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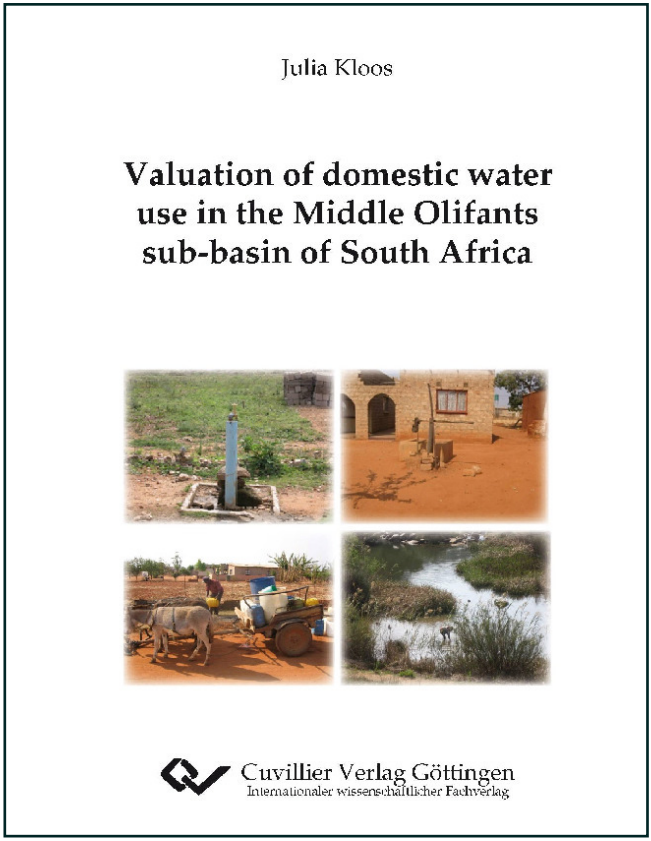
Valuation of domestic water use in the Middle Olifants sub-basin of South Africa



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Chapter 1

Introduction and objectives

1.1 Introduction

Access to improved drinking water has long been recognized as one of the main challenges of development. UN (2000) acknowledges the right to water at the level of the individual, which implies access to a minimum amount of water sufficient to cover basic needs. Progress towards universal achievement of this minimum level of water is associated with substantial health gains and remains a focus on international policy initiatives through the declaration of the Millennium Development Goals (MDGs). One of the targets of the MDGs is to reduce by half the proportion of people that have no sustainable access to safe drinking water by 2015 [UN, 2000].

WHO defines domestic water as 'water used for all usual domestic purposes including consumption, bathing and food preparation' [Howard and Bartram, 2003]. Access to domestic water in developing countries encompasses many forms and varies widely between regions, especially urban and rural areas [Komives et al., 2005]. Households may use unimproved water sources such as rivers or boreholes, they buy water from neighbors, water kiosks or water tanks, have private in-house connections to the water network or collect water from public taps and standpipes. Usually, not only a single water source is used throughout the year but different water sources are combined depending on seasons and other conditions [Statistics-South-Africa, 2007].

Water resources are unevenly distributed in time and space and are found to be increasingly under pressure due to major population changes and increased demand from various water users. Water use worldwide has been growing at more than twice the rate of the population increase in the last century, and, although there is no global water scarcity as such, an increasing number of regions are chronically short of water [FAO, 2006].

In these water scarce regions, households are found to compete more and more with the agricultural sector, which demands water for food production, and industrial water needs. Water overuse tends to threaten sustainability and to have negative impacts on the environment. In order to sustain water needs from different water users and the environment, a shift towards efficient use of water sources, water allocation strategies that maximize the economic and social

returns to limited water resources, and, at the same, time enhance the water productivity of all sectors and ensure environmental sustainability is needed [FAO, 2006].

Optimal water allocation is based on economic valuation and, therefore, economic valuation of water is becoming more and more important for policy-makers which are faced with planning processes in water management and aim to achieve an efficient water allocation. Economic valuation refers to attaching a monetary value to water and water services using specific valuation techniques. Net benefits of different water management alternatives can, hence, be compared to identify the most suitable option [Unesco, 2006].

Various characteristics of water such as physical, cultural, political and economic factors make water special in terms of its valuation. Domestic water use has characteristics of a private good when households have access to a private water connection, but also characteristics of a public good - when water sources are communally used. Existing and functioning markets for water allow for demand estimation using actual prices to value water while especially in developing countries, where domestic water is often not priced, non-market valuation techniques based on 'Willingness to pay' are applied.

The concept of 'Willingness to pay' refers to the amount of income households are willing to give away in order to receive some improvement in circumstances such as an improvement in water services (or avoid a deterioration). But a low 'Willingness to pay' may not necessarily reflect a low preference, but a low ability to pay. Low-income households may have a lower 'Willingness to pay' due to their limited income capacities. In this endeavor, there needs to be a special focus on issues related to low-income households to ensure equity in access to water and on the social impacts of water allocation policies.

In economic terms, water provision can be categorized as a multi-attribute product [le Blanc, 2008]. Water services can be defined by several dimensions: price, quantity, and quality are most commonly referred to [le Blanc, 2008], but also frequency of supply in terms of days and hours, distance of the water source, waiting time and other attributes play a role. Households may receive very different service levels with regard to these attributes [Komives et al., 2005] and may characterize water services from very poor to excellent depending on them. Therefore, these differences in service levels have to be taken into account when water services are evaluated.

As the provision of water services induces costs, cost recovery is regarded as a central element of a sustainable provision of water services, and a precondition for improvement of quality levels and extension of access to improved water sources in rural areas. Therefore, criteria such as financial sustainability and the 'user pays' principle are applied when setting tariffs. Policy-makers widely recognize a basic amount of water that is essential for life and health. Charging all households equally according to the 'user pays' principle would be comparable to denying access a basic amount of water for households who cannot afford paying. In certain cases, people need more water than they are willing or able to pay for, so policies are designed to help the poor satisfy basic water needs and address water security [Unesco, 2006]. Multiple

criteria influence policy decisions on appropriate tariff structures. Tariff-setting must balance both costs[1] and value considerations such as 'Willingness to pay'.

Economic valuation is therefore an essential tool for water management in order to identify the value of water at the level of water user groups, but it can also identify differences in valuation within a specific user group. Valuing water use of households by using the 'Willingness to pay'-principle needs consideration of household characteristics - especially income - to be able to avoid negative social impacts of an efficient water allocation.

1.2 Motivation of the study and research questions

Located in a semi-arid region in the North-West of South Africa, available water resources in the Olifants River basin are used by different water user groups like growing industries, especially mines, households living in rapidly and uncontrolled growing settlements, large and small-scale farmers with irrigation activities as well as power plants. It is counted as the third most water stressed basin in South Africa [DWAF, 2004]. The Olifants River is of special ecological importance because it enters Krueger National Park and underlies transboundary commitments with Mozambique [Unesco, 2004]. Severe overexploitation of water resources at the expense of ecological functions and the availability of water for basic human needs already takes place in the Middle Olifants - a sub-basin of the Olifants River basin.

While South Africa already successfully achieved the MDG target of halving the proportion of people lacking access to safe water by 2015[2], still 9 million people mostly in rural areas lack access to water [Unesco, 2006]. Especially the predominant rural population in the Middle Olifants sub-basin is disadvantaged in terms of accessing potable water for domestic purposes [Levite and Sally, 2002, DWAF, 2004]. South African water policy was basically reformed from 1994 onwards and the new water law stands out due to a constitutional right to water in which water is formally recognized as a human right [Constitution, 1996]. In order to ensure this, the national Free Basic Water (FBW) policy was implemented. Water is recognized as an economic (Dublin principles) but also as a social good; access to water is granted for all households (NWA, 1998). At the institutional level, Catchment Management Agencies (CMAs) are established in all Water Management Areas (WMAs). They are responsible for water resource planning and management at the catchment level addressing the new policy goals of equity in access to and benefits from water, economically optimal water uses and long term sustainability including ecological functioning. This is in accordance with the principles that, globally, tend to be seen as best practices of Integrated Water Resources Management (IWRM)[3]. The IWRM-approach has received much attention and it has been one of the most important policy issues for the post-apartheid regime in South Africa. IWRM is a tool to increase water use efficiency, equity in

[1] A discussion of costs in terms of full supply costs, full economic costs and full costs can be found in Unesco (2006).

[2] reduced from 40 percent to 19 percent since 1994.

[3] For a definition of IWRM and important concepts see appendix

access to water and environmental and ecological sustainability [GWP, 2000] and thus suitable to address the South African policy objectives.

Since current water use practices do not meet the objectives, reallocation of water from low to high value uses and in a way that promotes social equity and sustainability is needed. Despite the recognition that water is an economic good, the current prevailing approach to water allocation in South Africa is strongly administrative. In other words, it is based predominantly on the relevant administration (the CMA) to allocate water in order to reach the above policy goals [PDG, 2004]. The water scarcity in the basin makes a detailed planning and management of water resources between the major water user groups - households, industries and commercial farmers - necessary to prevent negative effects of overuse. The prevalent tools, registration and licensing of water users, address water allocation in an administrative way. Before licenses are distributed, a registration process which captures all water users and their current water needs takes place. But it is a rather static approach that cannot capture the effects of some influencing factors or changing prices and does not ensure an economic efficient water allocation.

Due to the complexity of water management caused by physical, economic and socio-economic dependencies, research is required to assist the new institutional settings providing information on economic valuation of all water uses at the catchment level. This study is conducted as part of the project "Integrated Water Resources Management Pilot Project in the Middle Olifants sub-basin of South Africa ('IWRM Middle Olifants')" which aims to provide a modeling tool based on the economic valuation of different water uses in the sub-basin and optimizes water use in a way that ensures equity in access, efficiency and sustainability of water use. The 'IWRM Middle Olifants'-project estimates aggregate demand functions of the most important water users in the sub-basin - households, commercial farmers and mines - and maximizes benefits under considerations of efficiency, equity and sustainability given the available water yield determined by a hydrological model. This yields an optimal allocation of water and the respective shadow prices for the different water users. No reallocation of water could generate higher welfare from the available water resources. Such a modeling tool is useful for the responsible planning institution at the basin-level (CMA) to be in a better position to plan and forecast water demands of all water users when some conditions change and to be able to forecast effects of increasing water prices on demand. As sub-project within the framework of the 'IWRM Middle Olifants' - project, this study has its focus on domestic water use addressing the following research questions:

- What is the current situation of households with regard to access to water? What kind of service levels do households receive at different water sources and how much water do they actually use?
- Which water service attributes do households value most and how much would they be willing to pay for different water services? What are important factors that influence 'Willingness to pay' and how is it connected to their ability to pay?

- What kind of subsidies can help to ensure access to water and payment of water bills by low-income households? How do households value mechanisms used to increase payment rates such as prepaid payment meters?

1.3 Objectives

Specific objectives of this study are:

1. To characterize current access of households to water.

   Collecting household-level data on water sources, distances and waiting times as well as socio-economic characteristics is usually done in the South African Census and the 'Household Survey' by Statistics Services, South Africa (StatsSA). Findings are then presented at the smallest aggregate level of local municipalities and enumeration areas. This snapshot of access to water tends to underestimate the number of households without adequate services because it is based on proximity or use of a water source rather than on the quality and reliability of service that users actually obtain [Komives et al., 2005]. Though two households can be categorized as having access to a public tap, it makes a difference whether water is provided once a week or every day. So far, there is little information on a detailed characterization of water service levels in terms of all important attributes such as frequency of supply, hours of supply and quantities used from each water source that allows describing the situation of households at the catchment level.

2. To analyze preferences and 'Willingness to pay' for different domestic water services.

   A better understanding of the values that households place on important characteristics of water services and the determinants of their economic behavior and choices is necessary to provide policy-makers with important information. Valuation of domestic water services reflects preferences of households with regard to water service attributes and is useful to detect which service attributes provide the strongest utility to households to be improved first. When calculating 'Willingness to pay', factors contributing to heterogeneity of households' preferences need to be considered. It is helpful for water authorities to know how much households are willing to pay for single attributes given households' financial capacities and other characteristics as well as their welfare gains introduced by clearly defined improvements in water services. As water is a continuous good, corresponding quantities and impacts on water demand have to be considered explicitly.

3. To analyze the opportunities of different policy interventions on improving access to water for low-income households.

In the year 2000, the responsibility for water services was shifted to local governments and national government has steadily decreased financial and technical support. Municipalities in

the capacity of water services providers are under considerable pressure to become financially self-sufficient and to recover service-related costs from all areas including poor communities [Tissington et al., 2008]. This means that reaching cost-recovery of water services, may come at the expense of low-income households. Knowing 'Willingness to pay' of low-income households given their financial constraints contributes to a better design of water tariffs and subsidization schemes.

1.4 Outline of the study

This research is divided into five chapters. After the introductory chapter 1, chapter 2 presents background information on water use and availability in the study area - the Middle Olifants sub-basin -, the legislative framework of water management as well as the practical implementation of IWRM in South Africa. Chapter 3 focuses on concepts and techniques available for economic valuation of water with special emphasis on non-market techniques and embeds economic valuation into the general consumer theory and welfare theory. Special attention is given to the differences between continuous and discrete data. In this chapter the choice of the appropriate valuation technique is discussed in detail. Chapter 4 presents the procedures, analyses and results of a household survey conducted in the Middle Olifants. Following sampling procedures, structure of the questionnaire and design of the choice experiments, a description of the situation of households with regard to water services quality, water quantity, water use and pricing of water is given. Data analysis with a latent class model aimed at a special consideration of household characteristics such as income, current water services, and attitudes of households in the estimation of 'Willingness to pay'. Chapter 5 concludes the whole study by presenting a summary and discussion of the main findings, addressing policy implications and finally providing suggestions for future research.