricultural community may be regarded as a loss for the individual who suffers it, while from the point of view of the local community it does not imply any damage if it is cancelled by increased turnover by a different enterprise in the local community. Should the loss in turnover by an enterprise be cancelled outside the local community or region, it is not regarded as damage from a national point of view, but is still seen as such in a local or regional context.

The aim of this article is to determine the secondary effects of floods from a regional and national point of view. The input-output technique is used for this purpose. First of all a brief methodological review of the secondary effects of floods as seen from a regional and national point of view is given, after which the extent of the secondary effects of floods with different probabilities of occurrence is calculated.

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Methodological review

The input-output technique is used for estimating the secondary effects of floods; information which is important to public authorities. Information concerning the secondary effects of projects has little value for private enterprises, while in the case of public projects it is of great importance for the evaluation of economic profitability. It is important to measure the extent as well as the concentration of the ripple effects of projects. Bell, Hazell and Slade, as quoted by Kirsten (1989) stated that the ripple effects of an agricultural project are considerable and especially centred in the local economy. Miller and Blair, as quoted by Botha (1991), regarded the input-output technique as an excellent and powerful technique especially for providing answers to certain policy questions.

The input-output model is a mathematical representation of an economic system that provides a review of the transactions (sales and purchases) between the different sectors or industries within an economic system. Miller and Blair (1985) discussed demand, supply and price input-output models with the demand model dealing with the backward linkage effects, the supply model with the forward linkage effects and the price model with the influence of a change in prices. The demand model is used most often and is also regarded as the standard model. Van Seventer (1990), quoted by Botha (1991), warned against the simultaneous use of both the demand and supply models as this can result in double counting.

Assumptions and limitations of the input-output table

The input-output table is based on three basic suppositions, namely homogeneity, linearity and proportionality and Botha (1991) summarised these as follows:

- The homogeneity assumption proceeds from the assumption that all the industries in a specific sector are homogenrous in