Chapter 13
Application of Quantitative Methods in Natural Resource Management in Africa: A Review

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ABSTRACT

Sub-Saharan Africa (SSA)'s natural resource base constitutes the sub-continent's greatest asset. These Natural Resources (NRs), both renewable and non-renewable, are the backbone of the continent as they play very critical functions in the livelihood strategies of the people. There are a wide range of questions and issues concerning the proper management of these NRs. One of the issues relates to the economics of resource preservation, which includes questions associated with the quantifiable benefits of resource preservation, the environmental costs and benefits of Soil and Water Conservation (SWC) strategies, the economic impact of land use changes, and valuation of ecosystem goods and services. The other issue concerns the ecosystem and economic system interaction. Particular themes of interest are the co-management of natural resources, trans-boundary natural resource management, and the management of resources to reconcile revenue generation, social development, and environmental services of natural resources. This chapter reviews the literature on quantitative approaches that have been undertaken to enhance the understanding of selected Natural Resource Management (NRM) problems on the continent. The review suggests that a wide range of quantitative approaches have been applied in the context of the African resource economics literature, but this review also identifies some specific areas that have received little attention.

DOI: 10.4018/978-1-4666-4329-1.ch013

1. INTRODUCTION

The African continent is richly endowed with natural resources. These resources constitute a backbone of the livelihood strategies of the people in the continent. The study of these resources is clearly of great importance to researchers in Africa. Unfortunately, Natural Resources (NR), renewable and non-renewable, present some peculiarities that make empirical approaches to understanding them somehow complex. To name a few, first, NR involve many dimensions that combine economic, social, environmental, and political considerations and objectives. Hence, proper understanding of their management will draw from a wide range of fields including law, population biology, petroleum engineering, ecology, hydrology, entomology, geography and many others (Wilen, 1985). Secondly, they evolve over time and space. Thirdly, NR problems may involve a wide range of stakeholders with differing objective and utility functions and use values. Fourthly, they are not homogenous in nature. Fifthly, they may not be any market for some of the products thereby making market valuation difficult. Sixthly, the abundance or absence thereof of NR in a particular country or region does not necessarily mean that it would be profitable for them to be exploited.

The aim of the present review is to provide a critical analysis of the empirical literature with respect to addressing Natural Resource Management (NRM) problems within the context of Africa. The entry point of this review is, however, not the application of empirical approaches but rather the review of how specific NRM problems have been addressed using quantitative approaches. While there is a danger of this chapter ending up being too broad and insufficient depth, it makes the point of the dearth of applications in addressing key NR management problems on the continent. Consequently, it demonstrates the urgency in building the capacity of researchers at African universities and other research institutions to be able to undertake such rigorous research.

There are six main parts to this chapter. Section 2 identifies and examines very briefly a select number of major questions concerning the management of NR that should be of interest to the student of NRM issues in the African continent. The questions are not meant to be exhaustive but to provide a baseline for addressing the issues. In section 3, a review of the state of knowledge is presented based on peer-reviewed works and available gray literature. The approach in this section is to review the state of the knowledge with respect to addressing critical NRM questions identified in section 2. Section 4 examines the challenges that emerge from the review of previous research. Implications for future research and for capacity building are outlined in section 5. The final section provides a summary and conclusion.

2. NATURAL RESOURCE MANAGEMENT

It would be too ambitious to attempt an examination of all key NRM challenges and critical issues in just one chapter. Therefore, this chapter addresses only a select number of NRM considerations that are relevant to SSA. Specifically, this review focuses on two areas: (1) the economics of resource preservation and management and (2) ecosystem and economic system interaction.

2.1. Economics of Resource Preservation and Management

Concern over the sustainability of the earth's endowments has been reflected in economic literature at least from the time of Malthus. For Malthus, population was increasing faster than the scarce resources of nature to sustain human economic