Productive water uses at household level in rural Kenya: case study of the Ukambani district

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Introduction

Nowadays it is widely acknowledged that water is critical to all production chains of the economy. Its available quantity and quality affects output and economic growth (Sullivan, 2002; Biltonen and Dalton 2003). As human population grows, and as the level of economic development increases, human needs for water are growing and competition between different users (agriculture, industry, households, energy, environment) increases (Soussan, 2003; Rosegrant et al., 2002; Bouhia, 2001). This increasing pressure on water resources has resulted in a shift to a more holistic approach of water management, the integrated water resource management approach (IWRM). This approach outlines the evaluation in an integrated way of the complex system of interactions between the multiple bio-physical and socio-economic demands co-existing in a river basin. To manage water resources efficiently it prescribes that decisions should be based on attributing correct values to water uses.

Another recent shift in thinking on water management is the acknowledgement of the multiple uses of water within sectors (see fig. 1). In the past, a purely sectoral division of water uses was made, identifying agricultural, industrial and municipal water use. This arbitrary division does not correspond with reality. It neglects the importance of irrigation water for domestic purposes or the fact that municipal water is used for productive enterprises like home gardens etc…(Bustamante et al., 2004; Meinzen-Dick and Bakker, 2001; Bakker et al., 1999). The second panel of fig. 1 demonstrates how various activities take place in the overlapping areas between traditionally identified water-using sectors. Small-scale agro-processing for example occurs at the intersection of agricultural, industrial and municipal water use, while small-scale livestock farming mostly consumes municipal or agricultural water. Ignoring these multiple uses of water distorts the benefits attributed to water. In this way recognizing the multiple uses of water is complimentary to IWRM: it helps to assign more correct values to water uses.

Productive uses of domestic water

One of the benefits of water use certainly not to be neglected is the positive impact on the livelihoods of the poor. Especially in the extensive semi-arid and arid areas of the developing world, rural livelihoods are strongly influenced by water use (Hope et al., 2003a). The impact goes further than the traditional public health benefits attributed to it (Moriaty and Butterworth, 2003a). Water can also be a resource used in or necessary for productive activities and its collection is important in terms of time consumption (Makoni et al., 2004; Soussan, 2003; Pollard et al., 2002). Following categories of water use by rural communities can be identified (Mokgope and Butterworth, 2001): 1) Water for basic human needs – these uses are focused on survival, providing water for drinking, cooking, sanitation and hygiene, with mainly health impacts and benefits; 2) Water for productive activities – these uses impact on food security or income. Output may serve own consumption (subsistence production of vegetables, brick-making) or the market (sale of vegetables, fruits or ice blocks). Activities may also be associated with providing services (e.g. hair salons); 3) Water for other activities – these uses are not focused on production and mainly have religious or environmental significance.

As a productive asset for the poor, water is thus generating both financial and non-financial livelihood benefits (ODI, 2002; ODI, 2003). Better understanding and analysis on how exactly these productive water uses affect the livelihood of the poor has a huge potential to add to the goal of reducing rural poverty. Hence, benefits from productive water uses should not only be taken into account within water resources management but also within poverty reduction strategies (Hope et al., 2003b; Moriaty and Butterworth, 2003b; Wateraid, 2001). Currently however, the contributions to livelihoods of productive water use at the household level, and in 'informal' village-based enterprises are even rarely considered in water resource management planning (Perez de Mendiguren, 2003; Mokgope and Butterworth, 2001). The first objective of this study therefore is to identify the productive water use activities in which the study population participates and to get an idea of the rate of involvement. Secondly, the water use for the activities is assessed, and finally the benefits in terms of income contribution or contribution to the nutritional status are evaluated.

Study area and survey

The study area is located in the administrative region of Eastern Province of Kenya (see fig. 2). The Ukambani community consists of approximately 2.5 million people scattered over an area of approximately 44,680 km². The community is divided into four administrative districts: Kitui, Machakos, Makueni and Mwingi. The main source of income for the rural community is subsistence agriculture. As to agricultural potential, the region is divided in three zones namely a semi dry area, with no potential and at best one harvest per year; a semi arid zone, with possibility of two crop yields per year except for maize; and a hilly zone, which is likely to have two crop yields. Most of the region is classified as semi arid, with rainfall levels between 400 to 900 mm per annum (Moresmau and Hanne, 2004). Due to the unfavorable climatic conditions a high percentage of the population is living below the poverty line and experiences frequent food shortage and water scarcity. This situation is deteriorated by underdeveloped water infrastructure.

A project of the Belgian Technical Cooperation (BTC) was selected as entry point to the study population, allowing easy access to the community. The Integrated Natural Resource

Management in Ukambani (INRMU) project was chosen as most appropriate for this study because one of its components deals with water use efficiency. The sample population for the questionnaires was restricted to two districts of Ukambani community namely Machakos and Makueni. The survey was carried out during January 2005. The population of the two districts was further stratified into two strata: the first strata comprising households participating in the BTC project, and the second strata comprising households not participating. Both strata were selected from the same area in accordance with the Central Bureau of Statistics list of enumeration areas as contained in Kenya's Demographic and Population Census of 1999 (Central bureau of statistics, 2001). Sixty-three households were randomly selected over the strata: 31 in the project and 32 outside the project. The household was used as unit of analysis because it forms the basis of the socio-economic structure. Information gathered covered water use patterns and livelihood aspects. Furthermore, focus group discussions were organized to elaborate on certain issues covered in the questionnaires (Ochieng, 2005).

Results and discussion

Sample population characteristics

The main occupation of the sample population is farming with 80.7% of the population involved in this activity. Other occupations mentioned are trading and salaried employment, accounting for 7.0% and 12.3% respectively. The monetary income of the households ranges between Ksh. 500/month and Ksh. 55000/month with an average of Ksh. 8369/month. The large range is indicative for the large variability in incomes. Moreover, the majority of the households relies on several income sources. The most common income earning activities are production and sales of food crops, vegetables and livestock products. To many households salaried work is also important. When households participating in the project and non-participants are compared, the average monthly income of the latter is lower: Ksh. 5757 compared to Ksh. 11271. This difference was shown to be significant (p=0.026) in an independent sample t-test.

Water use characteristics

Table 1 presents the water use characteristics of the sample population. It can be seen that households spend on average nearly two hours on water collection. Furthermore, distances from a water source range from 50m up to 7km. Most of the households in the sample (79%) use water from a communal water point. This has an impact on the involvement in productive water use activities. Because of existing agreements on the use of the water, households with communal water access are often more limited in the amount of water they can use. As a result, it can be seen that households with a communal access are involved less (51%) in productive water use activities compared to households with a private access (92%). This is in accordance with the findings of Hope et al. (2003a), who noted a positive relationship between the tendency of being involved in vegetable irrigation and the ownership of a private water supply. Another reason not to involve in productive water use activities might be the costs linked to water. Mokgope and Butterworth (2001) confirmed this hypothesis in their study on rural productive water use. A similar finding resulted from the focus group interviews, where fluctuating water prices were put forward as important obstacles for the poor to participate in water dependent activities. Since these fluctuations are mainly determined by the degree of scarcity, one way of overcoming the problem is assuring a steady water supply throughout the year. This can be achieved by introducing storage of water. Barron et al. (2003) indeed showed for the same study area that participation in crop production augmented by increasing storage capacity. Currently however, storage capacity is highly variable between households in the sample (see table 1) and no significant link between storage and involvement in productive water uses could be established.

For basic needs (cooking, hygiene, washing) households appear to use similar amounts of water per capita. This finding is in accordance with what Thompson et al. (2001) found for Kenya.

Evaluation of productive water uses

Three productive water use activities were identified by the community: crop production, water sales and livestock production (see table 2). Respectively 46%, 5% and 49% of the respondents were involved in these activities. No significant difference in involvement in these activities could be established between those participating in the BTC-project and the non-participants. When considering the entire population, the average productive water use per household consisted of 448 l/day. If only the households that actually use water for productive purposes are taken into account, the average use becomes 638.5 l/day. Incomes generated by these activities are also presented in table 2. The highest monthly income contribution is generated by vegetable production, which on average adds Ksh. 7564. per month, making it the main component of the cash income of many households. Contributions made by livestock related activities or water sales are considerably lower.

To test if involvement in productive water uses impacts significantly on the household income a number of lineair regressions was carried out. In these regressions dummy variables were used for the involvement (0=not involved, 1=involved). Summary of the regression results is given in table 3. It was shown that involvement in vegetable production has a significant influence (1% level) on the monthly household income. Mathew (2003) found a similar result for productive water point gardens in Zimbabwe. Involvement in livestock related activities or water sales on the other hand did not have a significant impact on the income. By any means, this does not imply that the role of livestock can be neglected. The fact that the average ownership consists of a limited number of animals, rather suggests that these animals are mostly kept as an additional source of food. As such, livestock will not necessary influence household income significantly, but will have impact on the nutritional status. This hypothesis was tested by looking at the protein diversity of the diets of the households. Based on a list of food items consumed by the households during one week households were divided into three categories: (1) having only beans and peas as protein source, (2) supplementing beans and peas with animal proteins and (3) using beans and animal proteins, but no peas. Crosstabulations show that protein sources of the diets are significantly different for participants and non-participants in productive water activities (table 4). The Chi-Square test statistic is significant at the 10% level[1]. Diet categories 2 and 3 proved to be more associated with participants of productive water use activities. These two diet categories, containing animal proteins, might be regarded as superior to category 1. The nutritional superiority of these diets results mainly from the presence of micronutrients , which otherwise are often lacking in the diet of the sample population.

Conclusions

The majority of the community is involved in productive water uses. Activities are mostly farm-based and particularly vegetable production is favored. Involvement in off farm activities seems still very limited. The study confirms the direct link existing between domestic water utilization and livelihood. Two livelihood impacts were assessed in this study: effect on income and effect on nutritional status. It was shown that vegetable production in home gardens contributes significantly to the household income. However, statements in the focus group interviews indicate that complementary measures, such as marketing support for the vegetables, might be necessary to fully exploit the benefits ascribed to productive water uses. This is consistent with the general view that impacts depend on other constraints, like access to other resources (land,

[1] $\chi^2(2, N = 53) = 5.31$, $p = 0.07$

credit) or limited market infrastructure (Moriaty and Butterworth, 2003b). Finally, it was revealed that households involved in productive water activities put more variation in their daily diets compared to those not participating in such activities. The most discriminating aspect between both diets is the significantly higher consumption of animal proteins in the diets of the former. This is very important in the context of animal protein scarce diets like those occurring in the study area. Further research on the effects of productive water uses at household level on calorie intake or on other livelihood aspects such as vulnerability to shocks could help to draw up an adequate picture of the benefits related to these uses. This would not only be beneficial in the light of IWRM, but could also elucidate the role these uses can play in poverty reduction.

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Tables and figures:

Table 1. Water use characteristics of the sample population

Water use characteristic	Mean	Range	Water use characteristic	
Time spent/day (min)	111	0-360	% of households with	
Distance from source (km)	1.48	0-7	- private access	21
Storage capacity (l)	838	0-10000	- communal access	79
Domestic use per capita (l)	25	17-35		

Table 2. Productive water uses and their contribution to household incomes

	Participation rate (%)	Average income generated (Ksh.)	Range of income contributions (Ksh.)	Average amount of water used per day (l)
Vegetable production	46	7564	240-24000	672.6
Livestock related activities	49	2474.6	30- 8540	69.44
Water sales	5	3166.7	2000-4500	753

Table 3. Relationship between monthly household income and involvement in productive water uses

Independent variable	Coefficients	t-ratios
Regression 1		
Constant	4622.6***	2.925
Involvement in vegetable production	7185.0***	2.905
Regression 2		
Constant	8015.5***	6.356
Involvement in water trade	3284.5	0.608
Regression 3		
Constant	5878.8**	2.141
Involvement in livestock activities	2925.6	0.923

*** indicates significance at the 1% level ; ** indicates significance at the 5% level and * indicates significance at the 10% level

Table 4. Crosstabulation: Protein diversity in diet and participation in productive water use activities

			Protein diversity		
			Category 1	Category 2	Category 3
Participation in productive water use activity	Yes	Count	8	14	6
		Percentage	15.1%	26.4%	11.3%
	No	Count	15	7	3
		Percentage	28.3%	13.2%	5.7%

Fig. 1. Shift from sectoral approach of water use to the concept of multiple uses

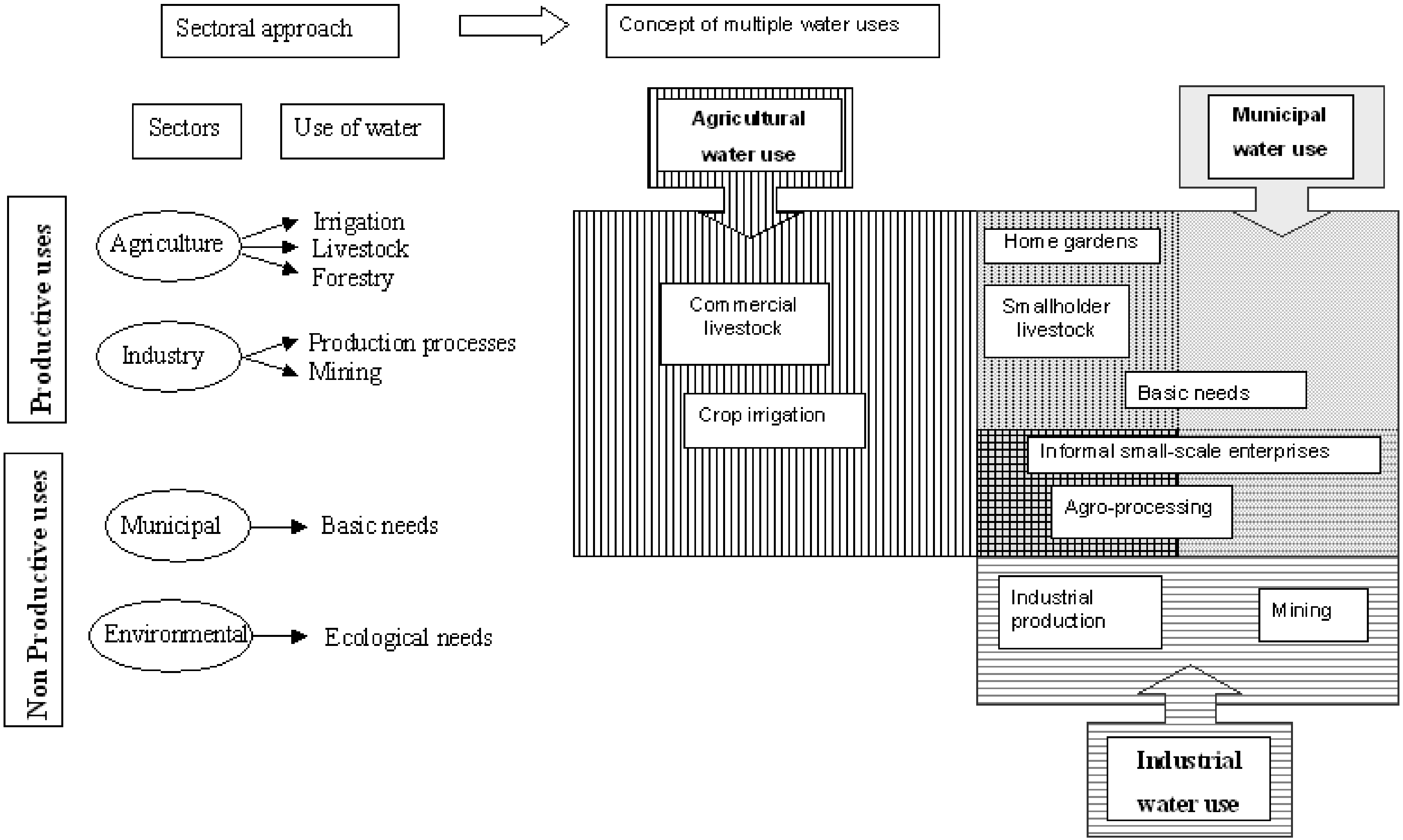

Fig. 2. Situation of the study area