UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Managing the trade-off between conservation and exploitation of wetland services for economic well-being: The case of the Limpopo wetland in southern Africa

By

Wellington Jogo

Submitted in partial fulfilment of the requirements for the degree of

PhD Environmental Economics

In the
Department of Agricultural Economics,
Extension and Rural Development
Faculty of Natural and Agricultural Sciences
University of Pretoria
South Africa

August 2010

Dedication

To my daughter, Celine, and wife, Phillipa

Declaration

I declare that this thesis hereby submitted by me for the PhD degree in Environmental Economics at the University of Pretoria is entirely my own independent work and has not been submitted by me anywhere else for the award of a degree or otherwise.

Parts of the thesis have been published in journals.

Any errors in thinking or omissions are solely my responsibility.

Signed: _____ Date: _____

Name: Wellington Jogo.

Acknowledgements

I am very grateful to my supervisor, Professor Rashid Hassan, for his untiring support throughout my PhD programme. I acknowledge his high intellectual guidance and patience throughout the course of this work. His enormous contribution has really shaped this work to what it is.

This study benefited from the financial support of several institutions. The financial support received from the CEEPA-SIDA PhD programme is greatly appreciated. Further acknowledgement goes to the Challenge Program on Water and Food for research funding provided through Project Number 30, which is hosted by the International Water Management Institute (IWMI). The fellowship I was awarded by IWMI through its capacity-building programme is gratefully acknowledged. The author also acknowledges the International Start Secretariat for providing a START/PACOM Doctoral Research fellowship, which funded some stages of this work.

Various persons deserve to be accredited for the support they gave at various stages of this work. In particular, I would like to thank Dr Renneth Mano for his financial assistance during the early stages of my PhD programme without which I could not have proceeded this far. Dr Sylvie Morardet played a significant role in linking me to the project which funded this research. The contributions of Drs Sylvie Morardet, Mutsa Masiyandima and Dinis Juizo in the development of some components of the ecological-economic model are gratefully acknowledged. I also received some useful comments and references from Dr Donovan Kotze, Dr Sara Aniyar and Professor Max Finlayson which I acknowledge.

Many thanks go to Olalekan Adekola, Charles Mametja and local enumerators for helping in the collection of household survey data. I would also like to thank the people of Ga-Mampa for their cooperation and for offering their time and useful insights during the household survey.

I have benefited a lot from the wonderful atmosphere in the Department of Agricultural Economics, Extension and Rural Development. Special thanks go to Dr Eric Mungatana for his friendship, encouragement and, above all, brotherly advice. I treasure the comfort and encouragement received from my fellow PhD students in particular the following: Davison Chikazunga; Charles Nhemachena; Abebe Beyene; Temesgen Deressa; and Sinqobile Chumi.

My father, Benjamin Jogo sadly passed away before he could see the completion of this work. I would like to acknowledge the foundational support he gave me without which I wouldn't have proceeded this far. May his soul rest in peace.

The support, love and care of my daughter, Celine, and wife, Phillipa, inspired me particularly during the final stages of this thesis. Thank you for your unwavering support and patience during these trying times.

Finally, many others have contributed in various ways to the completion of this thesis, and although not mentioned by name, you are really appreciated.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Managing the trade-off between conservation and exploitation of wetland services for economic well-being: The case of the Limpopo wetland in southern Africa

By

Wellington Jogo

Degree: PhD Environmental Economics
Supervisor: Professor Rashid M. Hassan
Department: Agricultural Economics, Extension and Rural Development

Abstract

This study had two main objectives. The first objective was to determine the factors that influence rural households' labour allocation and supply decisions for competing livelihood activities, including wetland activities. The second objective was to: develop an ecological-economic model establishing the linkages between the economic and ecological components in a wetland system and apply the model to evaluate the impacts of alternative wetland management and policy regimes on wetland functioning; and supply ecosystem services and economic well-being.

To achieve the first objective an agricultural household framework was used. The reduced form labour use and supply equations for wetland products and agricultural grain, derived from optimising the agricultural household model, were estimated jointly using a seemingly unrelated regression model. The model was fitted to data collected from a survey of 143 households in a wetland system in the Limpopo basin of South Africa.

Results showed that poor households, most of whom are female-headed households, have less capacity to participate in off-farm employment and rely heavily on farm and wetland activities for their livelihood. This implies that environmental protection policies that limit access to the wetland resources will deepen poverty as the poor will suffer more from deprivation of resources, which play a key role as a livelihoods safety net for the poor. This suggests that in order to enhance the sustainable management of wetlands there is need to identify and promote local level wetland management practices that allow the poor to use wetlands to enhance their economic well-being with minimum adverse effects on wetland ecological conditions instead of adopting strict wetland protection measures. In addition, there is also a need to broaden the opportunities for the poor to diversify into off-farm livelihood activities. This minimises the risks of income fluctuations associated with farm and natural resource-base livelihood sources and therefore provides the necessary positive incentives for wetland conservation and sustainable use. Better access to education is an important instrument for enhancing the poor's ability to diversify into off-farm livelihood options. These results suggest that wetland conservation and sustainable use has to be integrated with the broader rural poverty reduction initiatives such as: improved access to education; investment in irrigation infrastructure; and improving access to markets.

Results also indicate that a household's exogenous income and wealth status (asset endowment) enhance farm production whilst reducing dependence on wetland products for livelihood. The government should pursue policy measures that reduce rural household liquidity constraints and enhance investment in productive assets (e.g. improving rural household access to credit and off-farm income opportunities) to boost farm production and enhance wetland conservation and sustainable use.

To achieve the second objective the study developed a dynamic ecological-economic model. The model is based on the system dynamics framework to capture the multiple interactions and feedback effects between ecological and economic systems. The application of the model in simulating policy scenarios suggests that wetland ecosystem

services (crop production and natural resource harvesting) are interlinked with trade-offs involved through their competition for labour, water and land resources. Policy scenario simulation results showed that diversifying livelihoods out of agriculture simultaneously improves economic well-being and enhances wetland conservation. Pure conservation strategies impose significant losses in the economic welfare of the local population unless supported by diversification of livelihood sources. The simulation results also show that the development of a competitive marketing system for harvested biomass products increases returns to wetland biomass products relative to that of wetland grain and it reduces conversion of wetlands to agriculture. Simulation of the predicted reduction in annual precipitation due to climate change in southern Africa showed that climate change is likely to accelerate the conversion of wetlands to agriculture, confirming the important role wetlands play in managing climate variability in smallholder agricultural systems. Government policies that support livelihood diversification into off-farm livelihood opportunities and improve the capacity of the rural poor to adapt to climate change, especially droughts, are critical for wetland conservation and sustainable use.

Keywords: wetlands; southern Africa; agricultural household model; labour allocation decisions; dynamic ecological-economic models; human well-being; ecological security.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Acronyms and Abbreviations

CBA	Cost-Benefit Analysis
CPI	Consumer Price Index
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GLWD	Great Lakes and Wetlands Database
MCA	Multi-criteria Analysis
MEA	Millennium Ecosystem Assessment
NTFP	Non-Timber Forest Products
PCA	Principal Component Analysis
SAR	South Africa Rand
SUR	Seemingly Unrelated Regressions
UNDP	United Nations Development Programme
USD	United States Dollars
USFWS	United States Fish and Wildlife Service