

# Monitoring the bank storage dynamics component of the riparian water balance in the Sabie River, Kruger National Park

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## Abstract

Transpiration by riparian vegetation is a major consumptive water use in natural river systems, and must be considered when making water allocations for environmental conservation. Transpiration needs can be estimated by integrated modelling of bank storage dynamics, transpiration processes, and river hydraulics. Development and application of the bank storage model require field data describing the response of the phreatic surface to river stage fluctuations, the spatial and temporal distributions of water content in the unsaturated zone, and the geometry of the bedrock boundaries. A site on the Sabie River in the Kruger National Park, South Africa, is currently being monitored to collect such data. The phreatic surface response is interpreted to improve understanding of the nature of the subsurface flow, and its response to transpiration. Measurement of soil moisture by neutron probe and laboratory analysis has confirmed the effectiveness and reliability of the neutron probe method, and provided the necessary calibration data. Delineation of bedrock boundaries by physical probing and the use of ground-penetrating radar has demonstrated the effectiveness of the radar technique.

## Introduction

Bank storage dynamics in the riparian zone adjacent to a river channel determines water availability to riparian vegetation, and is an essential component of the riparian water balance. Although few studies have dealt directly with bank storage as a source of soil moisture in the riparian zone, considerable attention has been focused on the seepage from unlined canals due to its importance for the management of water resources (e.g. Todd and Bear, 1961; Bouwer, 1969; Worstell, 1976; and Wachyan and Rushton, 1987). These seepage studies generally involve the development of seepage rate formulae using theoretical analyses, laboratory studies, and limited field data. Wachyan and Rushton (1987) suggest that further detailed modelling and field studies be undertaken on the conditions within the soil zone adjacent to the channel.

A hydrological study involving monitoring groundwater response to river stage fluctuations at a site on the Skeena River floodplains in British Columbia, Canada, is described by Beaudry (1989). Specific high quality data were collected over the period 1986 to 1988, using intensive and extensive networks of piezometers located adjacent to backchannels. The data were collected to provide an understanding of the hydrology and environmental characteristics of the floodplains. Inadequate data on the physical characteristics of the site unfortunately preclude its use for verification of the numerical bank storage dynamics model described by Birkhead and James (1993).

The design and installation of monitoring systems for river stage and bank storage at a study site on the Sabie River, Kruger National Park (KNP) are presented here, and preliminary results are discussed. These data are necessary to verify a computational bank storage dynamics model.

The seven major rivers flowing through the KNP (Crocodile, Sabie, Olifants, Letaba, Shingwedzi, Levuvhu and Limpopo Rivers) all rise beyond its western border and drain catchments that are being subjected to increasing pressure for their available land and water resources (Fig. 1). This pressure results from the escalating

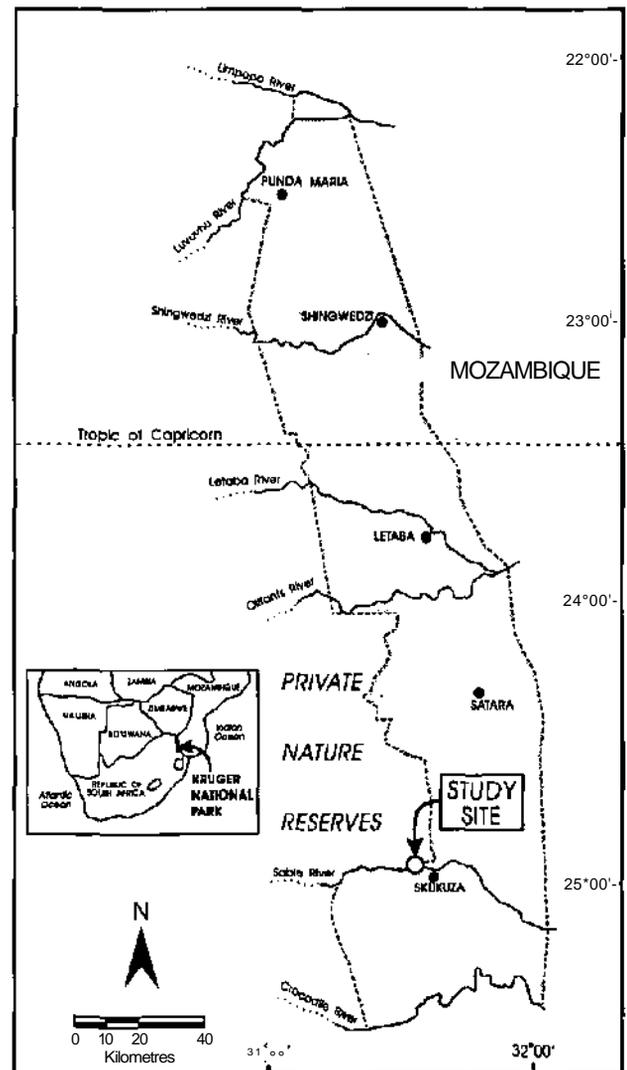


Figure 1  
Location of the study site along the Sabie River in the Kruger National Park

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