Participatory Policy Development for Integrated Watershed Management in Uganda's highlands

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Thesis

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Table of Contents

Chapter 1

Introduction

Introduction

1.1 Resource degradation in Uganda's highlands

Current agricultural practices in the Ugandan highlands have resulted in severe natural resource degradation, which forms a serious threat to food security for the local population. The problem of soil erosion occurs mostly in the highlands which are, because of their fertile volcanic soils and abundant rainfall, among the most densely populated areas in the country (NEMA, 2008). In the steeply sloping highlands, soil erosion affects 60% to 90% of the total land area (Opondo et al., 2006).

The present agricultural practices involve removal of trees and other natural vegetation on slopes and their replacement with annual crops. Maize is a favourite crop, but a poor cover crop which exposes the soil to the erosive forces of rain. Soil erosion not only results in persistent reduction in crop yields through the loss of the fertile top soil but also in river sedimentation and flooding in the downstream areas (NEMA, 2002).

The population of Uganda is growing rapidly; it has increased from 24.2 million persons in 2002 to 30.7 million in 2009 (UBOS, 2010) and 33 million in 2011 (Population Secretariat, 2011; UBOS, 2010). Of this population, 70% depends on agriculture for their livelihoods. With this population growth, pressure on the natural resources is mounting fast. Furthermore Uganda is a poor country characterized by limited livelihood options for the rural population. The combination of increasing population pressure on resources, continuing resource degradation despite existing conservation efforts, and limited livelihood options shows an urgent need for a new policy strategy which will ensure improved livelihoods for the local population.

This introductory chapter explores and introduces the different aspects of new policies and management approaches to cope with such problems, as background to the research questions and study area for the rest of the thesis. Hence, in the subsequent two sections new policies and especially Integrated Watershed Management are introduced, in which participation of local stakeholders forms an essential element. Section 4 analyses the kind of information requirements that are necessary for such new participatory watershed management approaches. Section 5 introduces the research questions that are central in this thesis, to be followed by an introduction to the study area, Ngenge watershed in eastern Uganda. The chapter closes with an overview of the remaining part of the thesis.

1.2 Need for a new policy strategy

The continuing degradation of natural resources threatens the very livelihood of the rural population in the Ugandan highlands (NEMA, 2008) and creates an urgent need for mitigation measures. Watershed management practices that involve changes in land use and vegetation cover, with the main objective protection of soil and water systems, are required. To be successful, these practices have to aim at improvement of the standard of living of the population of the watersheds by increasing land productivity so that sustainable livelihoods and sustainable land use practices can be secured for the population (Alemayehu et al., 2009; Mahdi et al., 2009). Mechanisms to minimize erosion need to be devised to also limit sedimentation. Appropriate land-use and land management practices that maintain extensive ground cover are useful in reducing soil loss and sediment delivery (Tamene and Vlek, 2007). Aided by the African Highlands Initiative (AHI) and other development partners, the Government of Uganda is therefore designing and implementing policies and strategies to address poverty, land degradation and declining agricultural productivity. However, this is no simple matter.

Existing policies on natural resource management have not been implemented successfully and as a result soil and water conservation measures are not practiced adequately (NEMA, 2008; Larsen et al., 2008). The existing policies and legislation for natural resource management in Uganda despite being well formulated are inadequate from the perspective of the primary stakeholders, the people (often farmers) directly dependent on the resources for their livelihood. The policies continue to be formulated and implemented without considering local conditions and practices in each area. This has been documented being the case since colonial times (Stockdale, 1937 and Stocking, 1985). The initiatives for formulating policies to combat land degradation seem to come from different 'outsides' (Schippers, 2008). It has become apparent that long-term changes in governance structure and underlying values and paradigms cannot occur within a water management regime in isolation from the societal context (Hisschemoller and Mol, 2002; Tippet et al., 2005). And worldwide more and more people involved in soil and water conservation realize that the long-practiced top-down planning approach was wrong and resulted in recommendations that were perceived not as immediate farmer priorities (EROAHI, 2005; Petts, 2006; Carter, 2008; Sanginga, 2005; Ganesh and Schmidt-Vogt, 2009). Policies can only succeed if they are formulated and implemented by involving the farmers themselves (AGILE, 2007). But, most policies and legislation in Uganda have been formulated without adequate consultations from the communities. This has resulted into serious conflicts between the government agents implementing the policies and the local communities. These conflicts mainly stem from government's policies aimed at conserving the resources and yet the people need to utilize the resources for their livelihoods. Two such policies concern preservation of the Mt Elgon forest and protection of the riverbanks whereby the people are denied access to the forest resources and the cultivable riverbank, respectively. There has been lack of a clear process for inclusion and involvement of various community categories and other local level stakeholders in natural resource governance, with respect to both formulation and implementation of policies and measures (AGILE, 2007; GOU, 2008).

Furthermore, in Uganda there is lack of effective communication between the central government and the local authorities in the process of implementation of policies and laws on water and soil conservation (MERECP, 2005) and the economic conditions have not provided the necessary incentives to farmers in the highlands to make long-term investments in improved management of their natural resources. The economic situation is exacerbated by limited credit and persistent low local wage rates (Opondo et al., 2006).

During the last two decades the policy-making processes in Uganda as much as elsewhere have changed from involving only the top policy makers to being more consultative to lower level policy-makers and other, non-governmental, stakeholders. With the Local Government Act the Government of Uganda has opened up the policy debate and process to solicit stakeholders' views and ideas, as this Act gives decision-making power to the people. Democratically elected local councils at various administrative levels have the power and financial budgets to develop and implement policies concerning natural resource management (Siriri *et al.*, 2005). As a result a number of by-laws have been passed by local councils on agriculture and food security. There is, however, need to develop complementary policies on the use of soil and water resources to ensure their efficient use and preservation (Opio *et al*., 1998; NEMA, 2005; NEMA, 2008). But in order to design and implement resource conservation and development interventions full involvement of stakeholders is required.

1.3 Integrated Watershed Management as a tool to support policy development

Integrated Watershed Management(IWM) can be defined as the process of planning and implementing water and other natural resources management strategies in watersheds, with an emphasis on integrating the biophysical, socio-economic and institutional aspects of natural resources management (Singh et al., 2002). IWM is emerging as an alternative to the centrally planned and sectoral approaches of river basin

management planning across the world (Tefera and Stroosnijder, 2007). The watershed context provides the natural framework for investigation into the complex and reciprocal linkages among land use, soil and water resources, and the interdependence of people in their resource use practices (Bewket, 2003). It allows a direct linkage between upslope land use practices and the state of downslope water and soil resources. It provides a unit in which the majority of the effects of interventions can be expected (Siriri et al., 2005). As a result of this physical significance watersheds are also considered to be the logical spatial constructs for the sustainable and integrated management of natural resources with the direct involvement of local populations. This practice is popularly known as integrated watershed management (Bewket, 2003). Today, the IWM approach is being pursued in many countries around the world and its contribution to conservation and sustainable soil and water resource use, as well as improved livelihoods, has been generally perceived as quite successful (Paranjape et al., 1998; Bewket, 2003; Davenport, 2003).

Adoption of IWM is based on the assumption that watershed management will work provided that the biophysical context is matched with proper socioeconomic incentives and a very supportive policy context (Perez and Tschinkel, 2003). Integration, coordination and full involvement of all relevant stakeholders is required, to be able to design and implement locally relevant, acceptable and sustainable resource conservation and development interventions (Bewket, 2003). Globally, policymakers and stakeholders are under pressure to promote both environmental restoration and land development plans that address present concerns, while having limited knowledge of the long-term impacts of their decisions on the regional system (Berger and Bolte, 2003). Through land-use and other policies governments directly or indirectly either promote or undermine the management of watersheds and the conservation of resources. However, the more serious problem is often the enforcement of the policies and rules. Many laws and regulations are impossible to enforce, among others because they are poorly designed (Perez and Tschinkel, 2003).

To be effective watershed management requires interagency and multi-user interactions and agreements regarding land-use decisions. It is critical for implementing organizations, therefore, to engage in dialogue with land users and local governments to promote integrated planning, management and evaluation of upland and downstream activities. This will require bridging several local government and political boundaries (i.e. municipalities or provinces) within the watershed, fostering an understanding of environmental interactions and taking into account the many government, religious and customary laws and local norms that regulate access to natural resources. At the same time, it will require fostering a comprehensive understanding by citizens and governments of the environmental effects and values of land and water use decisions, and promoting discussions to find ways within a watershed system to make groups more responsible for the impacts they have on other groups. This should lead to public and open recognition and reconciliation of potential conflicts between natural and political boundaries and acknowledgement of the impact policies may have on natural resources. Achieving this type of coordination is a complex undertaking that has often been attempted, but seldom satisfactorily accomplished (Perez and Tschinkel, 2003).

An important aspect essential for the success of the overall IWM effort is building social capacity (Davenport, 2003; Pahl-Wostl, 2002). Building social capacity is providing the foundation to support behavioral change within the watershed. Watershed management involves working with people to make the right short- and long-term decisions in their daily lives, that is, changing their perceptions and behaviour. Successful social capacity building efforts move the stakeholders through various stages of awareness, knowledge, understanding, ability, and desire to active participation. These stakeholders then are empowered and thus are in a position to contribute to relevant decision-making for natural resource planning and management (Siriri et al., 2005; Davenport, 2003; Pahl-Wostl, 2002).

To design realistic and promising conservation approaches the involvement of various stakeholders has to be combined with a rigorous understanding of the processes, extent and rate of resource degradation as well as the socio-economic and institutional circumstances at the local level (Bewket, 2003). One of the challenges that the Government of Uganda faces in confronting the problem of land degradation is lack of information to empirically support policy recommendations and plans (Nkonya *et al.,* 2008).

1.4 Need for data to support policy development

There is currently a lack of timely, up-to-date information to support policy development on sustainable natural resources management in Uganda. Policy and decision making in the context of sustainable development requires rapid, effective and efficient access to and integration of appropriate recent information from a wide range of sources and disciplines, including information on land cover dynamics derived from remotely sensed data (Kalluri et al., 2003; Sedano et al., 2005; Xiuwan, 2002). For effective policy development, the Government of Uganda needs information on the relation between land use and the risk of erosion. It is too expensive and time-consuming to carry out soil erosion studies for all the arable soils and climatic conditions (Majaliwa, 2005). Moreover, the high spatial variability of soil erosion means that in order to plan mitigation measures, sound knowledge is needed on where erosion is occurring (Le Roux et al., 2007; Visser and Jansen, 2008).

Given the data scarcity in the country, there is need for convenient and appropriate ways and tools which provide policy-relevant data. Since 1995 NEMA has taken over the responsibility of the implementation of environmental management in the country. This is achieved through the country's environment policy. However, NEMA requires updated information from the districts on the state of the environment. In the face of insufficient resources a methodology is required which will enable acquisition of timely information on the state of the natural resources for interventions to be planned appropriately.

In order to design and implement locally relevant, acceptable and sustainable resource conservation and development interventions, coordination with and integration and full involvement of the various stakeholders with their different interests is required. In IWM, stakeholders are fully involved in decision-making (Bewket, 2003; Siriri, *et al.* 2005; Tefera and Stroosnijder, 2007). For effective decision-making on management strategies, the involvement of stakeholders early on in the IWM process is crucial (Billgren and Holmen, 2008; Grimble and Wellard, 1997; Simpungwe, 2006). An important aspect of IWM is the identification and consequent coordination and integration of all stakeholders (Bewket, 2003; Cobourn, 1999; Heathcote, 1998). This calls for identifying all important stakeholder groups and their interests, and enables them to reach consensus on the objectives of the IWM program. This requires intensive collaboration: watershed management plans must be "owned" at the same time by all stakeholders, with a general long-term goal or vision for the entire watershed (Cobourn, 1999; Reed, 2008, Kaplowitz and Witter, 2008).

Although in stakeholder analysis all stakeholders and their viewpoints should be analysed, stakeholder analysis should especially focus on identifying key-stakeholders when it comes to crucial decision making concerning natural resource management. If through stakeholder analysis the key stakeholders are not identified and selected, stakeholder involvement – and thus IWM as a program – becomes unmanageable (Billgren and Holmen, 2008). Thus a stakeholder analysis is required as a tool to reduce the all-inclusive stakeholder group to a workable realistic action-group for decision-making, consisting of committed key-stakeholders with sufficient decision power.

A key objective of participatory approaches in IWM is generating a social learning process, in which actors learn by exchanging views and insights and in which a process towards collaborative action is stimulated. Learning that results in enhancing a group's ability to change its ingrained perceptions and assumptions has been termed 'social learning'. The concept of social learning provides useful insights into

the processes and factors that support fruitful stakeholder involvement in river basin management planning (Tippet et al., 2005). Command and control strategies of policy-making and intervention are inadequate to address change in a complex system in which multiple stakeholders interact with dynamic ecological systems. As Mostert (1999, p. 565, developed from Tippet et al., 2005) has stated ''it is one thing to know how the use of the river basin should be changed, it is another thing actually to change the behaviour of the users''.

The implementation of integrated water management is not possible without the increased collaboration of authorities and stakeholder groups from different sectors, e.g., spatial planning, flood protection, and water supply management. Because most water management regimes can be described as a fragmented institutional landscape, the stakeholders are not accustomed to interacting with each other (Mostert et al. 2006, developed from Pahl-Wostl et al., 2007). Both collective action and the resolution of conflicts require that people recognize their interdependence and their differences, and learn to deal with them constructively. To do this, different groups need to increase their awareness about their biophysical environment and the complexity of social interactions. Stakeholders need to be well informed and learn new skills in order to maximize the benefits of their participation. A cyclical relationship between active engagement and social learning suggests that participation may be essential to encourage social learning, as it is in the interaction of different parties, exploring each others' world views and perceptions and their potential impact on the environment, that social learning can occur. At the same time, social learning is seen as an essential outcome of participatory processes if watershed management is to be successful in the long run (Tippet et al., 2005). The participation of a diverse group of people in a systemic process of collective decision-making builds shared understanding. The idea of participation has been widely adopted at the local level to make development more effective and sustainable and to empower people to manage their own development (Pahl-Wostl, 2002; Stagl, 2006). Multi-stakeholder processes take participation to a higher level by bringing governments, businesses and civil society together in a process of interaction, dialogue and social learning (Pahl-Wostl et al., 2007).

Encouraging social learning implies emphasis on the process of developing options and involving different stakeholders in making decisions. This study was carried out to stimulate social learning processes through bringing stakeholders together to jointly make decisions on policies for the implementation of IWM in the Ngenge watershed in Uganda. Multi-stakeholder workshops are used as an instrument for social learning. The participation of a diverse group of people in a systemic process of collective decision-making builds shared understanding (Pahl-Wostl et al., 2007; Maarleveld and Dangbégnon, 1999).

1.5 Research aim and questions

The population of Uganda is growing rapidly, with 70% being dependent on agriculture for its livelihood. Current agricultural practices are causing soil erosion problems which are also leading to water degradation in the form of sedimentation. Previous attempts to manage the soil erosion problem through policy interventions have not been successful. The watershed is the most appropriate unit for water management and consequently the wider natural resource base since it is the hydrogeological unit that harbours the natural resources (Sarangi et al., 2004). Therefore it is hypothesized that a reduction in soil erosion and sediment delivery and as such an increase in livelihood can be achieved through the use of an integrated environmental watershed management program.

The aim of this research is to contribute to insights and knowledge for designing participative policy making for the implementation of Integrated Watershed Management. To work towards designing sound participative IWM for Ugandan highland watersheds a methodological approach will be followed in three phases:

Phase 1: This phase, for acquisition of policy relevant data, involved three programmes - a) Data collection on physical aspects of water and soil degradation. Remotely sensed data was interpreted and field data collected on erosion features in order to realise a rapid tool for analysing erosion risk to inform policy; b) Carrying out a stakeholder analysis to establish who should participate in the decision making process for policy development; and c) Conducting a household questionnaire to establish the state of land management and the perceptions and expectations of the people in the watershed.

Phase 2: Designing a participatory decision-making platform for IWM. From the information obtained in Phase one, drivers of existing land and water management were extracted and presented to stakeholders brought together in collaborative workshops to construct scenarios and develop action and workplans. The action plans are consequently to provide policy options and the processes in the workshops are to be analysed to establish the extent to which social learning occurred.

Phase 3: Recommendations for IWM as a policy strategy for Ugandan highland watersheds. The findings of the first two phases are expected to provide information on stakeholder decisions for policy; a minimum data set required for the establishment of a participatory policy development platform for IWM; and updated stakeholder perceptions.

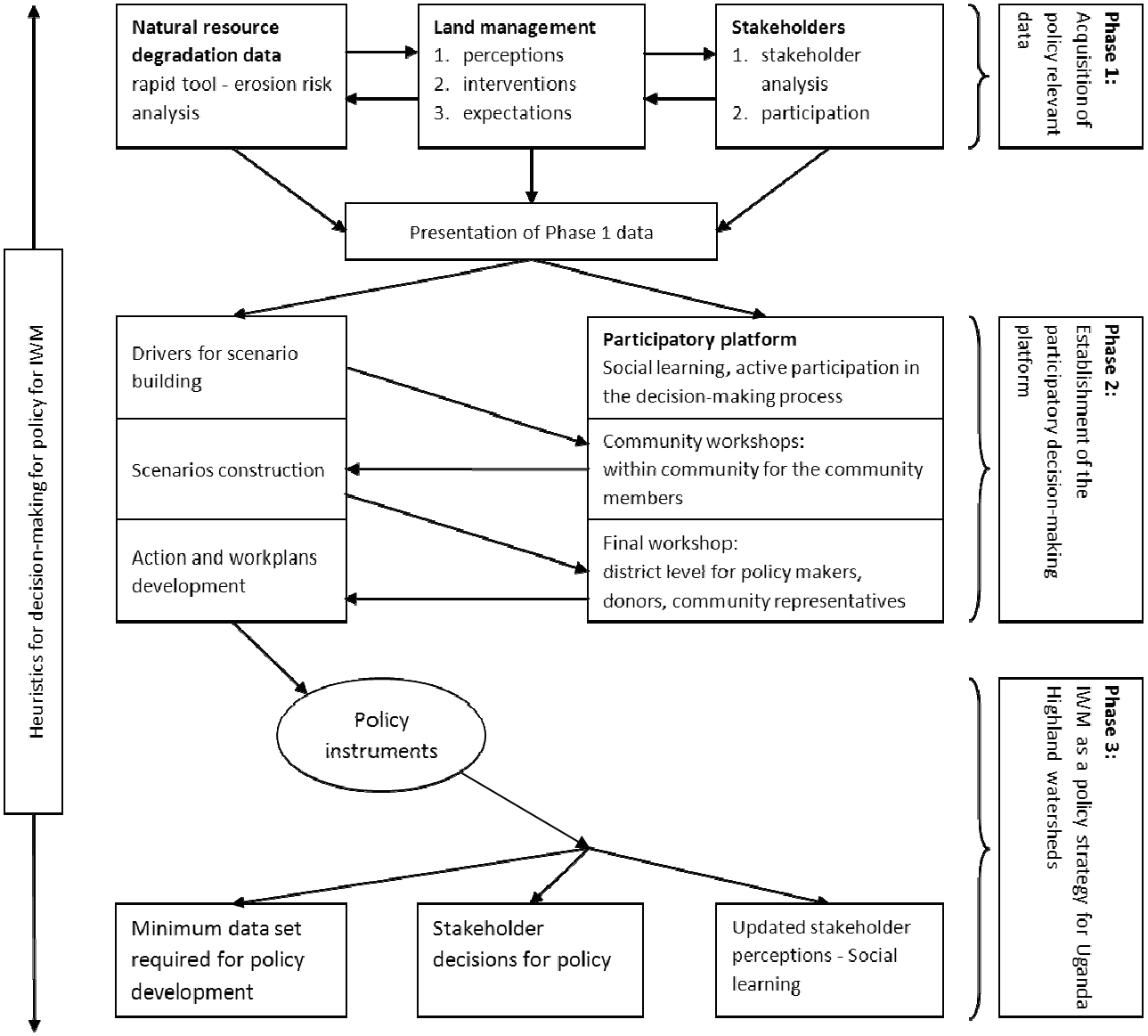

Figure 1.1. Flow diagram of the methodological approach to the study.

Figure 1.1 shows a flow diagram of the methodological approach to this study and full details are presented in the chapters. The research commenced with conducting Phase 1 from 2006 to 2008 and Phase 2 following from then on up to 2009. Meanwhile analysis and interpretation of the information obtained was carried out and continued until 2011 to realise Phase 3.

Based on the requirements for a viable IWM the following research questions central to this study are as follows:

1. How can erosion risk in Uganda Highland watersheds be assessed rapidly to support policy development?
2. How can the relevant stakeholders in Uganda Highland watersheds for participation in integrated watershed management be selected and analyzed?
3. How can social learning be made instrumental for integrated watershed management in the Ugandan Highlands?
4. What are potentials and problems of IWM as a policy strategy for Uganda Highland watersheds?

1.6 Research area

The Ngenge watershed, on the slopes of Mt. Elgon in Eastern Uganda (see Figure 1.2), was selected for this study because it represents the typical environmental circumstances that occur in the highlands of Uganda - soil erosion resulting from deforestation for arable cropping under influence of increasing population pressure. This watershed is particularly interesting because its history of erosion problems emerging after highland deforestation for farming is recent, dating back to less than 3 decades ago. Although – like in other watersheds – the upstream and downstream problems within the catchment area are physically interrelated, in the Ngenge watershed these problems also depend on socio-political developments, such as insecurity from cattle rustling and nature conservation measures on Mount Elgon.

The watershed is 665 km^2 and lies within 34^{o}E to 35^{o}E and 1^{o}N to 2^{o}N. The upstream part (3000 m.a.s.l.) is situated on the cool, humid northern slopes of Mount Elgon and extends westwards to the downstream part (1000 masl) in the hot, dry extensive flat wide plain that merges into the Lake Kyoga flats (Ollier and Harrop, 1959). Over the last 25 years, rapid population growth of indigenous forest dwellers and the surrounding communities has resulted into deforestation and conversion of the forested area into land for subsistence arable farming. Rich volcanic soils combined with abundant rainfall provide a high potential for agriculture. Smallholder subsistence farmers with a mixed crop and livestock production system are typical in the area – average farm size 0.8 - 1.6 ha (Kapchorwa 2006). The present agricultural practices result in severe soil erosion, gully formation, and high sediment loads in the rivers during the rainy season (BIC, 1998; DSOER, 2004).

The catchment can be divided into three sections: downstream, midstream and upstream; these sections also divide the five subcounties of the watershed: Ngenge; Binyiny and Kaproron; and Benet and Kwosir, respectively (Figure 1.2). The total population is 55,068 and the average population density 262 persons km^{-2} (UBOS 2002). The greater part of this population is concentrated upstream, where population density is highest, followed by the midstream area. Downstream the population density is very low since people left the area, fleeing the insecurity brought about by cattle rustlers. The very high population density upstream is due to resettlement of the forest dwellers, people from the plains and those coming to exploit the soil resources for agriculture.

Ngenge subcounty, at the foot of the mountain, in the hot and dry extensive floodplain, is subject to flooding when the rivers from the mountain overflow their banks. The inhabitants are traditionally involved in livestock keeping but more recently (since 2006) cultivate rice, which is possible due to the recent sedimentation combined with the frequent floods. The midstream and upstream areas are characterized by steep slopes with adequate and reliable rainfall (Kapchorwa, 2006). Midstream, there are well established

settlements with the people living on subsistence mixed farming. Both perennial and annual crops are planted, but the soils are characterized by declining productivity due to continuous cultivation without fallow. Soil erosion is still a problem despite soil and water conservation interventions, unlike in the upstream area where soil and water conservation is largely inadequate. The upstream area consists for a greater part of an area excised from the Mt Elgon forest to re-settle indigenous forest inhabitants and the people displaced from the lowlands by cattle rustling. The indigenous forest inhabitants were removed from the forest when it was turned into a national park in 1980. Because of extensive tree removal for annual cropping without soil and water conservation measures, this area is characterized by severe soil erosion.

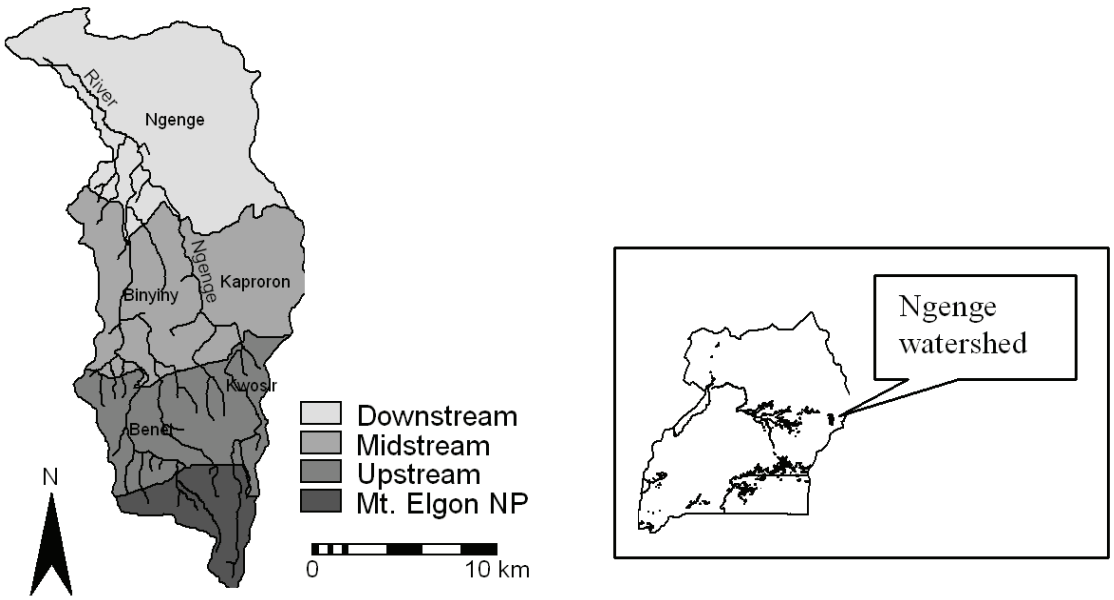

Figure 1.2. Map of the study area, Ngenge watershed, Uganda (Source: Digitizing contours from Topo maps of Surveys and Mapping department, Uganda).

1.7 Thesis outline

The thesis has 6 chapters of which 4 have been submitted or are published in international refereed journals as independent papers. This chapter 1 forms the introduction to the study. Chapter 2 investigates a tool for rapidly assessing erosion risk to support decision-making and policy development at watershed scale. At the same time it provides an excellent assessment of the state of the physical conditions in the Ngenge watershed.

IWM involves bringing stakeholders together for decision making and therefore a stakeholder analysis was carried out to identify the key stakeholders for participation in IWM in Chapter 3. A key objective of participatory approaches in IWM is generating a social learning process, in which actors learn by exchanging views and insights and in which a process towards collaborative action is stimulated. Results of an analysis of the process of social learning that was aimed at in the stakeholder meetings is presented in Chapter 4. In Chapter 5 the potentials and pitfalls of IWM as a policy strategy for land and water management are explored. The last chapter (6) is the synthesis, which includes a presentation of the major conclusions, an assessment of the newly generated knowledge, and the limitations of and recommendations from this study.

Chapter 2

A tool for rapid assessment of erosion risk to support decision-making and policy development at the Ngenge watershed in Uganda

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A tool for rapid assessment of erosion risk to support decision-making and policy development at the Ngenge watershed in Uganda

Abstract

This study tests a rapid, user-friendly method for assessing changes in erosion risk, which yields information to aid policy development and decision making for sustainable natural resources management. There is currently a lack of timely, up-to-date and current information to support policy development on sustainable natural resources management in Uganda. The study was carried out in the Ngenge watershed, a typical catchment in the Ugandan Highlands, characterised by deforestation in favour of subsistence agriculture without adequate soil and water conservation measures. The watershed is experiencing soil erosion, sedimentation and flooding problems which are threatening agricultural productivity and food security. Sustainable management of environmental resources is needed to ensure a livelihood for the rural population which is dependent on the land. Historical erosion risk was evaluated in three steps using multi-temporal satellite data.

First, current erosion risk was assessed by combining slope and vegetation cover during periods of high intensity rainfall. The data used for the assessment was obtained from public (free) satellite images. Erosion risk was then linked to land use and finally to the change in vegetation cover over the years 1980 - 2000. The analysis of erosion risk using rainfall, slope and NDVI (Normalised Difference Vegetative Index) as a proxy for vegetation cover gives an indication of the current erosion risk in the area. The results of historical vegetation cover change analysis indicate an overall increase in areas under erosion risk in the study area from 1980 to 2000. This method of erosion risk mapping provides a quick and straightforward means for identifying priority areas for interventions for soil and water resource management. Considering that resources are limited, the interventions to be appropriate have to be focused mainly on areas affected by degradation.

Keywords: erosion risk, rapid assessment, vegetation cover, slope, rainfall, remote sensing

2.1 Introduction

In developing countries soil erosion is considered to be a serious threat to agricultural development (Posthumus and Stroosnijder, 2009). Erosion by water following the clearance of the natural vegetation directly reduces agricultural productivity and, as a consequence, reduces food security (Kessler and Stroosnijder, 2006; Okoba et al., 2007; Tamene and Vlek, 2007). In Uganda, 68% of the population depends mainly on subsistence farming for their livelihood (UBOS, 2002). Their agricultural practices are leading to the degradation of the soil and water resources (Isabirye et al., 2008). Soil erosion is the most severe and extensive form of degradation in the country: The erosion process and the depletion of soil nutrients are the major contributors to declining productivity and increasing poverty (NEMA, 2007; Nkonya et al., 2004; Tukahirwa, 1988). Most of the eroded soil is conveyed to the rivers, resulting in increased sedimentation which has raised the river beds, causing frequent flooding downstream (DSOER, 2004).

The continuing degradation of the natural resources threatens the very livelihood of the rural population (NEMA, 2007) and creates an urgent need for mitigation measures. Aided by the African Highlands Initiative (AHI) and other development partners, the Government of Uganda is therefore designing and implementing policies and strategies to address poverty, land degradation and declining agricultural productivity. However, this is no simple matter. Policy and decision making in the context of

sustainable development requires rapid, effective and efficient access to and integration of appropriate current information from a wide range of sources and disciplines, including information on land cover dynamics derived from remotely sensed data (Kalluri et al., 2003; Sedano et al., 2005; Xiuwan, 2002). The existing information on the environment and natural resources of the country is inadequate for appropriate policy development (NEAP, 1994). It is too expensive and time-consuming to carry out soil erosion studies for all the arable soils and climatic conditions (Majaliwa, 2005). Moreover, the high spatial variability of soil erosion means that in order to plan mitigation measures, sound knowledge is needed on where erosion is occurring (Le Roux et al., 2007; Visser and Jansen, 2006).

Although deterministic erosion models that describe processes and quantitative outcomes, can be used to construct maps, a qualitative approach is usually adequate for land use and conservation planning purposes (Vrieling et al., 2002) cited in (Visser and Jansen, 2006). For large areas it will be more feasible to construct erosion risk maps rather than to quantify the erosion (Le Roux et al., 2007; Visser and Jansen, 2006). Erosion risk is referred to as the relative risk of erosion occurring at a certain location by comparison with other locations in the region mapped (Visser and Jansen, 2006). Vrieling et al. (2006) showed that erosion risk in a watershed can be mapped accurately using information on the steepness of slopes and vegetation cover only.

For effective policy development, the Government of Uganda needs information on the relation between land use and the risk of erosion. Given the data scarcity in the country, the most appropriate way of obtaining policy-relevant data is to perform an erosion risk analysis using remote sensing data and relate it to current and historical land use. As already noted, erosion risk provides information on the relative risk of occurrence of soil erosion at a specific location under a given land use. Analysing the historical land use based on historical vegetation cover change analysis and combining this information with the erosion risk under a specific land use will provide insight into the historical changes that have led to the current situation.

Since 1995 NEMA has taken over the responsibility of the implementation of environmental management in the country. This is achieved through The National Environment Policy. However, NEMA requires current updated information from the districts on the state of the environment. In the face of insufficient resources a methodology as presented in this paper will enable acquisition of timely information on the state of the natural resources for interventions to be planned appropriately.

The research described here was carried out to test a rapid tool for assessing erosion risk and providing current information to aid policy and decision making in the context of sustainable development in Uganda. For the assessment of current erosion risk and the evaluation of historical erosion risk, the rapid tool was tested on its capacity to provide adequate, timely, low-cost data which can be used for policy development and decision support. The specific objective of the study was to evaluate the history of vegetation cover change and its influence on change in erosion processes in the watershed. A 3-step method was followed, using multi-temporal satellite data. First, current erosion risk was assessed and the results were validated against field data, then, erosion risk was linked to vegetation cover and finally it was linked to historical cover. The research was carried out in the Ngenge watershed, situated on the northern slopes of Mt. Elgon ($1^{o}8'$N, $34^{o}33'$E), in Eastern Uganda.

2.2 Materials and Methods

2.2.1 Research area

The Ngenge watershed, part of Mt Elgon, like other East African Highland watersheds is characterised by high population pressure, a favourable climate regime and the cultivation of steep slopes without adequate soil and water conservation measures (Semalulu et al., 1999). Clearance of the forest on the slopes and replacement with annual crops is leading to severe erosion of the soils of the area (BIC, 1998; DSOER,

2004). The River Ngenge is one of the main permanent rivers arising from Mt. Elgon (4321 m.a.s.l.). With its extensive montane forest, Mt. Elgon represents a watershed of international importance; it constitutes a major catchment for some of the major rivers that feed the lakes in the Nile River basin. On its mountain slopes, adjacent to the forest (gazetted as Mt. Elgon National Park), lives a large rural population whose livelihoods and economic activities are largely dependent on the ecosystem goods and services of the highlands (Muhweezi et al., 2007). The agricultural activities of this highland population are resulting in severe soil erosion with high sediment loads in the rivers in the rainy season.

The Ngenge watershed (665 km^2; Figure 2.1) lies between altitudes 1000m and 3000m.a.s.l. and is characterised by a cold humid climate upstream and a semi-arid climate downstream. Upstream, the mean annual temperature is 15.6 C and the mean annual rainfall is 1450 mm, falling mainly from March to November. Rainfall peaks in April and May during the first and main growing season, which is from March to August. The second season, with less rain, is from September to November. In the central zone of the watershed (henceforth referred to as midstream), the climate is less humid and warmer than upstream, with a mean annual temperature of 20.4 $^{\circ}$ C and the mean annual rainfall 1186 mm. Here too there are two growing seasons: from March to August and September to November. Downstream, there is one rainy season from April to August, which is followed by a hot, dusty and windy dry season. Mean annual temperature is 22.9 C and the mean annual rainfall is 932 mm (DSOER, 2004) (Figure 2.2).

The soils of the Ngenge watershed are derived from volcanic ash agglomerates. Downstream the soils are dominated by clay and clay loams. Midstream, the soils are silt loams in the cliffs overlooking the plains and in the whole upstream area the soils are sandy clay loams (Chenery, 1960). The soils have medium to high fertility and therefore when combined with abundant rainfall the potential for agriculture is high. Agriculture is the primary source of livelihood for the population in the upstream and midstream areas of the watershed. It is characterised by smallholder mixed crop and livestock production: average farm size is 0.8-1.6 ha (Kapchorwa, 2006), which should provide food for an average household of 5 persons. The main crops are maize, Irish potatoes, beans, wheat, barley, vegetables, bananas and coffee. Bananas and coffee are mainly grown in the midstream area, where settlements are well established. Here there are also several farms under woodlots of *Eucalyptus* spp. and *Grevillea* ssp. The animals kept are cattle, goats, sheep, poultry and donkeys. Downstream, the main sources of livelihood are selling fuel wood, burning charcoal and, recently, as a result of increased flooding and sedimentation, growing rice. Agricultural production in the watershed is mainly for subsistence purposes; any surplus is sold. Fertilisers and manure are applied to improve yields upstream and midstream, but downstream no inputs are required because the soil is enriched by sedimentation after flooding. Ox-ploughs, donkeys and human labour are used on the farms. Generally no soil conservation measures are carried out; though in the midstream area, some bunds are constructed and planted with *Napier* grass. However the soil conservation measures in the midstream area do not cover the whole area.

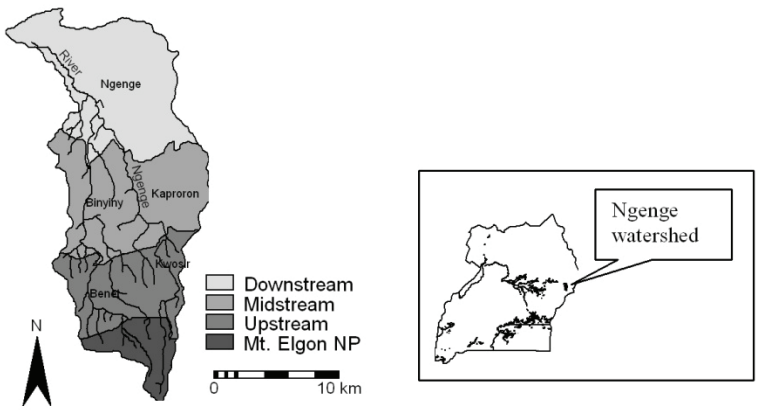

Figure 2.1. Location of the study area, Ngenge watershed, Uganda.

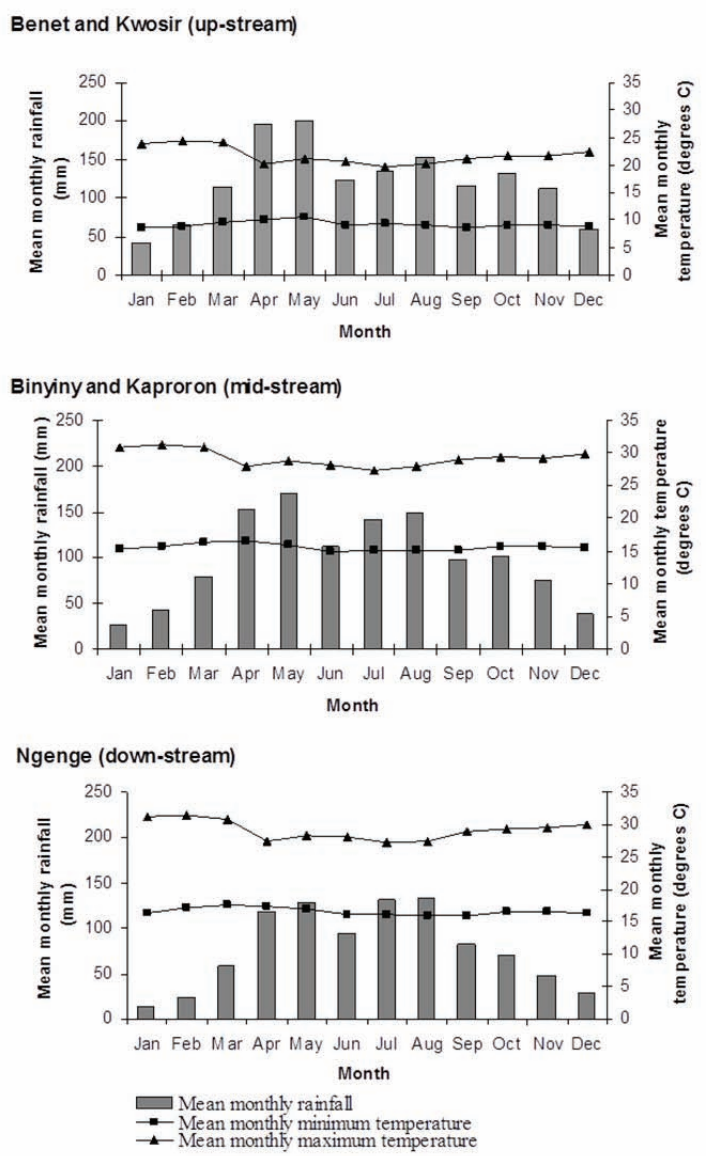

Figure 2.2. Mean monthly rainfall (mm) and temperature (C) distribution for the different areas of the Ngenge watershed, Mt. Elgon, Uganda (DSOER, 2004).

Administratively, the Ngenge watershed lies within Kapchorwa District, and is situated about 12 km east of the main town, Kapchorwa. The watershed encompasses five subcounty areas which adequately correspond to the three main sections of the watershed: Benet and Kwosir upstream, Binyiny and Kaproron midstream, and Ngenge in the floodplain. The total population in the watershed is 55,068 and the population density 262 persons km^{-2} (UBOS, 2002). The average annual population growth rate between 1980 and 1991 was 2.2% and between 1991 and 2002 it increased to 3.5% (UBOS, 2002). The greater part of this population is concentrated upstream (average pop density: 422), followed by the midstream area (average pop density: 297). Downstream the population density is very low (average value: 9). The reason the population density is low downstream is because people have left the area, fleeing the insecurity brought about by cattle rustlers. The very high population density upstream is due to resettlement of the forest dwellers, as well as to settlement of people from the plains and those coming to exploit the soil resources for agriculture. The resettlement of the forest dwellers as well as other landless people was carried out in 1983 as part of measures aimed at preservation of the forest ecosystem. The resettlement was carried out on an excised portion of the forest and it resulted into conversion of forest into arable land. The resettlement exercise was carried out haphazardly without equipping the people with soil and water conservation skills and this resulted into severe soil erosion which has continued until this day.

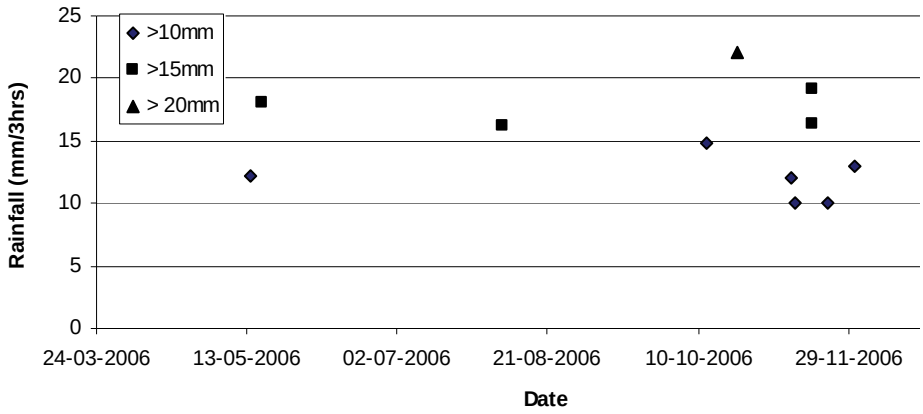

Figure 2.3. Occurrence of high intensity rainfall events in 2006 in the Kapchorwa region Uganda (TOVAS, 2006).

2.2.2 Research methodology

The method used to assess the current erosion risk was developed by (Vrieling, 2007) and modified by (Visser and Jansen, 2006). Details of the method are presented in (Visser and Jansen, 2006); in this article, only the application of the method for the research area is described. The method uses radar rainfall estimates for assessing erosion risk periods and combines slope with multitemporal NDVI images to provide time-dependent erosion risk maps. NDVI is used as a proxy for vegetation cover (Vrieling, 2002). These maps can be used when planning mitigation measures (Visser and Jansen, 2006). Most of the data is freely available on the internet. This is particularly important, given the scarce resources and inadequate data to aid the formulation of appropriate policy. To validate the erosion risk maps and to establish a relation between land use and erosion risk, field data was collected on current land use and the state of resource degradation in the watershed. Finally, historical vegetation cover change was evaluated, to establish how erosion risk evolved. The GIS software ILWIS 3.3 was used for the analyses.

Risk assessment

To obtain the periods of highest erosion risk, 3-hourly rainfall estimates were obtained from the Tropical Rainfall Measurement Mission (TRMM), through TRMM Online Visualisation and Analysis System (TOVAS: http://disc2.nascom.nasa.gov/Giovanni/tovas/). (Visser and Jansen, 2006) set thresholds of 5, 10 and 15 mm rainfall per 3 hours to evaluate the periods with the highest rainfall intensities. However, for the Ngenge watershed, it was preferred to use the thresholds of 10, 15 and 20 after consideration of the higher values of 15, 20 and 30 mm used by Vrieling (2007) since the climate in his case closely resembles that of Uganda. The data are available at a 0.25^{o} grid and although the spatial resolution is low, it can be assumed that a good indication can be obtained of when high rainfall intensities occur (Vrieling, 2007). There are periods of moderately high rainfall intensities in the months of April and May (Figure 2.3), which are also the months with the highest monthly rainfall (Figure 2.2). The periods with the highest rainfall intensities will form the basis for the selection of the MODIS images for analysis of vegetation cover for the time range from January 2006 to December 2006. The year 2006 was chosen for the detailed analysis because the latest images available at the time of the study were of that year.

Table 2.1. NDVI classification for the timely assessment of erosion risk in the Ngenge watershed, Mt. Elgon, Uganda.

NDVI class	Value range
Very low	0-0.25
Low	0.25-0.4
Medium	0.4-0.6
High	0.6-0.75
Very high	0.75-1.2

Table 2.2. Classification of the slope for the timely assessment of erosion risk in the Ngenge watershed, Mt. Elgon.

Slope class	Slope %	Risk of erosion
Flat	< 3.5	Very low
Gentle	3.5 – 7.0	Low
Moderate	7.0 – 12.0	Medium
Steep	12.0 – 19.0	High
Very steep	> 19.0	Very high

The temporal variation in vegetation cover over a year was determined for the year 2006 using Normalised Difference Vegetative Index (NDVI) measurements from low-resolution MODIS (Moderate-Resolution Imaging Spectoradiometer) imagery (250m pixel size). The MODIS imagery is freely available from the Terra NOVA Platform. The MOD13Q1 product was used, which is a 16-day composite vegetation index product derived from daily surface reflectance data. The NDVI for the 16-day period is calculated on a pixel-by-pixel basis, in which images are selected or excluded based on quality, cloud cover and viewing geometry, as described by (Huete et al., 2002). The NDVI indices derived from the MODIS images were classified into five classes ranging from very low NDVI (0.8) to very high (1.2) (Table 2.1). The classified NDVI map was combined with a classified slope map derived from a digital elevation model (DEM). The DEM, with a resolution of 90 x 90 m, was obtained for free from the CGIAR website (http3://CGIAR, 2007). In order to be consistent with the DEM and the land use maps the classified vegetation cover maps were reprojected to a UTM projection, using nearest neighbour resampling and a 90 m output pixel size. The slope map was classified based on the related risk of erosion (Table 2.2) and on the requirements of erosion control interventions (Morgan, 2005). Erosion risk is high when periods of high rainfall intensity coincide with periods of sparse vegetation cover (low NDVI) on steep slopes (Vrieling et al., 2008). Erosion risk was classified as no risk, low risk, medium risk, high risk and very high risk (Table 2.3) by applying a qualitative integration of the slope (Table 2.2) with the NDVI (Table 2.1) and rainfall.

Table 2.3. Erosion risk classification based on the NDVI classes and slope class for the Ngenge watershed, Mt. Elgon.

Slope class	NDVI class	Erosion risk
Flat	All	No risk
Gentle	Very high	No risk
	High	No risk
	Medium	Low
	Low	Low
	Very low	Medium
Moderate	Very high	No risk
	High	Low
	Medium	Low
	Low	Medium
	Very low	High
Steep	Very high	Low
	High	Medium
	Medium	High
	Low	High
	Very low	Very high
Very steep	Very high	Low
	High	Medium
	Medium	High
	Low	Very high
	Very low	Very high

Validation

To be able to validate the assessment of erosion risk, information on current land use and erosion was collected in the field in 2007. Field data was collected from 393 field observations, following the Assessment of Current Erosion Damage (ACED) method (Herweg, 1996). Transects were randomly earmarked and data was collected on: erosion features and their extent; land use; altitude; slope; and the geographical location along the transect and within a distance of 10 - 15m from each side of the transect. Interviews with key informants were carried out to obtain information on the prevalence of erosion so as to qualify the field observations on the causes of erosion and most especially the origins of the extensive erosion features - gullies and landslides - and the sources of sediment. To be able to compare the erosion risk map with the field measurements, the erosion observations were classified into five classes of erosion intensity (Table 2.4). The observations were made on the erosion features rainsplash, sheetwash, rill and gully erosion and landslides. The landslides normally are classified as geormophological land degradation features, however, it was imperative to include them in the erosion classification because in this area they are caused by agricultural activity. The landslides greatly contribute to sediment loading (field observations and key informants).

The 393 field observations on erosion risk were identified on each of the erosion risk maps and the classification on the maps was compared with the field data on current erosion for that period.

Table 2.4. Erosion classification of field observations in the Ngenge watershed at Mt. Elgon.

Class of erosion intensity	Observations	Details of field observations
No or very little erosion	No signs of erosion All deposition observations	All deposition observations
Little erosion	Little rainsplash and sheetwash Moderate rainsplash and sheetwash	Rainsplash: Little: splash pedestals scarce Moderate: splash pedestals cover ¼ of the field and < 1cm high Sheetwash: Little: few scattered cases of capping, deposited silts < 1 cm deep Moderate: capping covers ¼ of field, deposited silts 1-3cm deep
Moderate erosion	Severe sheetwash and rainsplash Little rill erosion	Severe sheetwash: capping covers >1/2 of field, deposited silts >3cm deep, pedestals clearly visible, roots exposed Severe rainsplash: splash pedestals cover more than ¼ of field and > 1cm high. Rills: Little: up to 5 cm deep and up to 10cm wide; one or 2 rills in field
Severe erosion	Moderate and severe rill erosion Gullies and landslides – small extent	Rills: Moderate: 5 – 10cm deep and 10 – 20cm wide; two to four rills in field or many with the low dimensions Gullies: Small: permanent channel 20cm deep and 30cm wide; only one observed in field; Landslides: Small: 3 -5m wide halfway down the slope
Very severe erosion	Severe rill erosion Gullies and landslides	Rills Severe: 10 – 20 cm deep and 20 – 100cm wide; rills cover half or more of the field Gullies: Moderate: permanent channel 20 – 50cm deep and 30 – 60cm wide; only two observed in field; Severe: permanent channel >50cm deep and > 60cm wide; more than two observed in field Landslides: Moderate: 5 – 10m wide half way down the slope; Severe: >10m wide half way down the slope

Change in land use and erosion risk

A map of the land use was created by combining field data with a transcribed Google™ Earth map of July 2006. The land use map was classified into five main land use types: forest, perennial agriculture, annual cropping, grazing land and bare ground (unutilised ground).

Average NDVI time series were obtained for the most important land use classes in the area, i.e. forest, perennial agriculture, annual cropping, grazing land and bare ground (unused land). Representative areas of the land use classes were selected and average NDVI time series were generated for them. The same procedure was followed for each land use class. Only areas larger than 1 pixel on the map were selected for then they could easily be identified on the map. The classified land use map for the year 2006 and field observations obtained in the period April to November in 2007 were used to interpret the MODIS images.

Historical vegetation cover change was derived from LANDSAT images for the years 1980, 1990 and 2000. The images were those taken in the month of August. The images, with a spatial resolution of 30 by 30m were interpreted for change in vegetation cover, using NDVI indices as proxy for vegetation cover. The classification of vegetation cover was based on information from field data, the 2006 land use map, and discussions with key informants knowledgeable about the settlement history of the area. Five main classes of vegetation cover were inferred from NDVI: very low cover, low cover, medium cover, high cover and very high cover.

To establish how erosion risk evolved historically, the change in vegetation cover over from 1980 to 2000 was analysed. Changes in the area of the different vegetation cover classes on the 1980, 1990 and 2000 vegetation cover maps were calculated. A decrease in the area of the "high vegetation cover" class between 1980 and 2000 implied an increase in land under high erosion risk, as did an increase in the "low vegetation cover" class.

2.3 Results and discussion

2.3.1 Erosion risk assessment

Figure 2.4 shows the classified slope map of the Ngenge watershed. The map shows steep slopes (> 19%) for most of the midstream and upstream sections. Downstream, the slopes are gentle to flat.

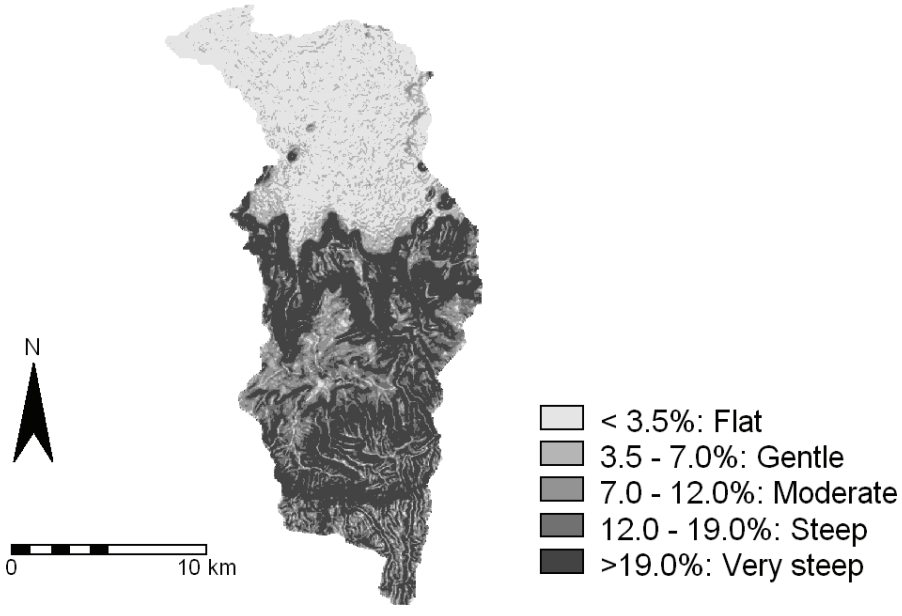

Figure 2.4. Map of slope classes in Ngenge watershed, Mt. Elgon, Uganda.

Figure 2.3 shows the distribution of the occurrence of high intensity rainfall events in 2006. During 6 events rainfall exceeded 15 mm per 3 hours; this occurred in May, August and October and November. No high intensity rainfall events occurred in January, February or December. Seedbeds are planted in April for the first crops and in September for the second crop. Based on the occurrence of high intensity rainfall events and the crop calendar, it was decided to analyse the vegetation cover for the months of April, May, August, September, October and November of 2006, as a basis for the erosion risk analysis. For these 6 months the temporal variation in vegetation cover for 5 cover classes is represented in the left-hand column of Figure 2.5. The very high vegetation cover in the southern part of the watershed corresponds with the natural forest reserve on Mt. Elgon (Figure 2.6). The area under high vegetation cover does not vary greatly over the year, except for August. In August this area is classified as very low NDVI. In theory, a low NDVI reflection can be explained by the consequences of a dry spell, wilting of leaves, and fire (Wesche, 2003). The severe El Nino drought of 2006 (NCDC, 2007) could account for the low NDVI values, but not for the very fast recovery of vegetation to very high in the following month. We therefore assume some miscalculation occurred in the original MODIS image. On the rest of the map no significant reductions in vegetation cover occurred; there were no reports of a large fire.

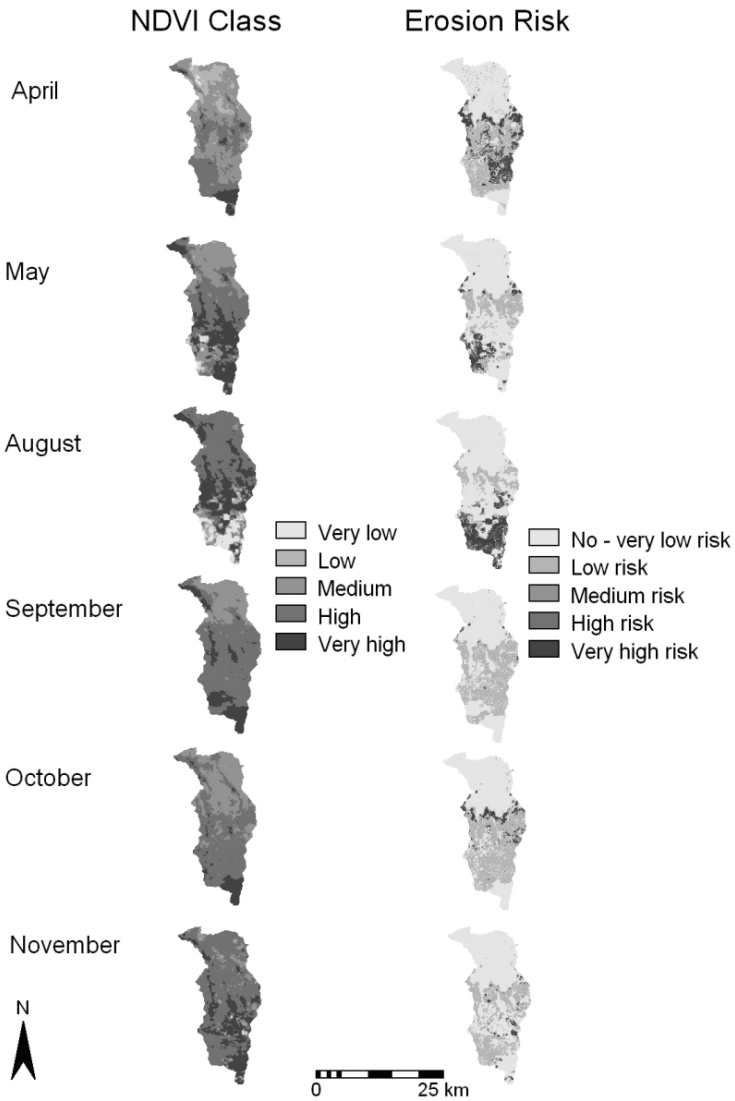

Figure 2.5. Erosion risk maps for the Ngenge watershed on Mt. Elgon in Uganda, constructed using 6 MODIS images taken in 2006. Left-hand column shows the classified NDVI maps and right-hand column the erosion risk maps, combining slope information and NDVI class.

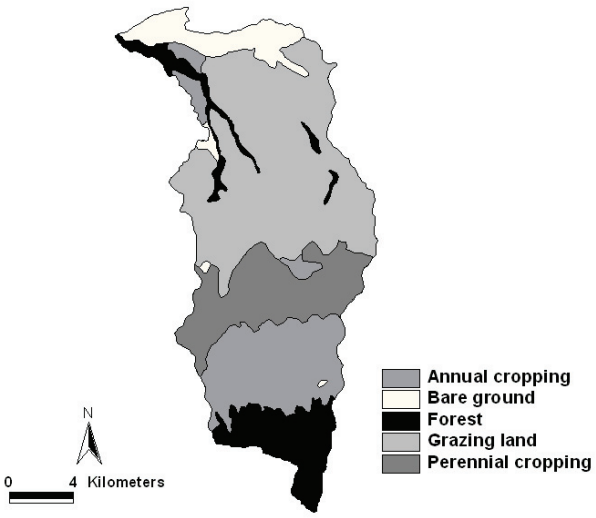

Figure 2.6. Land use map (2006) of the Ngenge watershed on Mt. Elgon, Uganda (classification from Google™ Earth map).

The lowlands show a large variation in vegetation cover. The main vegetation type in the area is grassland. In April the map shows a low cover, presumably because the grass had turned brown as a result of the dry season of November to March (Figure 2.2). Cover increases to moderate when the rains increase around May and by August the cover is high. In September and October the cover reduces to moderate but increases again to high in November. However, by then the rains are diminishing, so from November the cover will reduce to low again, as a result of the dry season. The midstream area also shows a large variation in vegetation cover. This area is characterised by mixed farming of perennial and annual crops. In April the vegetation cover is shown as moderate, with patches of high cover. The cover increases to high with patches of very high in the remaining months. The patches of very high cover represent the riverine vegetation along the course of the river, whereas the high cover area represents the cultivated area. The upstream part of the watershed outside the forest shows a large variation in vegetation cover. This area is under annual crops, the most important being maize. In April, at the start of the growing season, the vegetation cover is moderate in some areas and high in others. Cover increases to high, with patches of very high in the other months except August. In August the cover is shown as very low. At this time of the year the first season has ended and land is being prepared for the second season crops. However, the maize crop - to be harvested in November - still covers a significant area and therefore the cover should not be so low. As explained earlier, the NDVI values obtained for this particular area are too low to be attributed solely to the effects of the dry season. From September to November the cover is high, with patches of very high. The high cover is brought about by the second season crops and the maturing maize.

Table 2.5. Percentage of surface of the total Ngenge watershed in Uganda falling within the different risk classes for the erosion risk maps developed for the high risk periods in 2006.

Month	**Erosion risk (% of pixels)**				
	No risk	*Low*	*Medium*	*High*	*Very high*
April	48.35	32.73	0.44	6.10	12.39
May	68.23	23.16	0.47	2.53	5.61
August	65.43	15.97	1.17	4.35	13.08
September	62.31	37.08	0.00	0.24	0.38
October	54.48	39.15	0.00	2.27	4.11
November	68.00	29.56	0.09	0.69	1.66

The right-hand column of Figure 2.5 shows the erosion risk maps. These maps were created for the 6 months by combining the classified NDVI maps with the classified slope map (Figure 2.4) (Table 2.3). As expected, the entire lowland plain is shown as having no risk of erosion in all the months because it is generally flat and deposition of sediment occurs here. High and very high risk areas are found midstream and upstream where the terrain is sloping. In April, May and August, large areas have high or very high risk of erosion. In April and May the first season crop is beginning to grow and is yet to provide a good soil cover. In August the very high risk area upstream is a result of the low NDVI indices resulting from inherent miscalculations in the original MODIS image. There is a reduction in risk from September to November: at this time the second season crops are growing and the maize crop is maturing, ready for harvest in November. In November, erosion risk reduces to low because while the maize crop is being harvested the second season crops are already well established, providing a good cover to the ground. In the upstream area beans are planted under the maize crop in October just before harvest in November, so that when the maize is harvested the beans are already growing. The bean crop provides ground cover, which contributes to the reduced risk of erosion shown on the map.

Table 2.5 shows the percentage of pixels within the different risk classes for the 6 months in 2006. For all the months considered, the most widespread erosion risk class is "no risk": it covers over 50% of the area (except for April: 48%). This is attributable to the large downstream area, which is mainly flat, as well as to several patches midstream and upstream which are under very high vegetation cover. In all the months the "low erosion risk" class also covers a large area, because of the areas under perennial cropping and the scattered woodlots. The "medium erosion risk" class is represented by a very small area for all the months. From this class the number of pixels in the classes of "high" and "very high" increases; there is a marked increase in April (start of growing season) for the class "high risk" and during the months of April and August for the "very high risk" class. A comparison of the erosion risk maps and the land use map shows high risk of erosion during the months of April, May and August in the cultivated areas. In April, and to a lesser extent in May, the crop is just starting to grow, and in August land is being prepared for the next growing season. The high risk area is shown on the land use map as being under annual cropping.

Table 2.6. Occurrence and severity of erosion features in the Ngenge watershed at Mt. Elgon, Uganda, 2007.

Type of erosion	Intensity	Downstream (Ngenge)	Midstream (Binyiny)	Upstream (Benet)	Total
Deposition	Low	0	0	0	0
	Moderate	0	1 (1%)	0	1
	Severe	15 (100%)	9 (4%)	6 (4%)	30
None	-	0	10 (5%)	22 (14%)	32
Gullies	Low	0	0	0	0
	Moderate	0	10 (5%)	6 (4%)	16
	Severe	0	9 (4%)	9 (6%)	18
Landslides	Low	0	0	2 (1%)	2
	Moderate	0	2 (1%)	29 (18%)	31
	Severe	0	14 (6%)	9 (6%)	23
Rills	Low	0	3 (1%)	2 (1%)	5
	Moderate	0	13 (6%)	11 (7%)	24
	Severe	0	46 (21%)	17 (10%)	63
Sheetwash	Low	0	12 (6%)	15 (9%)	27
	Moderate	0	29 (13%)	17 (10%)	46
	Severe	0	54 (25%)	15 (9%)	69
Rainsplash	Low	0	1 (1%)	0	1
	Moderate	0	3 (1%)	0	3
	Severe	0	0	2 (1%)	2
Total		15 (100%)	216 (100%)	162 (100%)	393

The proportion of the observations due to each type of erosion in the three sections of the catchment is shown as a percentage in brackets.

Table 2.7. Validation of erosion risk assessment for the Ngenge watershed, Mt. Elgon, Uganda.

Month	% of field erosion observations					
	Upstream		**Midstream**		**Downstream**	
	Correctly classified	Mis-classified	Correctly classified	Mis-classified	Correctly classified	Mis-classified
April	68	32	75	25	100	0
May	76	24	65	35	100	0
August	90	10	50	50	100	0
September	95	5	64	36	100	0
October	95	5	83	17	100	0
November	100	0	100	0	100	0

2.3.2 Validation of erosion risk

In order to verify the erosion risk results, areas on the erosion risk maps were compared with field data on current erosion collected in the period April to November 2007. The total number of observations made during the transect walks for the field survey was 393 (Table 2.6). Table 2.7 shows a summary of the results of the comparison carried out between the field erosion data and the erosion risk maps. The best correspondences were found for the observations in the downstream area and for the month of November both upstream and midstream. In the downstream area there is mainly deposition since it is flat. Deposition in this study is classified as “no risk” considering that no soil loss is occurring, however, deposition in itself could do harm to crops especially in the early growing stage where it could kill the young plants. In this particular study area, downstream is a grassland area and therefore erosion risk will be classified as “no risk” since grassland benefits from deposition. In November, the area upstream and midstream is under good vegetation cover due to the full grown crop being harvested. Erosion risk is low at this time. The method underestimated erosion risk for a considerable number of observations with low or medium risk classes for April upstream, and May, August and September midstream. The observations classified as high risk during these periods resulted in the maps as low or medium risk. Upstream and midstream, in April the fields are freshly sowed and are therefore under high erosion risk due to a low vegetation cover. In the midstream section most fields are opened up again and planted with the second season crop during the period August to September. At this point the fields are all bare and vulnerable to erosion. Therefore many of the field observations taken during these months up- and midstream were for severe erosion, which was occurring at the time of the fieldwork because of a lack of a good vegetation cover on the ground. A possible explanation for the misclassifications is that the fields, being fragmented are smaller than the pixel size. A larger pixel size may result in a higher classification of vegetation cover for adjacent fields where one is bare and the other covered with vegetation such as a perennial crop or pasture. However, for most of the months - May to November upstream and April, October and November midstream, the correspondences between the classification of the method and the field observations were practically reasonable. For monitoring erosion risk, therefore, particular attention should be accorded to the upstream area during the period April/May and midstream during the period of May to September. A summary of the different components which should be analysed for the best estimation of erosion risk in the Ngenge watershed is presented in the decision tree (Figure 2.9) and in Table 2.8. The table also shows the circumstances validating the need for the erosion risk analysis.

Table 2.8. Decision Table for erosion risk analysis for the Ngenge watershed, Mt. Elgon, Uganda.

Month	Rainfall intensity	Agricultural management	Expected vegetation cover	NDVI	Erosion risk	Need for erosion risk analysis
January	Low	Harvest	Medium	Moderate	No risk	No
February	Low	Land preparation	Low	Low	No risk	No
March	Low	Seedbed preparation and planting	V. low	Low	Low	No
April	Moderate	Planting and initial crop growth	V. low	Moderate	High - v. high	Yes
May	High	Crop growth	Medium	High	High - v. high	Yes
June	Moderate	Full crop growth	High	High	Moderate	Yes
July	Low	Harvest	High	High	Low	No
August	High	Seedbed preparation and planting	Low	Low - high	High - v. high	Yes
September	Moderate	Planting and initial crop growth	Low - high	High	High	Yes
October	High	Crop growth	Low	High	High	Yes
November	High	Full crop growth and harvest	High	High	Low	Yes
December	Low	Harvest	High	High	Low	No

2.3.3 Erosion risk and historical land use change

Figure 2.7 shows vegetation cover maps for the years 1980, 1990 and 2000 resulting from the analysis of NDVI from LANDSAT images. The total area under very high and high vegetation cover decreased considerably between 1980 and 2000 (Figure 2.8). The decrease in vegetation cover occurred in the upstream and midstream areas. The reduction in vegetation cover is the result of land use changing from forest to perennial cropping. The slope classification shows very steep slopes (>19.0%) in this part of the watershed. The reduced vegetation cover on these slopes indicates that erosion risk increased over the years. The increase in the area under the low vegetation cover class indicates that soil cover declined. Since most of the area under low vegetation cover is downstream, the erosion risk remains low.

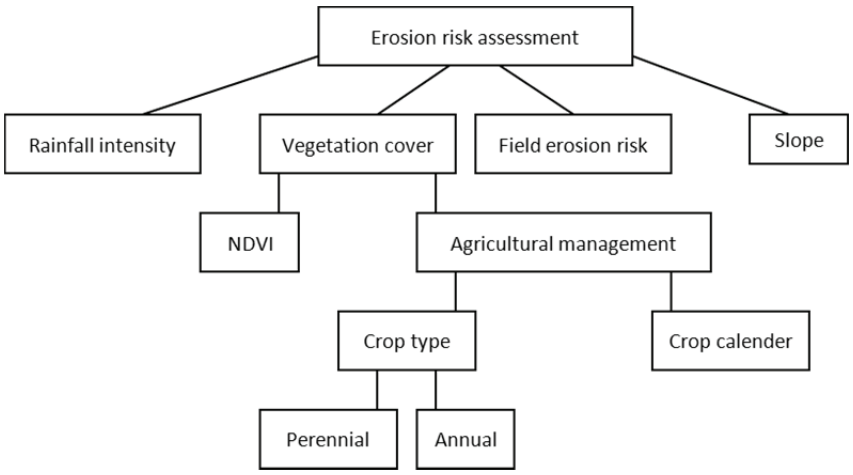

Figure 2.9. Decision tree for the assessment of erosion risk for the Ngenge watershed on Mt. Elgon, Uganda.

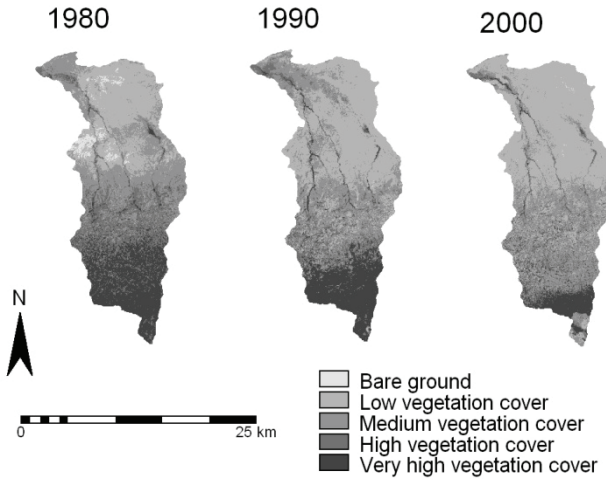

Figure 2.7. Maps of the analysis of NDVI from the three images of the years 1980, 1990 and 2000, respectively, to show the vegetation cover change in the Ngenge watershed on Mt. Elgon.

Apart from soil erosion, another form of resource degradation resulting from changes in vegetation cover is disturbance in the stream flow regimes of watersheds (Bewket and Sterk, 2005; Stroosnijder, 1996). According to (Bewket and Sterk, 2005) the underlying simple assumption is that land under sparse vegetation cover is subject to high surface runoff, low infiltration rate and reduced groundwater recharge. (Bren, 1997) investigated the effect of removal of slope vegetation on the diurnal variation in stream flow from a 46 ha catchment and observed that slope outflow increased after the vegetation on the slope had been destroyed. (Bren, 1997) concluded that the reason for the increase in slope outflow was probably that less water was taken up by the surviving vegetation. In studies on the effect of natural vegetation regeneration on drainage, (Keesstra, 2007) found that drainage reduced significantly with regeneration. This implies that vegetation removal causes runoff to increase and the runoff diminishes if vegetation cover increases, particularly if it is natural vegetation. Decreasing forest cover in the period 1980 - 2000 was, therefore, linked to increased flooding in the study area. According to the inhabitants - from community meetings carried out with them in the area - flooding occurrence started with the decreasing of the forest in the area. At present there are some conservation measures in the area - mostly in the midstream area but they are not sufficiently spread out in the whole area to trap the excess water. The roads are also seriously contributing to gully formation and sediment loading (personal field observation).

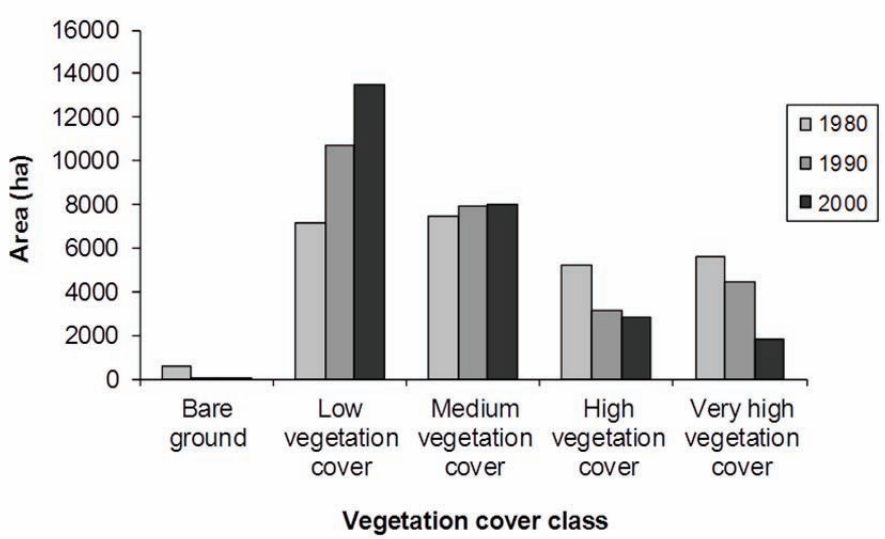

Figure 2.8. Area coverage for the different vegetation cover classes as derived from LANDSAT images for 1980, 1990 and 2000 for the Ngenge watershed on Mt. Elgon, Uganda.

Various studies have provided estimates of evapotranspiration ranging from 645 to 996 mm per year for natural forests and 339 to 420 mm per year for crops (Giambelluca et al., 2009; Schellekens et al., 2000; Scott and Sudmeyer, 1993; Wilson et al., 2001). From these studies we can conclude that when an area under natural forest is converted to arable land there is a significant amount of excess water released in the rainy season which increases drainage. Nature seeks to establish a new equilibrium between the current drainage network and the increased drainage. Since the physical drainage network has not yet attained equilibrium, the increased drainage raises river volumes leading to bank erosion as well as leading to surface runoff, and the risk of flooding remains. This emphasises the need to put in place provisions for guiding this extra drainage at both field and watershed scale: for example, by constructing bunds that break the slope, by ploughing along the contour and by constructing watercourses.

2.3.4 Remarks on the method

This method of erosion risk assessment, which is presented in (Visser and Jansen, 2006) and was applied to this study provides a rapid assessment of erosion risk for an area where information is needed for making decisions about interventions. It enables the periods in the year which are critical for erosion risk to be identified. In a situation of high intensity rainfall on cultivated slopes, as is the case in the Ngenge watershed, this method provides information which is useful for guiding interventions. Such interventions will be aimed at ensuring a good vegetation cover for the soil during the periods of high erosion risk.

One of the strengths of this method is its applicability in a data-poor environment. In developing countries, viable data on land cover and the resource base is inadequate for sound decision-making (Haack and English, 1996). With an advantage of this method is that the data required for carrying out the assessment as well as the GIS software ILLWIS for processing it can be obtained free of charge from the web. For situations of limited funding, as is the case in Uganda, adequate information for decision-making for immediate interventions can be obtained with the only costs being for the equipment and specialised personnel. This method demonstrates the tangible benefits of using remote sensing, which include savings in cost and time (Kalluri et al., 2003). The method is straightforward and easy to apply, requiring only the temporal evaluation of vegetation cover at the moments of high intensity rainfall, and the spatial distribution of slopes in the area (Visser and Jansen, 2006).

Since land management practices (Mutekanga et al., forthcoming) significantly affect erosion risk, some ground truthing is necessary to verify the outputs of the method. Vrieling (2007) states that ground truthing is always required for assessment of erosion risk. The local people are also a good source of information on erosion risk in the area, and local leaders such as the local councils could be trained in risk assessment.

One land management practice observed in the field to increase the risk of erosion is weeding under the growing crop. Weeding is done twice during each growing season, leaving the soil under the crop bare and exposed to overland flow (sheetwash). Therefore although the assessment of erosion risk indicates low erosion risk, as the observations in the months of August, September and November show, the erosion risk is actually high as a result of weeding. Interventions other than those ensuring vegetation cover to the soil are required, such as erecting barriers to impede overland flow.

2.4 Conclusion

The results of the analysis of erosion risk using rainfall, slope and NDVI are an expression of the erosion risk in the area. The “no risk” class was positioned accurately: downstream, where erosion in form of soil loss is not a problem. All the other classes covering midstream and upstream indicate an environment highly susceptible to erosion and hence a need for appropriate land management measures. This method of erosion risk mapping therefore provides a quick and straightforward means for identifying priority areas for

interventions for soil and water resource management. Appropriate maintenance of the soil and water resources for perpetual utilisation is required, because in Uganda most of the population derives their livelihood directly from the land.

The erosion risk assessment method as described in this paper is a tool which enables rapid derivation of information to assist in more precise intervention programmes. Designing interventions which are realistic requires a thorough understanding of the processes, extent and rate of resource degradation (Bewket, 2003). The appropriate policy needs to be focused mainly on the areas that are the source of flooding and sedimentation. Policy makers also need to focus resources from their limited budgets appropriately (Vrieling et al., 2006).

The rapid assessment not only allows for current erosion risk to be incorporated into the design of development projects but also provides information to assist the planning of more detailed programmes for monitoring and assessing the impact of land-use developments (Boggs et al., 2001).

The results of the field erosion survey and the analysis of NDVI from the satellite images of 1980, 1990 and 2000 indicate an overall increase in erosion risk in the study area. This is demonstrated by the continuous decrease in the area under dense vegetation cover, which on the ground is natural forest and perennial cropping. It is necessary to institute mitigation measures which encourage improvement in the vegetation cover over the soil, particularly in the upstream and midstream parts of the watershed. The interventions should also focus on halting the reduction in forested area, to reduce the risk of flooding.

Though recent satellite images are readily available on the internet, the images taken during previous years for use in vegetation cover change analyses may not be readily available. The policy makers may need to invest resources in the acquisition of these images, in the manpower for their interpretation and in fieldwork to acquire data on areas of particular interest.

Chapter 3

Using Stakeholder Analysis for Integrated Watershed Management: Strategy Development in the Ngenge Watershed (Mount Elgon), Uganda

An abbreviated version of this paper is accepted for publication as:
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Using stakeholder analysis for integrated watershed management: strategy development in the Ngenge watershed (Mount Elgon), Uganda

Abstract

In the Ngenge watershed, on the slopes of Mt. Elgon in the eastern Ugandan highlands, agricultural practices cause serious soil erosion problems and subsequent decrease in soil and water quality. Attempts to manage soil erosion in Uganda through policy interventions have so far not been successful. Existing policies and legislation for natural resource management are inadequate and generally have been formulated without consulting local communities. In the Ngenge watershed an Integrated Watershed Management (IWM) programme was initiated in order to foster sustainable land and water management solutions. This paper is part of a series of publications that describe the strategy for the implementation of this IWM programme and its impact. Given that the success of IWM programmes heavily depends on stakeholders' participation and their ability to take decisions, this paper focuses on the use of stakeholder analysis in IWM. It starts off from the assumption that in IWM it is of crucial importance that all key-stakeholders in the watershed should be involved in programme development and implementation; and not just a few of them. The stakeholder analysis (SA) described in this paper was applied as a tool in the Ngenge watershed to select these key-stakeholders, and to initiate a series of workshops for the participatory formulation of action and work plans. Three criteria were used to select key-stakeholders: 1) stakeholders' commitment to the implementation of IWM; 2) their power to influence the policy-making and implementation processes; and 3) the expected impact of the IWM programme on the stakeholders. The SA adequately identified the key-stakeholders to be involved in strategy development for IWM, although at the community level this tool for stakeholder selection still needs to be improved. Similarly, the outcomes of the workshops, namely concrete action and work plans as well as the commitment of policy makers to continue with this process, are clear evidence of the usefulness of SA as a tool for strategy development in IWM.

Keywords: stakeholder analysis, key-stakeholders, selection criteria, integrated watershed management, policy making

3.1 Introduction

Previous attempts for sustainable natural resources management in Uganda through various policy interventions have not been successful (Opio *et al*., 1998; NEMA, 2005). The main reason is that policies in Uganda were traditionally made top-down with little or no input from local level stakeholders. However, since 2000 the policy-making process has changed to a more consultative process (Siriri *et al.*, 2005), which has created new opportunities for Integrated Watershed management (IWM) programmes in Uganda.

IWM can be defined as the process of planning and implementing natural resource management (NRM) strategies in watersheds, with an emphasis on integrating biophysical, socio-economic and institutional aspects (Singh et al., 2002; Bewket, 2003; Heathcote, 1998). IWM aims at establishing sustainable rural livelihoods based on sustainable NRM, concurrently with the full involvement of the people affected: the stakeholders (Rhoades, 2000, Bewket, 2003). Stakeholders include all parties whose participation is essential for successful management. These include regulatory agencies (state, authorities, local) responsible for protecting natural resources; any party whose authority is needed to implement a management plan (e.g. the local officials); and people who reside in or use the natural resources of the

watershed. An important aspect of IWM is the identification and consequent coordination and integration of all these stakeholders (Bewket, 2003; Cobourn, 1999; Heathcote, 1998). For IWM to work, its proponents must pay close attention to the human dimension of NRM, that is, get stakeholders from different institutional levels communicating, cooperating, and coordinating their efforts (Baloch and Tanik, 2008). For effective decision-making on management strategies, the involvement of stakeholders early on in the IWM process is crucial (Billgren and Holmen, 2008; Grimble and Wellard, 1997; Simpungwe, 2006). This calls for identifying all important stakeholder groups and their interests, and enables reaching consensus on the objectives of the IWM programme. This requires collaboration: watershed management plans must be "owned" at the same time by all stakeholders, with a general, long-term goal or vision for the entire watershed (Cobourn, 1999; Reed, 2008, Kaplowitz and Witter, 2008).

The objectives of the "local" stakeholders may be quite different from the objectives of regulatory agencies and may even conflict. For example, in the Ugandan highlands often local stakeholders are interested in converting forest area to arable land whereas regulatory agencies are interested in preserving the forest as a nature area. Between these two extremes, there is a wide spectrum of real and potential stakeholders such as local businesses, NGOs, tourists, donors and government authorities (Billgren and Holmen, 2008). Failing consensus, it is important to have points of disagreement clearly spelled out at the start of the process. This will facilitate communication between different stakeholder groups, and enhance the prospects of justifying the choice of a final management plan as an equitable, best solution (Butcher, 1999). However, decision-making can only be successful if all stakeholders are involved.

Stakeholder Analysis (SA) is therefore an important aspect of IWM. It can be defined as a holistic approach to gain an understanding of a system, and to assess the impact of changes to that system, by means of identification of the key actors (stakeholders) and assessment of their respective interests in the system (Grimble and Wellard, 1997). SA acknowledges that power relations and disagreeing interests can undermine sustainable NRM. Although in SA all stakeholders and their viewpoints should be analysed, SA should focus on identifying key-stakeholders when it comes to crucial decision making concerning NRM; otherwise stakeholder involvement – and thus IWM as a programme – becomes unmanageable (Billgren and Holmen, 2008). SA can be used as a tool to reduce the all-inclusive stakeholder group to a workable realistic action-group for decision-making: committed key-stakeholders with sufficient decision power.

The objective of the present study was to apply SA in IWM for this purpose, hence, to decide who should participate in strategy development and decision making for IWM in the Ngenge watershed. To realise this objective, a three step approach was used:

1. Identification of NRM problems and stakeholders involved;
2. Selection of key-stakeholders to be involved in decision making for IWM;
3. Workshops at local and watershed level to formulate concrete action and work plans.

3.2 Methodology

3.2.1 Study area

The Ngenge watershed, situated on the northern slope of Mt. Elgon, is a typical Ugandan highland watershed characterised by high population pressure, a favourable climate, and deforestation followed by cultivation of steep slopes without adequate soil and water conservation measures (Semalulu et al., 1999). The present agricultural practices result in severe soil erosion, gully formation, and high sediment loads in the rivers during the rainy season (BIC, 1998; DSOER, 2004; Mutekanga et al. 2010). The River Ngenge is one of the main permanent rivers arising from Mt. Elgon. With its extensive forest (gazetted as Mt. Elgon National Park), Mt. Elgon represents a watershed of international importance. Astride the border with Kenya, it constitutes a major catchment for some of the major rivers that feed the lakes in the Nile River

system in Uganda and Lake Rudolf in Kenya. The large rural population living in the watershed depend on the ecosystem goods and services of the forest on the mountain slopes (Muhweezi et al., 2007).

The Ngenge watershed (665 km^2) lies between altitudes 1000m and 3000m asl and is characterised by rich volcanic soils that provide the watershed with a high potential for agriculture. Smallholder farmers with a mixed crop and livestock production system are typical in the area, and agriculture is mainly for subsistence purposes, with an average farm size of 0.8-1.6 ha (Kapchorwa, 2006). Administratively, the Ngenge watershed lies within the Kween District, and encompasses five subcounty areas which adequately correspond to the three main sections of the watershed: Benet and Kwosir upstream, Binyiny and Kaproron midstream, and Ngenge in the floodplain. The total population in the watershed is approximately 55,100 and the population density 262 persons per km^2 (UBOS, 2002). The population density is highest in the upstream part, followed by the midstream area. Downstream the population density is very low. People left the downstream area because of insecurity brought about by cattle rustlers. The very high population density upstream is caused by resettlement of the forest dwellers and people from the downstream plains, and land seekers from outside the watershed.

3.2.2 Data collection

Data was collected in 2006 by a range of different activities: 1) literature review; 2) community Participatory Rural Appraisal (PRA) meetings; 3) interviews with key informants; and 4) direct field observations in the watershed.

The literature review was carried out to gain insight into the area and the socio-economic context of resource degradation, and to obtain information on different stakeholders and potential key informants. The documents and reports included relevant policy documents and reports on the socio-economic and environmental state of the district.

Three community PRA meetings were held in each section of the watershed. The objectives of the PRA meetings were to 1) obtain an overview of the history of NRM in the area; 2) identify, according to the community, the most important issues concerning NRM; 3) obtain information on the main constraints and opportunities in relation to NRM; 4) ascertain the potential key informants to be interviewed for further information; and 5) obtain information on the likely stakeholders in the watershed and the prevailing natural resource management problems.

The key informant interviews were carried out to obtain in-depth information on the prevailing problems concerning NRM in the watershed, as well as perspectives on causes and possible interventions. The interviews were semi-structured with open questions.

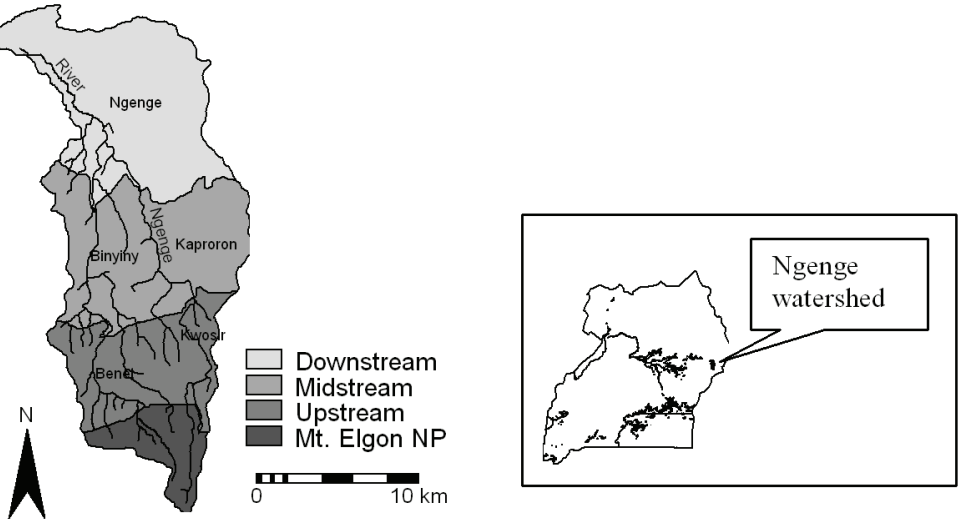

Figure 3.1. Location of the study area, Ngenge watershed, Uganda; NP stands for national park.

Direct field observations were guided by the District Environment and Forestry Officers aimed at obtaining an overview of the physical, socio-economic and political setting of the study area. Subsequently, random transect walks through the watershed were carried out to obtain data on the degree of natural resource degradation in the watershed and to identify the main causes and effects of the different problems (Grimble, 1998). The direct field visits gave an opportunity to cross check the information collected through the interviews. Details of the extent of degradation are presented in Mutekanga et al. (2010).

3.2.3 Stakeholder Analysis

From the information obtained during data collection, an assessment of natural resource problems in the watershed was carried out, including all stakeholders involved. Following Grimble and Wellard (1997), a stakeholder was defined as "any individual or group of people, organised or unorganised, who share a common interest or stake in land and water management in Ngenge watershed". Further analysis revealed the role of each stakeholder; their interests and objectives; and their degree of importance to the implementation of IWM in the watershed. From this all-inclusive group the key-stakeholders were identified: those that must participate in the decision-making process for IWM. A set of criteria was used to determine the key-stakeholders. The criteria were established by means of an in-depth analysis of literature on the stakeholder analysis process.

3.2.4 Workshops

Multi-stakeholder workshops were used to exchange views and insights, build shared understanding, and stimulate collaborative action. First level workshops were organized at subcounty level to capture specific community priorities for watershed management. The outputs from these community workshops were taken to the second level workshop, at the district level for consideration into action plans to be incorporated in the district development plan. This workshop focused on the watershed as a whole and encompassed the articulated interests of the community (Rinaudo and Garin, 2005).

3.3 Results

The results of the SA – applied as a tool in order to decide which stakeholders should participate in strategy development and decision for IWM in the Ngenge watershed – are presented according to the three steps of the approach:

1. Identification of NRM problems and stakeholders involved;
2. Selection of key-stakeholders to be involved in decision making for IWM;
3. Workshops at local and watershed level to formulate concrete action and work plans.

3.3.1 Step 1: Identification of NRM problems and stakeholders involved

Background to NRM in the Ngenge watershed

The origin of NRM problems in the Ngenge watershed dates back to 1983 when part of the Mt Elgon forest on the upper slopes was given to people for resettlement. These people came from the overpopulated forest dwelling Benet community (the Ndorobos) and from the Ngenge plains where people were fleeing from cattle raiders from the neighbouring Karamoja. The Uganda Government excised an area of 6000 ha on the edge of the forest for resettlement, which was soon cleared and cultivated, with soils exposed to erosive rains for long periods each year. The area attracted more people and led to diminishing land resources for cultivation and grazing and to further encroachment of the forest area. In order to protect the forest, it was converted to a national park in 1993 and declared inaccessible to the local people. The Uganda Wildlife Authority (UWA) took over the management of the National Park and discovered that the area given to the beneficiaries was exceeding the 6000 ha. A new border was established, including parts of

the already settled area neighbouring the forest, where UWA threatened to evict the people. Up to today people living beyond the new border are afraid of being evicted anytime. In addition, lack of access to the forest has denied the people a source of fuelwood, grazing land and other forest products and this is causing conflicts between the people and UWA.

Nowadays severe soil erosion is common on the slopes, and the rivers are often heavily loaded with sediments, while flooding and sedimentation downstream is serious. As a response, the National Environment Management Authority (NEMA) promotes soil and water conservation (SWC) measures, and several NGOs and CBOs in the area train people in sustainable farming methods. Simultaneously, elected Local Councils (LCs) are involved in development activities, at village level (LC1), parish level (LC2, for a group of villages), subcounty level (LC3, a group of parishes), county level (LC4, a group of subcounties), and district level (LC5). LCs are elected by the people from among themselves and are important for any developmental initiative. Most NRM initiatives are initiated at subcounty level (LC3), and then scaled-up to district level.

Identified NRM problems and the stakeholders involved

Table 3.1 shows the prevailing natural resource management problems in the Ngenge watershed and the stakeholders involved.

1. Land tenure insecurity

Due to the fear of eviction, upstream farmers have no tenure security and no incentive to invest in SWC. As a result, the land is left bare due to total deforestation and continuous cropping, with farmers investing in annual crops only in order to get quick cash. UWA, but especially the LC3 and LC5 leaders are responsible for assuring people land ownership. While this has not been settled, the district natural resource and agricultural officers have to work with the subcounty technical staff to sensitize the people on the importance of sustainable land management despite not having tenure security.

2. Lack of access to forest resources

As a result of deforestation in the upstream area there is a shortage of fuelwood as well as grazing land, a problem which has been compounded by UWA prohibiting any kind of human activity in the national park. Given that the local people need this area to support their livelihoods, there is increased forest encroachment causing clashes with UWA. The Local Councils, donors and NGOs who are interested in improvement of livelihoods are stakeholders in this conflict, as well as external stakeholders such as tourists who could provide support towards initiatives for improving livelihoods.

Table 3.1. Natural resource management problems in the Ngenge watershed on Mt. Elgon, Uganda.

NRM problem	Affected area	Stakeholders involved
1. Land tenure insecurity	Upstream	Local communities; UWA; LCs; District Natural resource and Agriculture officers; Subcounty technical staff
2. Lack of access to forest resources		Local communities; LCs; UWA; Donors; NGOs; Tourists
3. Soil erosion on farmland	Up- and Midstream	Local communities, Donors, NGOs, CBOs, District, LCs; Private sector, outside farmers, Subcounty technical staff
4. Riverbank erosion		Local communities; NEMA; Natural resource officer; NGOs
5. Cattle rustling	Downstream	LCs; Natural Resource Officer; Karimojong and Defence Force
6. Uncertain future of the wetland		Local communities; NEMA

Source: Key informant interviews, community meetings data and field observations

3. Soil erosion on farmland

Crop cultivation without SWC measures has led to loss of soil and nutrients; reduced yields; contamination of domestic water sources; siltation of rivers causing raised riverbeds and subsequent flooding of the rivers; landslides; and sedimentation downstream. There is inadequate extension for training in proper methods of cultivation on slopes. Next to the farmers several stakeholders are involved in this problem: the district administration, the subcounty technical staff, the LCs, Donors, NGOs, CBOs, the Private sector and external farmers who have commercial interests in the area.

4. Riverbank erosion

Due to increasing land pressure farmers cultivate up to the riverbank which has led to riverbank erosion. Riverbank erosion is contributing to serious flooding and sedimentation downstream. In order to reduce riverbank erosion, the Government through NEMA enforced the policy of riverbank management whereby 30m from the riverbank has to be left uncultivated. This resulted into eviction of farmers owning land on the riverbanks. The NGO KACODA provides alternative income sources to these farmers.

5. Cattle rustling

The downstream Ngenge Subcounty is a deserted area as a result of violent cattle rustling. In the 1970s many people fled upslope but are since 2002 returning back because government intervention has brought security. People are living in camps, protected by the national army, but without their livestock. They now dedicate themselves to agriculture, charcoal production and rice farming in the nutrient enriched wetland.

6. Uncertain future of the wetland

As a result of increased flooding and sedimentation downstream the wetland in the floodplain of the River Ngenge has expanded considerably. The floods created an opportunity to practise rice cultivation. Rumours are that NEMA wants to declare the area a protected wetland, limiting the agricultural activities of the community. There is no official decree and people live in uncertainty about what will happen, leading to suspicion towards any environmental activities.

3.3.2 Step 2: Selection of key-stakeholders to be involved in decision making for IWM

After identifying all NRM problems and stakeholders, the next step was to select the key-stakeholders: those that should be involved in strategy development and decision making for IWM. Table 3.2 shows the details of all stakeholders, their stakes in NRM, and their roles and objectives in an IWM programme. To select the key-stakeholders a set of criteria was applied, to ensure that the process had a legitimate representation of the different interests (Kirsty and Richards, 2007). First: key-stakeholders should have a high level of commitment to the implementation of IWM, assuring effective collaboration. Second: key-stakeholders are those that have power to influence the outcome of a project; a programme cannot do without them (Rastogi et al., 2009). Third: key-stakeholders are those directly affected by the project or policy to be implemented, and their participation gives the project legitimacy (Kirsty and Richards, 2007; Sanginga et al., 2004). In summary, the following three criteria were considered for selecting the key-stakeholders:

1. Stakeholder's level of commitment to the implementation of IWM;
2. Stakeholder's power to influence the policy-making process and implementation;
3. The expected impact of the IWM programme on the stakeholder.

A key-stakeholder was selected as such when complying to a high degree with at least one of the three criteria. Table 3.2 shows the criterion by which each key-stakeholder qualifies, which is shown in the last column with a "Yes". A key-stakeholder may fulfil all the three criteria but to a different extent as can be seen in the table in columns 5-7.

Table 3.2. Identified stakeholders involved in NRM and their role in policy for IWM in the Ngenge watershed on Mt. Elgon, Uganda.

Stakeholder category	Stakeholder	Stake in NRM	Objectives and role in IWM program implementation	Selection of key-stakeholders			
				Criterion fulfilled			Key stake-holder
				Level of commitment	Power to influence	Affected by policy	
Community	Community members such as farmers and women	Resource user: soils (crops), firewood, water	Improved livelihoods; Improved yields, reduced soil and water contamination	**	*	***	Yes
Local councils	Local councils 1-5 and Committees	Resource user Policy makers for NRM	Improved livelihoods; Mobilise people for policy implementation	***	***	***	Yes
Subcounty technical staff	Subcounty Chief, CDO, Health Insp. and NAADS coordinator	Resource users; Implementing policy	Technical advisers; Oversee policy implementation	***	***	***	Yes
District Administ-ration	CAO, Technical officers of Natural Resources, Environment, Forestry, Agriculture, Fisheries and Water	Implementers of Government policy	Technical advisers; Training and sensitisation; Resource mobilisation; Monitoring	**	***	*	Yes
	District Engineer	Implementation of policy	Engineering water sources and roads	**	***	*	Yes
	Technical officers of Community development and Gender	Involvement of vulnerable groups	Livelihood options, mobilisation and sensitisation of vulnerable groups	*	**	*	No
	Health Inspector	Technical adviser	Improved water quality; Improved health	*	*	*	No
National Government departments	NEMA and UWA	Policy advisor on NRM	Implementation of government policy	**	***	*	Yes
	Agriculture (NAADS), Water (DWD) and Roads (UNRA)	Implement government policy	Service and infrastructure provision: agricultural, water and roads' sectors	**	***	*	Yes
External stakeholders	Defence	-	Provision of security against Karimojong	*	**	*	No
	Karimojong	-	Cause of insecurity	*	**	*	No
	Outside farmers	Resource user	Utilise land for farming for profits	*	*	*	No
	Tourists and tourist organisations	Resource user	May support biodiversity conservation	*	*	*	No
Private sector	Traders from other districts	Resource user	Purchase goods for outside markets	*	**	*	No
	Food Processing: Uganda Breweries - barley; Job coffee - coffee	Resource user	Promote production of barley and coffee; provision of credit; Purchase harvest	*	**	*	No
	Seed companies	Resource user	Promoting new seed varieties	*	*	*	No
Donors and NGOs	Donors: IUCN, UNDP, AHI, KADLACC; SNV; HORIZONT NGOs: Church, KACODA and FHI	Donors as financiers NGOs as implementers of policy	Support policy implementation and sustainable management of resources according to their individual mandates	*	***	*	Yes
CBOs and Associations	CBOs and Associations	Empowerment of members	Training and education of the people on better agricultural practices	***	**	***	Yes

Source: Key informant interviews, community PRA meetings data and field observations

The Community

The community is an important stakeholder consisting of people that directly use the natural resources for their livelihoods: farmers and their families. They use land for crop production and grazing; water for domestic use and trees for fuelwood and non-timber forest products. Since these stakeholders will be affected to a high degree by IWM strategies and policies, they are considered to be key-stakeholders. However, considering the other two criteria, their commitment to the implementation of IWM will depend on the expected benefits, and currently their power to influence the decision making process is very limited.

The Local Councils (LCs)

The Local Councils are the political leaders in the district. Being policy makers for NRM in the district and with their objective to improve local livelihoods, the LCs are highly committed to IWM and have the power to influence the decisions. They are therefore key-stakeholders. The LCs are highly respected by the community and through the Local Government Act have the mandate to make bylaws. The LCs 1-3 are local leaders and responsible for the mobilization of the community for bylaw formulation and policy implementation. The LC3 is most important; at this level final decisions are made. The LC5 is the highest decision making body in the district, and have to approve all laws, bylaws and policies. It has high interest in participating in IWM and protection of the natural resources, since the different land and water management problems hinder the socio-economic development of the area. Special committees at subcounty level deal with land and water issues. Although most committees are inactive due to lack of facilitation and information, they are important to take part in the IWM decision making process.

The subcounty technical staff

The subcounty technical staff include the subcounty chief, National Agricultural Advisory Services (NAADS) coordinator, the community development officer (CDO), health inspector and the parish chiefs. They are all members of the community and work with the assistance of the committees. Their main task and commitment is to oversee the implementation of policy at subcounty level, and they also have the power to influence it. Moreover, as members of the community they are affected by policy decisions taken; hence they are typical key-stakeholders.

District Administration

The district administration is headed by the Chief Administrative Officer (CAO) and consists of several technical staff members who are important to participate in IWM policy making: the District Engineer and the officers for Natural Resources, Environment, Agriculture, Forestry, Fisheries and Water. They are technical advisors of the council, their offices and mandates directly influence NRM and the implementation of IWM, and they are responsible for implementation of Government policy at district level. Although they are only moderately committed to IWM (unless they are well facilitated logistically) they are considered key-stakeholders. Other technical staff members, particularly the community development and gender officer and the health inspector, are not considered key-stakeholders because of not meeting with any of the criteria.

National Government departments

The National Government departments are responsible for advising the government on policy and also for overseeing policy implementation. NEMA and UWA are the authorities in charge of the environment and tourism respectively and in the Ngenge watershed involved in policy advice and implementation. The NAADS and Directorate of Water Development (DWD) are governmental programmes, and responsible for policy implementation and service provision to local communities. Both are not very effective: NAADS works with only a few selected farmer groups, and water sources managed by DWD are often still

inadequate. The Uganda National Roads Authority (UNRA) is also important to participate in policy making for IWM, because of being responsible for maintenance of roads, which often contribute much to flooding and sedimentation downstream. Although all these government departments and programmes are only moderately committed (unless they are well facilitated logistically) they are considered key-stakeholders because of their high influence on policy making and implementation.

External stakeholders

These are stakeholders who do not reside in the watershed, but due to their activities have an influence on land and water management. An example is the Karimojong with their cattle raiding: since no constructive contribution is expected from them to the policy making process, they are not key-stakeholders. Outside farmers come from other districts to the watershed to hire out land for cultivation, aiming at gaining high profits. They do not feel responsible for resource degradation in the area and do not respect the bylaws on riverbank protection, forestation and good agricultural practices. Since they often hire people to cultivate the land and are not present in local meetings, these farmers also are not classified as key-stakeholders. Tourist organizations see an increasing number of visitors attracted to the National Park (e.g. for watching wildlife). With the development of tourism there is potential for increased revenue to the area for example through ecotourism. Nevertheless, given their low commitment and low power to influence decision making, tourist organizations are not key-stakeholders.

Private sector

The private sector is mainly private agricultural businesses buying or selling agricultural products in the watershed. Traders come from outside the district and require that products have to qualify to certain standards. Moreover, some agricultural processing companies promote products and offer good package deals to the farmers, and seed companies promote new seed varieties in this area. Although the private sector may to a certain extent influence the way the farmers' manage their land, they are neither affected nor committed to the IWM policy, and are thus not key-stakeholders.

Donors and NGOs

Donors provide financial support to specific activities in the watershed such as borehole construction, sensitization programmes on environmental protection and bylaw formulation. The four donor organizations in the area channel their financial support either through the district administration or through one of the NGOs. Although they carry out projects according to their own specific objectives, their mandates are usually in line with supporting livelihoods and NRM. As long as the IWM programme implementation falls within their mandates they are committed to support it. They are not affected by the implementation of IWM but since they have the capacity to mobilise funding for their activities they have high influence. As a result, they are key to participate in the decision making process.

CBOs and Farmer Associations

CBOs like NGOs are non-profit organisations, whose overall aim is to improve the living conditions of the people. They are founded by community members and are active at the grassroots level. Their activities mainly focus on sensitising people on afforestation, riverbank protection, hygiene and sanitation, good agricultural practices and NRM. Next to the CBOs, associations are groups of farmers that commercialize their agricultural products. Through the associations farmers are also able to attract experts to provide them with technical advice and training. There are four CBOs and four Associations operating in the area. Considering that both are composed of community members and highly committed to the decision making process they are key-stakeholders for IWM.

3.3.3 Step 3: Workshops at community and watershed level.

The community workshops

Considering the different sections of the Ngenge watershed (up, mid and downstream) and their specific problems, it was decided to organize one community workshop in each section. These three workshops aimed at capturing the opinions of local key-stakeholders on the most appropriate interventions for their area, and at motivating them to become involved in the decision making process. Most of the key-stakeholder groups in the community were represented. Farmers' representatives were diverse: landlord farmers, tenants, rich and poor farmers, but also those who apply SWC measures and those who don't (which influence decisions concerning land management). The local leaders were represented by the LC1 Chairman of the village where the workshop was held; by the LC2 and 3 Chairmen, and by the Subcounty Chief of the area. FHI, the active NGO in the watershed, was represented in only the upstream workshop. The District Natural Resources Officer and the Assistant Forestry Officer attended as overseers of the workshop dialogues. Some of the key-stakeholders could not attend the workshop due to logistical problems: the LC1 chairmen of the surrounding villages in the watershed, the chairpersons of the different committees dealing with land and water issues, and the CBOs and Associations operating among the communities.

The watershed workshop

After these community workshops a final workshop was organised at watershed level, aiming to involve the key-stakeholders that have the power to influence the success of the policy, particularly policy makers and donors. The intention was to bring the deliberations from the community workshops to the table in the final workshop for the policy makers and donors to consider for policy. In order to motivate and capture the full attention of the policy makers and donors, this workshop was held during one full day in a city hotel away from the study area. The results of this workshop were action and work plans, which are to be translated into IWM policy for implementation. Apart from women leaders from the communities, other community representatives were the LC3 chairmen and subcounty chiefs. A representative of the Benet Lobby Group representing those adjacent to the park was also present, but the Benet subcounty Speaker could not attend due to personal reasons. The district leaders were the LC5 Chairman; the LC5 councillor for women affairs; the CAO; the district environment officer; the NAADS coordinator; and the district engineer. A representative from both UWA and NEMA attended but the one from DWD did not. There was very poor participation from the donor community - from among those invited only AHI was present. The donors' participation was badly missed, not only because they could have learned from the peoples' opinions, but also because of the opportunity to inform people of how to obtain their support. Unfortunately, not all identified key-stakeholders could be invited to the workshop due to funding limitations: the councillors at LC5 dealing with land and water issues; the woman councillor representing the vulnerable groups; the coordinator for KADLACC (LandCare) who is an advisor for CBOs dealing with NRM in the district; and the Chairpersons of the CBOs and the committees at LC3.

3.4 Discussion

Watershed management projects need to start with rapid but systematic analyses of the nature and roles of stakeholders in the watershed (Rastogi et al., 2009). These analyses will be critical to design interventions that address the threats to and opportunities for watershed management created by the stakeholders' conditions and goals (Perez and Tsinkel, 2003). In the Ngenge watershed this analysis was carried out by means of a SA and subsequent workshops.

According to Prell et al. (2009), in order to identify stakeholders, it is first necessary to define the aspect(s) of the system, and the problem(s) or issue(s) under study. This is an important initial step, but one that is rarely considered explicitly in stakeholder analyses. Without knowing the issues, it is difficult to know which stakeholders should be involved (Prell et al., 2009). Yves et al. (2001) also argue that there is need for a clear method that allows process facilitators to identify all those who have a stake in resource management. The cases they studied suggest that this method must start from the functions of the resources and not from the users (Yves et al., 2001). But Prell et al. (2009) rightfully observe that this is often typically done in a top-down manner (by the team leading the SA) and may therefore mainly reflect their interests and biases. They therefore propose a more iterative approach, where initial scoping interviews and focus groups guide the selection of issues. Such a participatory way of bottom-up problem identification was also applied in the case of the Ngenge watershed, by means of community meetings, interviews and the SA.

SA is especially relevant to natural resources management because of the diversity of claims on these resources and resulting frictions among stakeholders. Rastogi et al. (2009) carried out a study in which they applied SA as a tool to minimize conflict in the conservation of the Corbett National Park (CNP). They identified and analyzed the different stakeholder groups and found out that the stakeholders opposed to conserving the CNP had low knowledge regarding the park's purposes. As a result, it was recommended to give more emphasis on knowledge transfer to stakeholders. In the Mount Elgon region Petursson et al. (2011) conducted a SA in order to foster a transboundary (Uganda-Kenya) protected area management regime with the border communities. They found out that institutional complexities constrained a joint approach to biodiversity conservation in transboundary areas, and recommended to urgently start taking into account the concerns of all stakeholders in order to avoid conflicts; not only the bordering communities.

The SA described in this paper not only identified the natural resource conflicts, but also laid the foundation for follow-up workshops and more collaboration among the different stakeholders in the watershed. Through the workshops the different stakeholder groups had the opportunity to express their opinions and learn about others' opinions. Developing such a shared understanding among involved actors is an important step towards building a common vision of what can and needs to be done (Schwilch et al., 2009). Given that the natural resources conflicts were distinct in each section of the watershed, it was logical to organise the community workshops for each section of the watershed separately (details of the workshop outcomes are described in Mutekanga *et al*, in press).

For in-depth deliberative decision making in workshops it is imperative to have small groups of participants; this ensures that all stakeholders have a chance to have their opinions expressed (Prell et al., 2009, Schwilch et al., 2009). Otherwise, in order to include all the stakeholders it would require organising workshops over several days to provide enough time for all the opinions to be heard (Schwilch et al., 2009). In Step 2 of the SA (selection of key-stakeholders to be involved in decision making for IWM) the three selection criteria were very useful in identifying key-stakeholders and reducing the all-inclusive group of stakeholders. To this end, the stakeholders were identified according to their individual roles and interests in land and water management. This was imperative since the natural resource conflicts in the watershed are the main cause of poor resource management. Furthermore, the conflicts are the reason why the communities do not undertake environmental action. According to Grimble (1997) conflicts and trade offs increase with increasing population pressure and increasing scarcity of the resource.

However, still the number of stakeholders indentified in the study area by this method turned out to be relatively big - taking into account the scope of this PhD study - and as a result not all identified key-stakeholders could be invited to the workshops due to timing and funding limitations for costs of lodging, transport, feeding and day allowances for the participants. Prell et al. (2009) describe the use of another method for the same purpose: an in-depth analysis of existing social networks to determine who out of all

stakeholders are most important to participate in NRM initiatives. They looked beyond the attributes of the stakeholders to the relations between them, arguing that the stakeholders in their decision making are greatly influenced by these networks. Thus by analysing networks they were able to categorise the stakeholders into various groups such as those with similar views; those who communicate effectively to each other; those who are highly influenced by an individual and many others (for details see Prell et al. 2009).

In the Ngenge watershed, farmer groups are not well-established and successful except in a few areas midstream. Facilitating group formation and building capacity concerning the need to co-operate and manage resources sustainably is thus necessary. This is a first important component of an IWM strategy. A second component is to form partnerships within the watershed and link farmers to other actors that have the knowledge they need (Kessler, 2006). In the Ngenge watershed KASEKO (a local CBO) has received training from IUCN and has successfully implemented soil and water conservation on their members' farms. Farmers in such partnerships tend to exhibit higher levels of adoption of best management practices on their farms than those who do not collaborate (Campbella et al. 2011). Moreover, within partnerships stakeholders feel interdependent, which is essential for joint decision making and cooperative action. In our case in the first step of the SA a start was made to tackle both components, by analysing the factors that influence their decision making (knowledge levels, capital, information, networks, etc.).

According to Schwilch et al. (2009), stakeholder workshops are successful when collective learning is facilitated, and information flows between different stakeholders are multi-directional. This requires a 3-day stakeholder workshop, although even then the short duration limits the depth of the process of mutual learning (Schwilch et al., 2009). In the Ngenge case each workshop took only one day, and although all the participants showed much enthusiasm, they indeed requested more of such workshops (and with more stakeholders) and of longer duration (2-3 days) in order to enrich the dialogue and mutual learning process.

Concerning participation, in the community workshops the active contribution and participation exceeded previous expectations; all invited participants attended. A major setback however was that, as already outlined above, not all identified stakeholders could attend the watershed workshop and had to be represented by others. Nevertheless, short comings are inherent to this kind of workshops but do not affect the generally positive feelings of participants and the added value of having been able to come together and express opinions. This might be interpreted as an indication of the importance of and value given to the mere fact of bringing together different stakeholder groups to exchange their ideas, experiences, concerns and knowledge (Schwilch et al., 2009). And according to Jepsen and Eskerod (2009) the SA should not be seen as resource demanding activity, but as an ongoing learning process and an opportunity to engage in dialogue with the stakeholders to take their thoughts regarding the project into consideration at an early stage. By choosing this perspective on stakeholder management they think that stakeholder analysis can make a great contribution to the success of a project (Jepsen and Eskerod, 2009).

The organisation of the workshops in the two levels - community and watershed - helped to involve many different categories of stakeholders, especially in the community workshops. According to Sanginga et al. (2004) despite considerable progress in local government reforms in Uganda, it is only to a limited extent that policy makers seek information from such key-stakeholders in designing and formulating policies. Farmers and local communities are often limited to simple representation and the small-scale poor farmer is often forgotten (Sanginga et al., 2004). They therefore recommend that participation can be promoted by facilitating platforms where community members or community representatives can engage in dialogue with the leaders and other stakeholders. Such a two-tier stakeholder process for collaborative planning has also proved successful elsewhere in complex stakeholder environments (Cullen et al., 2010).

Sanginga et al. (2004) in their action research project to facilitate the integration of participatory approaches to policy decision-making used three mechanisms for promoting policy dialogue which are complementary and feed into one another:

1. bottom-up community inclusive processes (community level policy dialogues);
2. subcounty representative policy meetings, and
3. district level stakeholders workshops.

They observed that the strengthening of community level processes cannot stand on its own and requires the support of the subcounty and the district since they have important political and administrative powers to make bylaws, prepare development plans, budgets and allocate resources. They argue that the subcounty as the basic political and administrative unit has good potential for stimulating local organisations and democratic processes to influence policies from bottom up. In our study the community workshops involved the participation of the subcounty leaders; in the Ngenge watershed the three different sections (up, mid and downstream) generally correspond to distinct subcounties. This highly contributed to the fact that the respective subcounties really owned the community workshops. According to Woods (2008), the participation process is more likely to be successful when the public can relate to the boundaries, scale and local nature of the issues. This is a key issue for effective public consultation and participation because 'ownership' of environmental problems and their solutions is essential to successful and sustained improvements (Woods, 2008).

The SA was generally adequate in identifying the key-stakeholders except for two categories of stakeholders within the community for whom it later became apparent that they should have been identified as a separate group. The first specific key-stakeholders missed to be identified were the opinion leaders in the communities, who are highly influential and can mobilise the people. Furthermore, their roles do not commonly change and they remain for a long time in the same position. Opinion leaders include the religious leaders, retired civil servants such as the teachers, the security forces and elders; and in the upstream area, the Ndorobo leaders (from this group only a Ndorobo leader was invited for the watershed workshop to represent the local communities adjacent to the forest). The second case concerns the specific kind of farmers who differ in each section of the watershed due to the differences in socio-economic context and agro-ecological zones, and who have different opinions on IWM. For example, tenant farmers may not necessarily be interested in SWC since they do not own the land and want to maximise utility of the plots being hired. The landowners may also not be very involved in land management since they mostly hire out their land to the tenant farmers. Therefore, in the process of developing the scenarios it became apparent that the perspectives of the different categories of farmers would be important and thus they were all represented in the workshops. Fortunately, at the time of inviting the workshop participants it was realised that the 'farmers' were of various characteristics, and the specific kind of farmer groups participated as such in the workshops. However, these differences should have been identified already in the SA.

3.5 Conclusion

From the results of the SA, policy makers and project managers have a guideline on who should be involved for the effective implementation of the IWM programme in the Ngenge watershed. The three steps followed to conduct the SA provided sufficient information for identifying the key-stakeholders and how they should be involved in the policy making process. For the first step, however, the SA failed to identify some specific stakeholder groups within the community stakeholder category. Further analysis of this particularly diverse category was necessary so as to further separate it into more specific categories basing on existing networks and groups. For the workshops, the two levels for organising them aided in ensuring that all the different stakeholder categories were well represented in the workshops and all had the opportunity to express themselves: firstly at community level in each of the different sections of the watershed and secondly, at watershed level with the policy makers and representatives from the donors and National Government. The outcomes of the workshops, namely the action and work plans are evident of the success of the SA in identifying who should participate. Calls by the policy makers for more of such workshops and also involving even more of the stakeholders implied that there was general satisfaction with the workshop processes and the participation of the stakeholders.

Chapter 4

Stimulating multilevel social learning in watershed management in Uganda

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Stimulating multilevel social learning in watershed management in Uganda

Abstract

Processes of social learning were stimulated and examined in two-level workshops organized to bring stakeholders together to dialogue on policies for watershed management in the Ngenge watershed in Uganda. In the first level workshops, held in the up-, mid-, and downstream sections of the watershed to capture the community priorities, scenarios were constructed. These scenarios were taken to the second level workshop, representing the whole watershed, which aimed at making action and work plans to be incorporated into policy. To examine the social learning process occurring in the workshops and to evaluate their potential outcomes in terms of new watershed policies, a conceptual framework of Pahl-Wostl et al. (2007) was adopted, distinguishing technical qualities (knowledge, plans, technical solutions) and relational qualities (personal relations, networks, trust) as potential outcomes of learning. The scenarios and the consequent action and work plans are the technical qualities emanating from learning in the workshops. The relational qualities were deduced from the multi-level nature of the workshops, which enabled stakeholders to realise their full potential in the decision-making process. The processes of developing the scenarios and making the action and work plans generated active involvement of the participants and encouraged exchange of ideas between them. Participants were satisfied with the workshop processes and called for the involvement of more stakeholders and for the continuity of the dialogue processes and implementation of the outputs of the workshops.

*Keywords:*social learning, watershed management, workshops, policy, Ngenge watershed

4.1 Introduction

4.1.1 Social learning and participation

Learning that results in enhancing a group's ability to change its underlying dynamics and assumptions has been termed 'social learning' (Tippet et al., 2005). The concept of social learning provides useful insights into the processes and factors that support fruitful stakeholder involvement in river basin management planning (Tippet et al., 2005). Implementation of integrated water management is not possible without the increased collaboration of authorities and stakeholder groups from different sectors, e.g., spatial planning, flood protection, water supply management. Without integrating the points of view of citizens and other stakeholders, water management runs the risk of getting stalled early in the implementation phase (Mostert et al. 2006; Pahl-Wostl et al., 2007). Both collective action and the resolution of conflicts require that people recognise their interdependence and their differences, and learn to deal with them constructively. To do this, different groups need to increase awareness about their biophysical environment and the complexity of social interactions. Stakeholders need to be well informed and learn new skills in order to maximise the benefits of their participation (Tippet et al., 2005; Heyd and Neef, 2006; Maarleveld and Dangbégnon, 1999).

The growing emphasis on social learning in scientific literature and in practice goes hand in hand with an increased attention to participation. Several authors suggest that there is a cyclical relationship between active engagement and social learning, in which participation is a crucial way of encouraging social learning, for it is in the interaction of different parties, exploring each others' world views, perceptions and potential environmental impact, that social learning can occur (Blackmore, 2007; Van Koppen, 2007; Tippet et al., 2005).

4.1.2 Pahl-Wostl's model of social learning

In this study, processes of social learning are investigated following the conceptual framework of Pahl-Wostl et al. (2007), which captures processes of multilevel social learning in river basin management (see Figure 4.1). In the centre of the framework are the multi-party collaboration processes, which are perceived to be the nuclei of the learning processes. These processes are influenced by the context in which they are embedded and they produce outcomes that may lead to changes in the context, resulting in a cyclic and iterative process of change. Another interesting feature of the framework is that it identifies and distinguishes the social relational aspects and the more technical issues of problem solving. With regard to the potential outcomes of learning, the framework distinguishes technical qualities, such as knowledge, plans, and technical solutions, and relational qualities, such as personal relations, networks, and trust. High technical qualities refer to theimplementation of highly effective measures to deal with an environmental problem. High relational qualities refer to a significant capacity of stakeholders to collectively deal with the problems, to enhanced trust in relationships, and to the satisfaction of the participants with the overall process (Pahl-Wostl et al., 2007). The context of social learning includes the governance structure and the natural environment in a river basin. Governance structure encompasses the legal and organizational framework as well as the cultural and socioeconomic environment, and has a strong influence on multiparty cooperation and social learning processes.

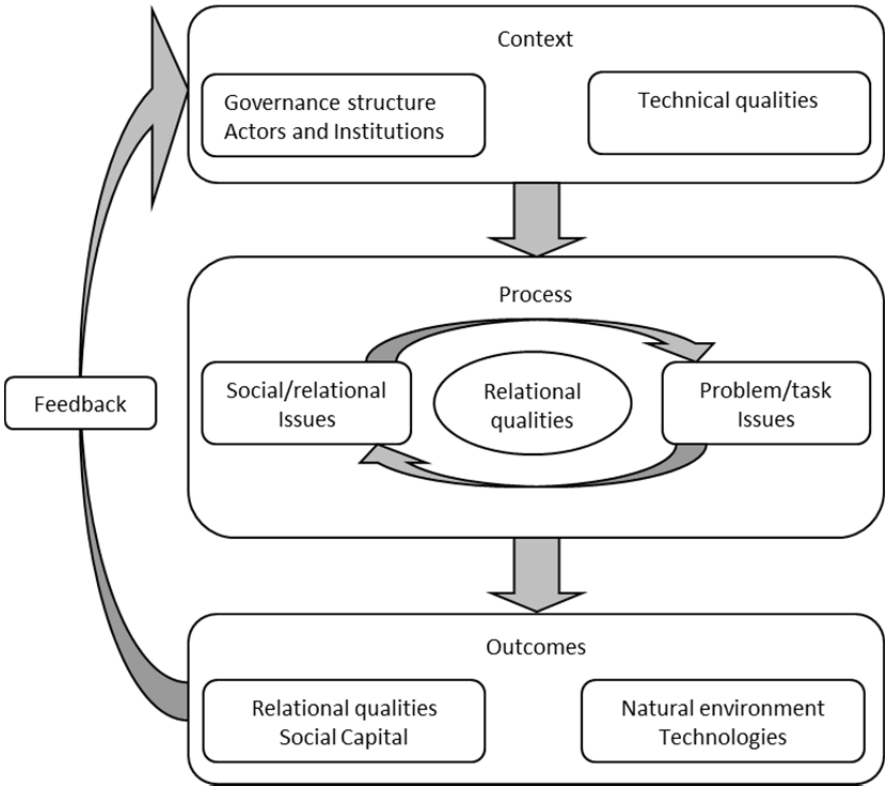

Figure 4.1. Conceptual framework for social learning in resources management (Adapted from Pahl-Wostl et al., 2007).

4.1.3 Multi-level learning

Pahl-Wostl et al. (2007) describe the overall social learning process as a multiscale process by which social learning is assumed to occur at different levels of agent interactions: *micro* – on short to medium time scales at the level of processes between collaborating stakeholders; *meso* – on medium to long time scales at the level of change in actor networks; and *macro* – on long time scales at the level of change in governance structure. These levels are interdependent, and multilevel change is assumed to proceed in an iterative and not necessarily sequential fashion via second-order feedback. A comprehensive understanding of social learning must take these multilevel processes on different time scales into account.

It is worth pointing out that there is no one-to-one relationship between time scales and governance scales. While it is obvious that long-term institutional shifts are often dependent on national and international level regime changes, we can also find micro-level learning on those levels. Conversely, long term structural learning can occur on local governance levels. Present-day governance is characterized by the interplay and cross-linking of scale levels in space and time (Bulkeley, 2006).

In this study the focus is on *micro* and *meso* levels of agent interactions. We stimulated and investigated social learning in resource management in three local level workshops and one higher-level workshop. The levels chosen for the workshops were in line with existing governance levels in the country. In Uganda, governance takes place at three levels: subcounty, district and national level. Traditionally, the relationship between these levels is hierarchical (Webler and Tuler, 2001). In recent years, however, this notion of government has been replaced by ideas of multiscale, polycentric governance, which recognizes that a large number of stakeholders in different institutional settings contribute to the overall management of a resource (Bulkeley, 2006).

In Uganda, traditionally, policies were made by a few people in government with little or no input from other stakeholders. Over the last 15 years or so, policy-making in Uganda has changed from a top-down effort of policy makers to a more consultative and participative process. The national government now solicits stakeholders' views and through the Local Government Act the power of decision-making shifted to the people. Democratically elected councils at various administrative levels have the power and financial budgets to develop and implement policies concerning natural resource management (Siriri et al., 2005). Local councils have passed a number of by-laws on agriculture and food security, but not yet on efficient use and preservation of soil and water resources (Opio *et al*., 1998; NEMA, 2005). Nunan (2007) calls for the integration between and within different governance levels to strengthen the effectiveness of natural resource management.

4.1.4 Stakeholder workshops as a means for social learning

Within the governance context described above, and building on previous research in the area (see Mutekanga et al., forthcoming) multi-stakeholder workshops were organized at different levels to promote and investigate social learning in the period of November 2008 - July 2009. Through a combination of workshops at different levels, different stakeholders developed action plans which could be incorporated in the district planning programmes. Local perspectives would thus be incorporated in managing soil and water resources.

4.1.5 Research questions

The questions guiding our research are as follows.

- Is it possible to stimulate multi-level social learning by organizing and linking stakeholder workshops at local and district level?
- If yes, which are the main factors enabling or constraining the success of the multilevel learning processes?

4.2 Methodology

4.2.1 Study area

The Ngenge watershed of Kapchorwa District formed our case study area. Astride the northern slope of Mt. Elgon, it represents a typical Uganda Highland watershed characterized by considerable human settlement whose agricultural practices are causing deforestation, soil erosion and sedimentation of rivers. The watershed consists of three parts - upstream, midstream and downstream - unique from each other in terms of socio-economic conditions and land and water management. In 1993 the Mt. Elgon Forest on the

upper slopes was declared a national park, effectively prohibiting all human activity. This necessitated resettling the forest dwellers and other landless people to the lower slopes. This recently resettled area forms the upstream part of the watershed, where subsistence annual crop farming is practiced without adequate soil and water conservation (SWC). This has resulted into serious soil and water degradation. There is lack of government intervention and due to poor infrastructure the area is not easily accessible by road. In the midstream part, which is more easily accessible, established settlements exist with subsistence farming of mixed perennial and annual cropping with some SWC but also soil and water degradation due to cultivation on slopes. The downstream flood plain is frequently affected by flooding and heavy sedimentation. The area is recovering from the effects of cattle rustling, which disrupted the traditional livelihood of livestock keeping. The people depend on fuelwood and charcoal burning, resulting in deforestation. Those who can obtain loans are growing rice on the enriched sediments coming from upslope. There is a serious shortage of good quality water for domestic use since the water sources contain heavily silted water.

4.2.2 Baseline information acquisition to develop drivers for scenario development

Baseline information for the organization of the workshop was obtained during extensive research in the area (see also Mutekanga et al, 2010; Mutekanga et al., forthcoming). Data collection was primarily by village meetings, focus group discussions, key informant interviews, a farm household survey and direct observation. The baseline information concerned the following issues on land and water management:

1. The physical, socio-economic, and institutional factors which influence development in the watershed;
2. Communities' perceptions of their main constraints and opportunities with regard to land and water management;
3. History of land and water management practices in the area;
4. The likely stakeholders to be involved in policy making processes.

Drivers of soil and water degradation were used in the workshops to structure the meeting and to guide scenario development. Drivers are the main problems in natural resource management as seen by the people. They are the determinants of man’s activity and impact on the natural resources and therefore are used as the basis for scenario development. Drivers may be biophysical (poor soil), socio-economic (population pressure), or an interaction between the two (erosion resulting from poor soil management).

4.2.3 Community workshops in the three parts of the watershed

A workshop was organised for local community members in each part of the watershed, since the three parts differ significantly in socio-economic situation and in land and water management issues. The venues selected for the workshops were locations most centrally placed in that part. Upstream, the workshop was held in Benet subcounty in the Presbyterian Church at the Kamnarkut trading centre. Midstream and downstream, it was held at the subcounty headquarters at Binyiny and Ngenge, respectively. Participants were selected on the basis of a stakeholder analysis (Mutekanga et al., forthcoming) according to their involvement in soil and water resources management. The stakeholder categories, the reasons for their selection and the invited participants are presented in Table 4.1.

For the dialogue processes in the workshops the drivers identified were presented to the participants and in groups scenarios were developed. The groups were organised in such a way that different stakeholders and policy authorities were present in each group, so as to promote exchanges between governmental and non-governmental actors. The scenarios were defined by listed and mapped activities.

Table 4.1. Stakeholder categories of invited participants to the community workshops in the Ngenge Watershed at Mt. Elgon.

Stakeholder category	Invited participants (no. of participants)		
	Upstream (24)	**Midstream (19)**	**Downstream (18)**
Community representatives - farmers, women, etc - directly affected by policy	Landless person - man from Yatui Wealthy land owner Steep slope farmer Riverbank farmer Tenant farmer Poor farmer Woman farmer Farmer with SWC Farmer from neighbouring watershed with LandCare programme	Landless farmer - woman Woman farmer owning land Steep slope farmer Riverbank farmer Farmer with SWC Woman farmer (LandCare) Woman farmer Tenant farmer Poor farmer	Landless farmer Woman small farmer Rich farmer Poor farmer Woman who rents land Riverbank farmers (3) – vegetables
Opinion leaders - do not commonly change roles and mobilize people	Church leader (Pastor) Ndorobo leader	Church leader (Pastor)	Church leader (Pastor) Woman mobiliser
Political leaders at subcounty - mobilisers of community, interested in socio-economic development of people	Chairman LCIII Speaker LCII Chairmen (6 parishes): Kaseko, Piswa, Kitowoi, Likil, Tabagon and Kwosir Woman councillors (2)	Chairman LCIII LCII Chairmen (5 parishes): Toswo, Kaptoyoy, Kono, Kapkoch and Tabagon Chairman LCI - Binyiny	Chairman LCIII LCII Chairmen (3 parishes): Kapkwot, Sundet and Greek River Woman councillor LC I Woman councillor LC II
District leaders - as observers	District Environment Officer	Assistant District Forest Officer	NAADS - representative
Donors - observers - need to know perspectives of the people	-	-	-
Subcounty technical staff - implementers of policy	Subcounty Chief	Subcounty Chief	Subcounty Chief
NGOs - FHI,	FHI representative	-	-

LC - Local Council; NAADS - National Agricultural and Advisory Services; FHI - Food for Hungry Initiative; Kacoda - Kapchorwa Community Development Association; LLS - Livelihoods and Landscape Services; (LandCare): involved in SWC programme of the LandCare NGO.

4.2.4 District workshop involving community representatives, policy makers and donors for action plan development

The outputs of the scenario development workshops were used in a district workshop with district and national policy makers. The selection of participants aimed at bringing together key stakeholders in natural resource management and policy at the district level, including top political and technical leaders in the district, government officials, and international donors. To ensure interplay between scale levels, the policy authorities from the communities and a few farmer representatives also participated in this district workshop. Participants are listed in Table 4.2. Because of the nature of the participants invited the venue for the workshop had to be appealing and away from their workstations, so that concentration was maximized during the workshop. On the basis of the scenarios developed by the local communities, 5-year action plans were developed, to be incorporated in the district development plans. The participants were divided in groups and each group was asked to develop a 5 year action plan for one driver. In a second step, the activities in each action plan were prioritized considering available resources, and a 1-year work plan was formulated. Each group consisted of at least a policy authority and a representative from each of the three community workshops.

Table 4.2. Stakeholder categories of invited participants to the district workshop for action plan development for the Ngenge Watershed, Mt. Elgon.

Stakeholder category	Invited participants (30)
Community representatives - leaders and women	Chairmen LCIII for each subcounty - Benet, Kwosir, Binyiny, Kaproron and Ngenge Speaker, Benet Subcounty
	Subcounty Chiefs - Benet, Kwosir, Binyiny, Kaproron and Ngenge
	Woman councilor LCIII
	Woman farmer
Local opinion leaders	Ndorobo leader
	Woman mobiliser
District leaders - policy makers	LCV Chairman
	Woman Councillor LCV
District technical staff - implementers	Chief Administrative Officer
	District Engineer
	District Natural Resources Officer
	NAADS Co-ordinator
Donors (invited as observers)	AHI, UNDP, HorizonT 3000 and IUCN representative
National Government representatives	NEMA, UWA and DWD representatives
Others	EMCABU and Kyambogo University representative

AHI - African Highland Initiative; UNDP - United Nations Development Programme; IUCN - International Union for Conservation of Nature; NEMA - National Environment Management Authority; UWA - Uganda Wildlife Authority; DWD - Directorate of Water Development; EMCABU - Environmental Management Capacity Building Unit, LC – Local Council, NAADS – National Agricultural and Advisory Services

4.2.5 Assessment of the social learning process

Social learning processes were assessed during the workshops and afterwards. Assessments included problem and task aspects as well as social relational aspects. During the workshop interactions among the participants were observed for signs of cooperation and learning from each other. The outputs of the workshops (scenarios and work plans) provided important insights into the problem and tasks aspects of learning. The observations were useful to investigate social relational aspects. An evaluation questionnaire was carried out at the end of each workshop to find out the participants' perceptions on the learning process.

The questionnaires consisted of open-ended and closed questions. For the district workshop an additional survey questionnaire was sent out to the participants after 5 months to evaluate the impacts of the workshop and to provide insight in medium-term outcomes of the social learning processes.

4.3 Results

4.3.1 Learning processes during the local community workshops

The scenario parameters and activities developed in the three subcounty workshops in response to the drivers are shown in Table 4.3. Some of the scenarios and activities came forward in one workshop, others were mentioned more than once. Table 4.4 presents the responses to the evaluation questionnaire at the end of each workshop. On the basis of the findings in these tables, and our observations during the workshop we will characterize the problem and task aspects and the relational aspects of learning processes.

*Problem and task aspects of learning:*All invited participants attended the workshops. Being in the villages with no PowerPoint, explanations were given orally. The handouts, made with simple tables and maps showing the rivers, roads and main villages, helped the participants to understand what was expected of them. The maps particularly aroused a lot of interest and motivation, especially when participants were asked to actually illustrate diagrammatically their visions on the future of the communities on the maps.

Table 4.3. Outputs of the local workshops in the 3 Ngenge watershed subcounties. Parameters of the scenarios developed and the activities in the action plans made

Driver	Area	Parameters in scenarios developed by the communities	Activities in the action plans to realize scenarios
Land shortage	Upstream	Sensitise community on diversification and on how to use small land Promotion of practice of crop rotation Short term crops and Integrated farming Family planning Fruit trees species introduced, agroforestry & SWC Promotion of collaborative forest management	Sensitisation meetings on crop varieties, Economically viable non-farming options Demonstrations on farm plots; Cross site visits Crop market studies Enabling policies and bye-laws for agroforestry and SWC Community structure for management - sensitise the communities
Land insecurity	Upstream	Land ownership	Demarcation of the Park official boundary Surveying of land for allocated plots and Park boundary Registration for customary ownership; Resettlement of the landless; Sensitisation on land ownership; Sensitisation on land grabbing/displacement
Soil erosion	Up- and Midstream	Creating awareness on SWC Contours constructed and plant grass strips, Napier and tree planting Protection of river-banks and trenches on roads as well Bye-law formulation on SWC implementation	Sensitisation campaigns on SWC Establishment of demonstration plots Formation, implementation of bye-laws by the district authorities 5-10m already left along the river banks to be enforced Local community institutions strengthened
Famine	Mid- and Downstream	Food security Backyard garden Storage and preservation Use of fertilisers to increase yields	Mandatory planting of food crops - cassava, yams, pumpkins; Fast growing vegetables - avocado; Simple irrigation; Drying the harvest - cassava, sweet potatoes; Proper storage using insecticides; Sensitisation and training; Soil testing for required nutrients; Use of organic vs inorganic fertilisers
Water quality	Downstream	Community mobilisation to request for boreholes, bridges Community mobilise themselves to maintain existing sources Boil and filter available water Communal water scheme More bridges constructed	Participatory planning process; Reactivate Water User Committees; Promote water harvesting Resource mobilization for boreholes and gravity flow schemes; Sensitisation on hygiene Form, implement bye-laws on proper management of water sources
Drought	Downstream	Training programme on irrigation Efficient irrigation systems Introduction of water efficient crops Implementation of good agricultural practices	Identify trainers, participants, training of trainers; Study weather patterns; Identify crop-water requirements; Identify drainage water requirements; Water transportation to the field; Prepare water channels; Identify water efficient crops, sensitise the people on the need for growing the crop and acquire the crop; Identify good agricultural practices and sensitise the community; Tree planting

Table 4.4. Responses to the evaluation questionnaires administered at the end of the community workshops, Ngenge watershed, Mt. Elgon (in No. of respondents).

Question	Upstream workshop			Midstream workshop			Downstream workshop		
	Yes	No	Neutral	Yes	No	Neutral	Yes	No	Neutral
1. Were the instructions given at the beginning of the workshop clear and enough to work on the scenario development?	16	3	2	15	0	0	11	0	3
2. Did you find useful the development of scenarios?	20	1	0	14	1	0	14	0	0
3. Do you think scenario development can be used for policy and decision making?	19	1	1	15	0	0	10	2	2
4. Did you find the workshop useful to learn other's perceptions?	18	2	1	15	0	0	12	1	1
5. Did you feel that you could express your opinion in the way the workshop was set up?	17	2	2	10	1	4	10	2	2

The maps provided a realistic perspective of the issues on the ground. Some of the participants requested for the handouts to keep for future reference and the Benet subcounty Chairman requested to keep the map of his area. In the first workshop some people stated that they did not follow the instructions given at the beginning (Table 4.4, question 1) because of the use of technical terms in the explanations. This was avoided in the following two workshops. Compared to the upstream and downstream workshops, the participants in the midstream workshop needed less time to come up with outputs, probably because they were already exposed to sensitisation on land management from the extension services active in the area. In all three workshops, [check] the participants agreed on the drivers and were thus able to actively work together on the parameters for the scenarios, as presented in Table 4.3. They developed scenarios which reflected the problem situation, presented relevant solutions, and had adequate detail for further development into action plans. This becomes apparent, among other things, from the parameters chosen and from the nature of the specific activities in the action plans, as shown in Table 4.3.

Most participants considered the development of scenarios useful and suitable for making decisions and developing policies (Table 4.4, question 3). The participants realised that the creation of scenarios enabled them to see how the future could be if they would not be prepared. And that although the changes they proposed take time to achieve, if they take action now, they can realise them. They commented that even though the developed scenarios of each group were different, they were interrelated and it was difficult to focus only on one driver.

Social relational aspects of learning: The participants responded actively to the presentations of other groups stating that they learned from others as well (Table 4.4, question 4). They reported to have learned through the interactions in the group work, both about scenarios and about agricultural practices of other farmers. The participants, mostly coming from local communities, celebrated the attention received from the facilitators. The participants concluded that the facilitators really understood the local communities after they studied these communities for two years. The Benet Subcounty Chief acknowledged the importance of soil erosion considering that 'even international researchers from Holland had been attracted by it'. Local participants felt being taken seriously and considered the attention by the facilitators as a sign that the issues discussed were important.

In Uganda women are not usually expected to speak in public gatherings, except for leaders. Therefore they were placed in their own groups to ensure that they felt free to express themselves in the deliberations. Only women leaders formed part of the other groups with the men. However, during the group presentations all women were able to confidently present their findings to the other participants.

4.3.2 Learning processes during the district workshop

At the district level workshop action plans were formulated, corresponding activities were prioritized and 1-year work plans were made. Table 4.5 shows the details of the work plans, with relevant activities, appropriate periods and the responsible persons. Table 4.6 presents the results of the evaluation questionnaire administered at the end of the workshop and Table 4.7 presents the responses to the impact evaluation questionnaire sent out to participants.

Problem and task aspects of learning: Attendance was very good; 26 out of 30 of the persons invited actually participated. At the start of the workshop the facilitators gave short PowerPoint presentations of what they had been doing in the area and what the purpose of the workshop was. Through facts and photographs these presentations showed what the situation was on the ground concerning land and water management. The participants, being mainly policy makers and administrators in the district, were very interested to learn more about the situation in the area, as was testified by the questions and debate generated by the presentations.

Like in the community workshops the participants actively engaged during the whole workshop process and came up with detailed action plans and work plans for the first year (Table 4.5). Some assigned activities - often ones with high importance for watershed management - cut across more than one action plan, for example the activities of sensitisation of the local people and of bye-law formulation (see Table 4.3). The participants responded positively in their evaluation of the workshop. Most of the participants considered the development of action plans useful; most of them also considered the process as a whole - that is, grassroot development of scenarios and subsequent development of action plans - as a useful way of policy and decision making (Table 4.6).

A common regret was that time was too short, yet there was much to do. The participants expressed that the workshop needed more time and resources so that all issues could be handled adequately. All the sessions had to be rushed since the workshop lasted only one day. More time was considered needed for participants to give their contributions and ask questions.

Social relational aspects of learning: Since the majority of the participants were policy makers, they already had an idea of how to make an action plan and work plan. The majority agreed that instructions at the start of the workshop were clear and sufficient (Table 4.6). The activities in the action plans (Table 4.3 col 4) and the details of the responsible persons and time frames for the work plans (Table 4.5) are proof of thorough deliberations by the participants in the work groups. The composition of the groups - with in each group a representative from the community and a policy authority - contributed to a dialogue process across administrative levels.

This dialogue between policy makers and locals helped participants in realizing the need and possibility to learn from each other. The interactions achieved during the workshop by bringing together a range of views and perceptions from different governance levels were highly valued by many (also several months after the workshop was held, as discussed below). There was a general consensus among participants that the workshop was useful to learn others' perceptions and that the setup of the workshop allowed them to express their individual opinions (Table 4.6). The size of the groups (max. 5 people) allowed for active involvement of all the members.

Unlike with the community workshops the participants in the district workshop responded to the researcher's presentation actively, but also more critically, notably by NEMA and AHI (donor) representative. But by the end of the workshop the AHI representative stated that the workshop was enriching in terms of knowing what the people expected and getting to know the people whom they as the donors can work with.

Table 4.5. Output of the district-level workshop: 1-year workplans (starting July 2009) for the implementation of action plans for the Ngenge watershed.

Driver	1-year work plan to kick start implementation of activities in the action plans																			
	Activity	Jul - Sep				Oct - Dec				Jan - Mar				Apr -Jun						
Land shortage	Awareness raising of options varieties												LCs							
	Demonstrations on farm plots		E																	
	Policies and bye-laws													LCs						
	Market studies of short term crops													LG						
Land insecurity	Mobilise resources and materials												LG; Sc							
	Awareness on existing land tenure systems and laws															LG; Sc				
	Identification of the Landless	LG; Sc																		
	Identify land for resettlement		DLB & Sc ALC																	
	Identification of key players in land management issues												Sc ALC; Sc C/m							
	Secure land use plans	DLB														DLB				
Soil erosion	Resource mobilisation	N																		
	Mobilisation of people			N,E																
	Formation of committees					N,E														
	Training of committees							N,E												
	Identification of demo sites												N							
	Buy tools												N							
	Set up demonstration sites													N						
	Monitoring and evaluation																		N,E	
Famine	Procurement of planting materials				Prod. Dpt; Proc. Dpt; CAO															
	Delivery of planting materials									FEW; Fs										
	Preparation of land and training									FEW; Fs										
	Planting													Fs; FEW						
	Weeding	Fs																		
	Processing and drying									Fs										
	Application of preservatives									Fs										
	Monitoring																LG			
	Sensitisation	LG; Ext; N																		
	Training on storage/ preservation	FEW; N; Fs																		
	Training post harvest construction	FEW; N; Fs																		
	Preservation; Storage					Fs; FEW														
Water quality	Maintenance of water sources (can you link to Table 4.3?)			DWO			DWO									DWO				
	Construction of water sources (same remark)						DWO													
	Construction of bridges							DE												
	Water quality tests		DWO																	
	Sensitisation, establishment of Water User Committees			DWO/ACDOs						DWO/ACDO										
	Monitoring /supervision		Pol/Tec				Pol/Tec				Pol/Tec						Pol/Tec			
	Home improvement campaigns/ Sanitation						DWO/ACDOs									DWO/ACDOs				
Drought	Drawing a training curriculum	Prod. Dpt																		
	Identifying trainers	LG Proc.																		
	Identifying trainees		LG																	
	Training of trainers					TOTs								TOTs						

Key: N = District Natural Resources Officer; E = Extension Staff; LCs; LCs = Local Councils; LG = District Local Government; Sc = Secretary; DLB = District Land Board; ALC = Acting Land Committee; C/m = Chairman; Prod. Dpt = Production department; Proc. Dpt = Procurement department; CAO = Chief Administrative Officer; FEW = Field Extension workers; Fs = Farmers; DWO = District Water Officer; DE = District Engineer; ACDO = Assistant Community Development Officer; Pol/Tec = Police / Technical teams; TOTs = Training of Trainers.

Table 4.6. Participants' responses to the questionnaire given at the end of the district workshop for the Ngenge watershed, Mt. Elgon (in No. of respondents).

Question		Yes	No	Neutral
1.	Were the instructions given at the beginning of the workshop clear and enough to work on as far as the development of the Action Plan is concerned?	15	2	3
2.	Did you find the development of the Action Plan useful?	18	0	2
3.	Do you think grassroot development of scenarios and development of the Action Plan can be used for policy and decision making?	16	0	4
4.	Did you find the workshop useful to learn other's perceptions?	19	0	1
5.	Did you feel that you could express your opinion in the way the workshop was set up?	17	0	4

4.3.3 Outcomes of the workshops

On the basis of the data collected, we can only tentatively gauge the outcomes of the workshops on short and medium term. The scope of the research project did not allow for an elaborate measurement of changes in the views and activities of local communities and district policy makers in the years after the workshops were held. Based on the findings during the workshops, we can make some inferences, however, about plausible short term outcomes. The questionnaire for the participants of the district-level workshop 5 months afterwards also sheds some light on medium-term outcomes.

Community workshops: A plausible outcome of the local community workshops was a deeper understanding of participants of land and water management issues. This is evidenced from the recurring responses to the evaluation questionnaire, in statements such as 'Working in groups makes people learn a lot'; 'Such group work should be enhanced so as to analyze community problems'; and 'The workshop was educative on the need for water and environment protection in the area'. The participants suggested that the duration of the workshop should be extended to two or four days, and that this type of workshops should be carried out more often and including more people, since they saw the necessity of having more sensitization regarding conservation. The participants desired that information obtained should be shared with the rest of the community. Apart from learning through the groups many participants stated that they also learnt a lot from the facilitators since they were presenting issues concerning their livelihoods. Finally, the participants were asked what they think could be done with the scenarios they developed. The common answer in the three workshops was that "the scenarios should be implemented". They expressed that the scenarios can help them to plan the future by making by-laws and policies. This was actually realised in the district workshop in which action and work plans were made to realise these scenarios. The scenarios were an important technical outcome of the local community workshops for they served as a useful input to the district workshop. The action plans are to be subsequently made into bye-laws.

From a number of responses to the evaluation questionnaires we can deduce an improved potential to working together in the future: 'By working together we shall achieve a lot'; 'We should contribute whatever we can (to realise a better future for our land)'; and 'I liked most the sharing of ideas together in a workshop'. In sum, the following outcomes of the community workshops are plausible: a deeper understanding of the land and water management issues and the need of collective action to solve them, and possibly a better potential to work on these problems in the future, in collaboration of community members, experts and authorities.

District workshop: The results of the survey administered 5 months later confirm the positive appreciation of the participants during and directly after the workshop: 12 out of 16 respondent confirmed that the workshop had laid an adequate base for policy making and 14 out of 16 confirmed that the development of action plans was a good base for further policy making. It is therefore plausible that this workshop has indeed supported a learning process among participants that reached further than the day of the workshop (Table 4.7). From the observations and evaluation during the district workshop and the results of the impact evaluation survey, we can also tentatively infer which aspects of learning were most important.

First, deeper insight was gained on the land and water management problems at stake. Ten participants stated that they learnt “Many things especially about watershed and land management and the effects of deforestation leading to soil erosion”. The general view of the respondents about the workshop was that by participating in it they were able to obtain deeper insights into the real issues pertaining to land and water management in their area (Table 4.7).

Second, social interactions were a key aspect of the learning process. Almost all participants expressed during and after the workshops that they especially liked the group discussions, presentations and the interactions between the district administration and those from various backgrounds - academics, community representatives, political leaders, and technical personnel. When asked what they liked most about the workshop, the most common answer was that the group work was a good opportunity to share ideas, experiences and meet with other people.

A third important aspect of the learning process was the exchange of views between the community level and the district level. The observations and survey results indicate that learning has occurred across governance levels. As one respondent wrote in response to the question on what they liked most of the workshop “I liked most the way the workshop was conducted and how emerging issues were discussed [with] peoples’ participation at all levels up to district LCV Chairman”. Some of the policy makers admitted to have learned from the representatives of the communities.

A potentially important technical outcome of the district workshop were the 1-year work plans to ensure that the deliberations from the workshops are actually being realised in management at the district. The participation of representatives from the communities in the development of the action plans provided a form of accountability to the communities. The outputs of the scenario and action plan development workshops provided information to the policy authorities on the people’s needs, which should be considered in the development of policies and programs. Given the scope of the research project (data collection ended with the survey 5 months after the district workshop), it was not possible to measure the extent to which the work plans were successfully implemented. The survey, however, shows that at least some activities have materialized (Table 4.7, question 3):

- Seven (of 16) respondents indicate that they have undertaken activities in the field of capacity building and sensitization, in follow up to the conference.
- Twelve (of 16) participants responded that they have contacted fellow participants based in the district, indicating that contact across various levels remained. One of them explicitly states that they have been cooperating with other participants of the workshop "during work planning process in the district with an ultimate aim of integrating the action plan into the district development plan for 2009/10”. One of the contacts established, as we know from personal information was between district officials and a representative of the donor community.

It is not possible to ascertain to what extent these contacts and activities are stimulated by the workshop processes, but it is plausible to say, given that they are stated in a survey on the district workshop, and given the general positive appreciation of the workshop's learning processes, that these processes had made a contribution.

Several participants commented - during the workshop and in response to the questionnaires - that these workshops should be held more regularly and should be extended to encompass other stakeholders (both local and national) as well. This gives support to the idea that multilevel learning processes established in this research have been experienced by participants as a useful process. At the same time, it points at the limitation of the research project with respect to the time span. To fully realize the potential of learning processes, a longer-term engagement would be needed, including, a new workshop to evaluate the progress made in workplans after a year, as five participants rightly suggest. Due to the ending of the research project, no further meetings have been organized. The follow-up of the learning processes, therefore, was fully dependent on the commitment of participants.

Table 4.7. Responses of participants of the district workshop for the Ngenge watershed, Mt. Elgon, to the impact evaluation questionnaire sent 5 months after the workshop (N = 16).

Question	No. of respondents answering affirmatively
1. What do you see as important outcomes of the workshop as a whole (tick all boxes that you see as important)	
• The participants have gained better insight in land and water management problems of Ngenge	10
• The participants have established better contacts among each other	8
• The participants have established an adequate base for further policy making	12
• I see another important outcome (please explain):	
- Basis for resource mobilization	1
2. What is your opinion on the action plan made in your group	
• They are a good base for further policy making	14
• They are not a good base for further policy making, but they have learned me important things	2
3. With regard to the workplan made for the first year, did you already undertake one or more actions as described in this plan?	
• Yes (please indicate which action or actions)	
- Capacity building of grassroots institutions	1
- Sensitization on water and land management	4
- Yes (but not specified)	3
- Establishment of water and soil conservation structures, creation of awareness and sensitizations among local communities and their leaders on water and soil conservation and management, integrated planned actions in district work plans for local government	1
- Control of soil erosion	1
- Sensitization of communities on land ownership	1
• No (please explain why not)	
- Need for facilitation	1
- - I do not work with Kapchorwa district	1
4. What is your view of the workshop?	
• It forms an important benchmark in participatory planning and implementation focusing on multistakeholder platforms	1
• It was very resourceful, it provided good information on factors causing degradation of the watershed	1
• Very good, very interesting and I have learnt a lot; it was of great help for planning purposes	6
• It was good, educative and blended academic with practice	1
• The workshop was good in learning real problems that happen on the ground	1
• It was well organized and conducted and the venue was appropriate for participants' concentration	2
• Workshop was very critical in dealing with environmental conservation	1
• It was very good, it provided an opportunity for stakeholders' participation in the issues	1
5. Did you contact other members of your group after the workshop?	
• Yes, I have not only contacted them but now working with them	1
• Yes, fellow participants, those within the district	10
• Yes, especially during work planning process in the district with an ultimate aim of integrating the action plan into the district development plan for 2009/10	1
• No	2
6. What did you like most in this workshop ?	
• Composition of members; peoples' participation at all levels up to district LCV Chairman	3
• Presentation by facilitators	4
• Exchange of views between the academic staff and practices on the ground	1
• I liked the way the workshop was organized and the venue and above all, the facilitators	2
• Group work, development of action plans by groups, group presentations	4
• Accommodation and reception facilities	2
7. What did you learn best in the workshop?	
• Stakeholders are well informed and aware of challenges they face and the interventions	1
• Water and land management, water and land management policies, and policy making on environmental issues	6
• How to address problems of soil erosion and water quality using community based approach	2
• Participatory action planning for watershed management	1
• Effects of erosion, soil management and conservation	4
• Issues related to Kapchorwa and its water resources and land use	1
8. Do you have suggestions for improvement?	
• Prioritize linking the workshop outputs with district plans for funding and ownership and sustainability	1
• There is need for follow up workshop to establish the extent to which issues have been implemented	2
• The advice given at the workshop should be intensified and also disseminated to other stakeholders	5
• More such meetings where we can learn more about management of our resources	4
• There should be evaluation of the meeting back in Entebbe after a year	5
• No suggestions for improvement.	1

4.4 Conclusions

Based on the outputs, observations, and questionnaire responses, we consider the workshops as successful processes of multi-level learning about watershed management, but we also identify shortcomings, particularly when medium- and long-term outcomes are concerned. Following the framework of Pahl-Wostl et al. (2007) we draw the following conclusions on the key processes and outcomes of the workshops and on enabling and constraining factors for successful social learning in the context of watershed management in Uganda.

Developing the action plans and concretising them in work plans enabled the participants to collectively agree on practical solutions to the problems in the watershed. By organising workshops on two governance levels stakeholders were enabled to realise their full potential in the decision-making process according to their role in society - whether community member or policy maker. Interacting with community representatives was a source of learning for the district leaders.

4.3.1 Processes and outcomes of the workshops

We identified the following key aspects of the learning processes in the community workshops. Presentation of up-to-date information from their area, based on extensive research in preparation of the workshop, made it easy for the participants to recognize the relevant issues of their area, as well as the commitment of the researchers. The processes of scenario construction and the making of action and work plans were successful means for stimulating social learning in the community workshops. The process of scenario construction enabled the participants to realise that it is possible to collectively agree on the best way of managing their resources and that it is important to involve different stakeholders in decision-making for there is much to learn from each other. Working in groups of 5-6 people in which different categories of stakeholder are well distributed provided an opportunity for full interaction between all the participants. Presenting their own work as groups was also a stimulating factor during participation. The use of maps stimulated thinking and creativity, which was reflected in the final maps presented at the end of the community workshops. The most important outcomes of the community workshops were a deeper understanding of the land and water management issues and the need of collective action to solve them, and possibly a better potential to work on these problems in the future, in collaboration of community members, experts and authorities. In addition, the results of the workshops were used as input for the district level workshop.

The district level workshop brought stakeholders in natural resource management and policy at the district level, including top political and technical leaders in the district, government officials, and an international donor, but also representatives from the community workshops participated. Presentation of the outcomes of the community workshops and participation of community representatives was a key aspect of the district workshop. Another key aspect were the action and work plans, which made it possible for the learning processes to focus on concrete action perspectives. Like in the community workshops, the exchange of views between stakeholders of different groups and governance levels involved in the Ngenge watershed management was highly appreciated by participants and plausibly made a significant impact on social learning processes.

The action and work plans also constituted a significant outcome of the multi-level learning process as a whole. While it was difficult to measure the degree of implementation and of social learning on a longer term, our findings indicate that at least on a short to medium term activities and cooperative relationships have been stimulated which can lead to better watershed policies and management,

We also identified shortcoming in the workshops as they were realized in this research project. First, only a selection of the relevant stakeholders were reached, and several participants pointed out the need to extend the workshops and involve others. Second, in all four workshops the time span of a day was found to be too short to carefully deal with all relevant views and issues. Third, and most important by far: after the research project ended, there have been no further meetings or evaluations to gauge and stimulate the implementation of action plans and the continuation of social learning processes. To some extent, processes engendered by the workshops have continued in existing institutions and activities, but with a more explicit and focused follow up, better and more certain results could have been achieved.

4.3.2 Factors influencing the effectiveness of social learning

The following key factors have enabled the relative success of the workshops.

- The large research effort to identify local concerns and drivers of problems. This helped to focus the workshops on the relevant issues and also added to the value of the meetings in the perception of the participants. The fact that the researcher had been around so long and was known to the people increased acceptance.
- The set-up of the community workshops, paying attention to explanation, using an easy-to-understand scenario technique and working in smaller groups. The oral explanations to the community workshop participants were greatly supported by simple, prepared handouts and maps of the areas, which they could easily identify with. The participants were greatly inspired by drawing their impressions on the maps. Using technical terms in the oral explanations can be a constraint and therefore should be avoided especially in the community situation. Working in smaller groups enabled each participant to express their opinion and contribute to the dialogue.
- The explicit linking of the district workshop to the community workshops and the inclusion of relevant policy actors. Presenting the outcomes of the community workshops to the district workshop for consideration and involving the community leaders helped to focus the decision-making process to the important issues in the communities. Grouping the community leaders together with policy authorities enabled learning about other's perceptions, appreciated other's opinions, and showed the need to work together. The donor and government representatives also had an opportunity to realise the perceptions of both the community representatives and the district leaders.
- The linking of the workshop to existing governance structures. The local council system has a potential positive influence on the nature of multiparty cooperation and social learning processes since the local councils are already members of the community and acknowledged as leaders and representatives in any deliberations for policy processes. With facilitation and education in problem/task management and engagement in social exchange processes they can play a key role in supporting continual collaboration for policy making for watershed management in Uganda.

We think that the approach of a multi-level learning process as presented in this article can successfully be applied to other watersheds for bringing stakeholders together for decision-making on watershed management, on the condition that there is an institution with commitment and resources to support this process, if possible for a longer period than was realized in this research. We also recommend to underpin and prepare such processes of facilitation with thorough research into the social and biophysical dynamics of the land and water management issues at stake.

Chapter 5

Potentials and problems of IWM as a policy strategy: the case of the Ngenge watershed at Mt. Elgon in Uganda

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Potentials and problems of IWM as a policy strategy: the case of the Ngenge watershed at Mt. Elgon in Uganda

Abstract

This study explores the potentials of integrated watershed management (IWM) as a strategy for land and water management in the Uganda Highlands, taking the Ngenge watershed on the slopes of Mt. Elgon as case study. The Ngenge watershed represents a typical watershed in the Uganda Highlands characterized by considerable human settlement whose agricultural practices are causing serious soil erosion problems accompanied by degradation of water through sedimentation. Food security is threatened and proper resource management is needed. To assess the potential role of IWM in addressing this situation, the characteristics of the Ngenge watershed were evaluated according to the features and challenges of the IWM approach. The watershed is characterised by subsistence cultivation on steep slopes; inadequate household income; inaccessibility to forest resources; and lack of government involvement. In the different parts of the watershed, stakeholders have varying priorities which have to be considered for any intervention in managing their resources to succeed. Given these different priorities and the general lack of income, financial cooperation through payment of environmental services is hardly feasible. As existing local councils operate with relative success, they could play a key role in policy and management, rather than in the development of a new IWM platform. NEMA, as a national policy institution could play a role in coordinating and supporting activities over the watershed area as a whole. A more general implication of this study is that the IWM approach cannot be 'rolled out', but needs to be geared to specific biophysical and social context factors.

Keywords: Soil erosion, Integrated Watershed Management, policy, Ngenge watershed, Uganda

5.1 Introduction

Uganda is an agricultural country with 70% of the population (UBOS, 2010; Population Secretariat, 2011), living in rural areas and depending directly on rain-fed agriculture for its livelihood. The Uganda highlands are among the most densely populated areas in the country owing to their fertile volcanic soils and abundant rainfall. The highlands are also most vulnerable to soil erosion, which poses serious threats to food security and rural development. The agricultural practices that contribute to erosion involve removal of trees and other natural vegetation on steep slopes and replacing them with annual crops, without implementing soil and water conservation measures.

Soil erosion is not only leading to declining crop yields from the loss of the fertile top soil layer but also to river sedimentation and flooding in the downstream areas (Nkonya et al., 2004; Tukahirwa, 1988; Isabirye et al., 2008; DSOER, 2004; NEMA, 2008). Existing policies on natural resource management have not been implemented successfully and this has contributed to measures for soil and water conservation not being practiced.

The population of Uganda is growing rapidly, it has increased from 24.2 million in 2002 to 30.7 million in 2009 (UBOS, 2010) and 33 million in 2011 (Population Secretariat 2011; UBOS, 2010). Therefore, pressure on the natural resources is mounting, and considering that Uganda is a poor country characterized by limited livelihood options for the rural population, there is need for interventions which will ensure significant and sustainable livelihood prospects. A promising strategy for sustainable management of land and water resources in highland areas is the watershed approach (Tefera and Stroosnijder, 2007). With the

watershed approach, the complex and reciprocal linkages between land use, soil and water resources, and the interdependence of people in their resource use practices are considered in decision-making for interventions (Bewket, 2003). Watersheds are also considered to be the logical spatial units for a sustainable management of resources with involvement of the local population. Over the last decade, this approach has become widely known as integrated watershed management (IWM) (Bewket, 2003). Today, the IWM approach is being pursued in many countries of the world and has successfully contributed to conservation and sustainable soil and water resource use as well as improved livelihoods (Bewket 2003; Davenport, 2003; Paranjape et al., 1998).

This study explores the potentials of IWM as a strategy for land and water management in the Uganda Highlands. The Ngenge watershed on the slopes of Mt. Elgon is used as the case study. The study was guided by the following research questions: (1) What are the factors influencing land and water management development in the watershed? (2) Which existing physical, social and institutional circumstances are favourable or unfavourable for the implementation of IWM as a strategy for sustainable land and water management in the Ngenge watershed? By answering these questions, we aim to contribute to the formulation of appropriate IWM strategies for the Ngenge watershed specifically and expect to contribute to the more general debate on the prospects of integrated management programmes in resolving prevailing water management crises (cf. Walther, 1987; Rahaman and Varis, 2005). The paper is structured as follows: In Section 2, we provide a brief characterisation of the IWM approach. The research site and methods are described in Section 3 and the results in Section 4. In Section 5 we discuss the implications for an IWM approach, and in Section 6 we present the conclusions and recommendations.

5.1.1 Key features of the IWM approach

IWM aims at integrated and sustainable management of land and water resources, by controlling degradation and ensuring long-term utilization. (Baloch and Tanik, 2008). It addresses not just water supply or flood control, but also water quality, habitat quality, and pollution prevention (Cobourn, 1999; Lee et al., 2008).

The interaction between the natural environment and human activities in a defined environmental system is characterized by high complexity. Therefore, IWM requires a holistic approach to achieve management objectives, taking into account the bio-physical, socio-economic, political, and institutional factors operating within that system (Baloch and Tanik, 2008). Past efforts in watershed management in many parts of the world failed because they were concentrated mainly on soil conservation, neglecting the welfare of land users (Singh et al., 2002). The IWM approach should integrate optimum utilisation of land and water resources; greater access to income generating activities; restore ecological balance through community participation in tree planting programmes; and better living conditions of the poorer through more equitable resource distribution (Singh et al., 2002).

Watershed management plans require coordination, integration, and full involvement of the various stakeholders despite their different interests (Bewket, 2003). IWM therefore promotes the development of a long-term goal or vision for the entire watershed by all stakeholders in the watershed community. It advocates the education of stakeholders about their individual and collective responsibility to resource management (Cobourn, 1999). These stakeholders include local communities but also other actors such as private companies and government. Government support is needed to create enabling conditions through the establishment of key local institutions and proper organizational structures, which are critical for the success of community action (Shiferaw et al., 2008).

The watershed is an area that drains all rainfall within its boundaries to a single outlet. With this downslope flow of water, upstream resource use practices can incite a chain of impacts - positive or negative - to which downstream areas are naturally laid open and thus influence resource use decisions and activities downstream (Bewket 2003; Bosch and Sterk, 2005). These kinds of spill-over effects that emerge

from spatial and temporal interdependence of resource users in a watershed require special policy support and institutional arrangements for integrated interventions in the watershed (Shiferaw et al., 2008). Typically for the IWM approach is the establishment of a watershed board or platform as the most appropriate institution for cooperation and collective action (Perez and Tschinkel, 2003).

Soil erosion leading to sedimentation downstream is a major environmental problem that reduces the functions of downstream dams and reservoirs for programmes such as electricity generation and irrigation (i.e. Nabahungu et al., in press). Although implementation of IWM plans requires adequate funds, funding of IWM efforts can be difficult in cash-strapped developing countries. To help alleviate funding problems, the concept of payment for ecological services generated by specific land uses within watersheds should be introduced as a key element in watershed interventions. Resources can be generated from downstream users (e.g. electric company, water supply utility) to support development interventions in the upstream parts of watersheds (Bewket 2003; Tefera and Stroosnijder, 2007).

Many of the investments in resource management technologies and activities required for watershed management do not pay back in a short period. Examples are tree planting and the construction of terraces for soil and water conservation. The costs are incurred upfront, while economic returns accrue in small incremental flows over a long period. The social benefits from watershed management such as ecosystem health may not be fully captured by individual resource users. This means that unlike other short-duration agricultural technologies (e.g., new varieties) the resource-improving IWM interventions require a relatively longer planning horizon (Shiferaw et al., 2008; Sarangi et al., 2004).

Considering all important aspects of IWM, the key features of the IWM approach can be summarised in the following design features.

1. Conservation of all biophysical resources
2. A holistic approach to resource management
3. Stakeholder involvement
4. Developing a policy making platform
5. Transfer of resources to compensate for costs and benefits
6. Long-term planning for sustainability.

5.1.2 Challenges of the IWM approach

Together, the key features make IWM a very ambitious approach. This ambition is not without challenges. According to Walther (1987) the effectiveness of IWM is primarily a function of the historical situation into which the project is placed and only secondarily of its professional design. The problems and solutions associated with integrated resource management in different regions may not be universal and therefore there may be challenges in its effective implementation in the field (Rahaman and Varis, 2005). The following challenges frequently surface in literature:

- The holistic approach of integration of the bio-physical, socio-economic, political, and institutional factors operating within the watershed is a challenge in itself since it involves coordination of different specialised sectors of decision-making for resource management and activities.
- For effective implementation of the IWM approach there is need for clearly stated, consistent, and feasible policies which can cope with conflicts that may arise (Cortner and Moote, 1994). These policies, however, have to be implemented into a complex existing situation and therefore have to operate in an institutional environment with political structures and cultural patterns that are rooted in history (Walther, 1987).

- IWM involves integration of ideas from various stakeholders who all have their own unique goals and agendas, for example profit maximisation, livelihood sustenance and political authority. Different stakeholders in the watershed may not easily agree on core values, such as the relative importance of environmental quality versus economic freedom (Leach et al., 2002). There is a challenge in ensuring a common goal by all the stakeholders in the watershed concerning sustainable management of the resources.
- Maintaining the cooperation of the different stakeholders over the long term especially that of a local community in need of quick fixes for livelihood problems may be a challenge since the benefits of IWM only accrue in the long-term.
- Most interventions introduced to address natural resource management crises have the requirement for funds for the initial implementation of the programme and IWM is not an exception. Funding is required for facilitating the coordination process as well as for sensitising the stakeholders about the implementation of the IWM programme (Kenney, 1997).

The IWM features and challenges highlighted in this section will serve as a guideline in assessing the possibilities of IWM for the Ngenge watershed.

5.2 Study Area and Methodology

5.2.1 Study area

The Ngenge watershed, on the slopes of Mt. Elgon in Eastern Uganda, was selected because it represents the typical environmental circumstances that occur in the highlands of Uganda - soil erosion resulting from deforestation for arable cropping under influence of an increasing population pressure. This watershed is particularly interesting because its history of erosion problems emerging after highland deforestation for farming is recent, dating back to less than 3 decades ago. The present agricultural practices result in severe soil erosion, gully formation, and high sediment loads in the rivers during the rainy seasons(BIC, 1998; DSOER, 2004). The River Ngenge is one of the main permanent rivers arising from Mt. Elgon (4321 masl). With its extensive montane forest (gazetted as Mt. Elgon National Park), Mt. Elgon represents a watershed of international importance; it constitutes a major catchment for some of the major rivers that feed the lakes in the Nile River system. On its slopes, adjacent to the forest, is a large rural population whose livelihoods depend on the ecosystem goods and services of the highlands (Muhweezi et al., 2007).

The Ngenge watershed is 665 km^2 (Figure5.1) with altitudes between 1000 and 3000masl and is characterised by a cold humid climate upstream (mean annual temperature 15.6 $^{\circ}C$; mean annual rainfall 1450 mm) and semi-arid climate downstream (mean annual rainfall 932 mm; mean annual temperature 22.9 $^{\circ}C$). Midstream, the climate is less humid and warmer than upstream (mean annual temperature 20.4 $^{\circ}$ C; mean annual rainfall 1186 mm) (DSOER, 2004). Rich volcanic soils combined with abundant rainfall provide a high potential for agriculture. The watershed lies within the Kapchorwa region and is situated about 12 km east of Kapchorwa town. It encompasses five subcounty areas which adequately correspond to the three main sections of the watershed: Benet and Kwosir upstream, Binyiny and Kaproron midstream, and Ngenge in the floodplain. The total population is 55,068 and the population density 262 persons km^{-2} (UBOS, 2002). The greater part of this population is concentrated upstream, where population density is highest, followed by the midstream area. Downstream the population density is very low since people left the area, fleeing the insecurity brought about by cattle rustlers. The very high population density upstream is due to resettlement of the forest dwellers, people from the plains and those coming to exploit the soil resources for agriculture.

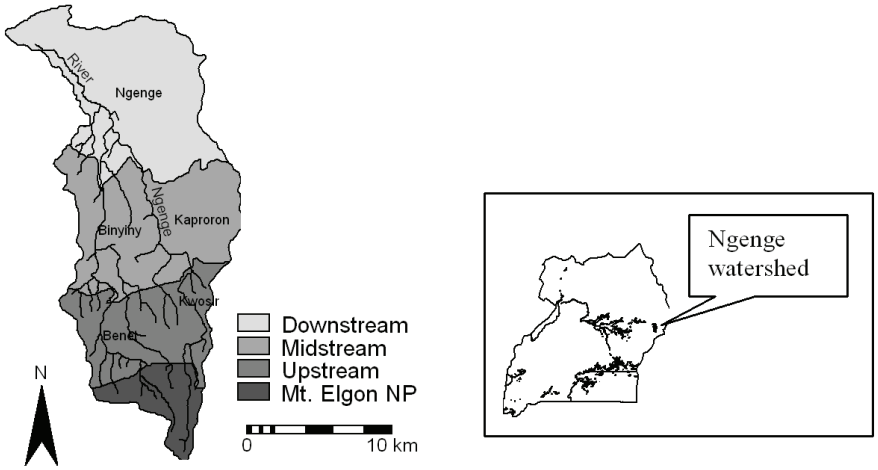

Figure 5.1. Location of the study area, Ngenge watershed, Uganda (Source: Digitising contours from Topo maps of Surveys and Mapping department, Uganda).

5.2.2 Data collection methods

Structured open-ended questionnaires were administered to two households per village in the watershed. The number of villages visited in each area were 23 upstream; 22 midstream and 12 downstream. The questionnaire was aimed at establishing: (1) the farm practices of the individual households and the physical, socio-economic, and institutional factors, which influence those practices; and (2) the expectations and priorities of the households in relation to appropriate interventions for sustainable land and water management. The interview was conducted with the responsible person present in the household at the time of the visit. In the majority of cases this was the household head or his son. Questionnaires were analysed for trends and the factors influencing land and water management development in the watershed.

Focus group discussions were carried out with different stakeholder groups involved in land and water management in the community, with the aim to establish the perceptions of the people concerning appropriate land and water management intervention options. The groups, which represented different categories of people in the community - farmers, youth, women, and the vulnerable including widows and people with disabilities were chosen in consultation with key informants in the community. Four focus groups from each of the three sections of the watershed were chosen.

Key interviews were conducted to obtain information from individuals who are in leadership positions in the community, i.e. opinion and local leaders; NGO and CBO representatives; and elders. A longer qualitative survey was carried out with a subset of the leaders for more explicit information on existing policies for land and water management.

A PRA meeting was held in each of the three sections of the watershed. These PRA meetings were open to all the stakeholders in the community and were aimed at establishing the following: (1) issues most important to the communities; their main constraints, and the opportunities to overcome the constraints in relation to agricultural production; (2) the history of land and water management practices in the area.

Direct field observations were used to obtain data on current land management practices and resource degradation. Reports, publications and project documents were reviewed to establish the influence of past and current policies and institutions on land and water management development in the watershed.

5.3 Results

5.3.1 Land and water management

Implementation of the nature conservation policy for Mt. Elgon Forest National Park necessitated resettlement of the forest dwellers to another area. In 1983, 7500 ha of the forest on the mountain slopes were released for settlement of these people as well as those displaced by insecurity downstream. The new inhabitants cleared the forest for agricultural purposes but were not instructed on SWC practices. Since then, severe soil erosion is a regular recurrence in the upstream area with peaks at the start of the planting season and during weeding of the crop. Continuous erosion resulted raised riverbeds in the downstream area, which combined with the increased runoff as a result of tree removal have caused large flooding problems.

Table 5.1 gives an overview of the negative effects of resource use as identified by key informants. In the midstream area settlements are well established and both perennial and annual crops are planted. There is implementation of SWC measures from active extension programmes since it is more easily accessible by road than upstream. Downstream, insecurity from cattle rustling caused displacement of people, but security has recently been restored and people are returning to their homes. However, without cattle providing an income, people have resorted to charcoal burning and fuelwood trade to provide a livelihood. This is resulted into deforestation in the downstream area.

Various programmes aimed to address the negative effects of resource use and are currently implementing interventions in the watershed. These include extension by NAADS (National Agricultural Advisory Services); riverbank management by NEMA (National Environment Management Authority); bye-law formulation by Kapchorwa Landcare Chapter; KASEKO Soil and Water Conservation Group; livelihoods improvement by Food for the Hungry Initiative; and Action-Aid support to the initial construction of the canals downstream.

5.3.2 Current practices

Landholdings are small - average 0.65ha and characterised by mixed cropping and livestock production. Main agricultural activities are shown in Table 5.2. Agricultural production is mainly for subsistence purposes and the surplus is sold. Only a few off-farm employment opportunities are available in the typical rural area and include trading in fuelwood, charcoal and grass for thatching.

Main crops grown are maize, Irish potatoes, beans, wheat, barley, vegetables, bananas and coffee. Bananas and coffee are mainly cultivated in the midstream area where settlements are well established. The land is prepared for sowing before the start of the rainy season - in March for maize and in August for the other annuals. Weeding is done three times in the growing season, so six times a year. The bananas are also weeded. Weeding exposes the soil to surface runoff leading to soil loss. Because the land parcels are small, they are continuously cultivated. To avoid soil exhaustion and heavy reliance on fertilisers, mulching and crop rotation are practised. However these measures are not sufficient to obtain reasonable yields, and farmers start to depend more and more on fertilizers.

In the Ngenge plains the traditional source of livelihood was livestock keeping before cattle rustling intensified in the 1970s, and it was characterized by large landholdings with an average farm about 5ha and large livestock heads owned. People are now settling back and the main sources of livelihood are fuel wood marketing, charcoal burning. People who have capital, can access loans and rent land in the flooding areas on which they can cultivate rice, which became possible as a result of increased flooding and sedimentation.

Table 5.1. Negative effects of resource use in Ngenge watershed on Mt. Elgon, Uganda.

Negative effect	Main cause	Origin of the cause
River sedimentation and flooding	Soil erosion	Steep slope cultivation without SWC practices. Annual crops provide low soil protection against the erosive force of rain. Ploughing at the start of every rainy season increases soil erodibility while weeding up to 3 times in the growing season enhances the detachability of the soil
Declining yields	Erosion of fertile top soil	Lack of SWC practices coupled with continuous cultivation of the fields leading to destruction of the soil structure are resulting into the loss of top soil
Decreasing water flows in the dry season	Deforestation upslope	Natural vegetation removal increases surface runoff and lowers the infiltration rate thus reducing groundwater recharge during the rainy seasons and as a result river base flow is reduced during the dry seasons
Landslides and gullies causing deaths and loss of property	Natural vegetation removal	Natural vegetation removal on steep slopes followed by annual crop cultivation without soil conservation measures leads to soil slips up- and mid-slope

Source: Key informant interviews

Table 5.2 Current land management and water resource utilisation in Ngenge watershed on Mt. Elgon, Uganda.

Current practice		**% households ***		
		Upstream	**Midstream**	**Downstream**
Land management				
Cultivation	Main crop – maize	91	84	39
	Main crop – rice	0	0	70
	Other annuals – irish potatoes, wheat, beans, vegetables	96	70	43
	Perennial crops – coffee, bananas	18	55	0
	Manure addition	58	59	9
	Fertiliser addition	29	41	4
SWC	Contour ploughing	9	14	0
	Trenches	11	2	0
	Bunds	51	16	4
Animal rearing	Oxen, cattle, goats, sheep, chicken	91	73	78
	Zero grazing	71	43	22
	Free range grazing	29	45	65
	Animal supplements	49	11	0
	Spray diseases of animals	44	16	35
Tree growing	Trees - *Eucalyptus*	58	41	4
	Trees - agroforestry	29	16	0
Water resource utilisation				
Open water	River, streams	36	25	4
	Open springs	22	20	4
Protected water	Protected springs	47	59	13
	Boreholes	0	0	78

Source: Household surveys, * percentage of interviewed households carrying out the practice / using the water source

Trenches and ditches are dug by some farmers to direct the storm flow away from their garden and also to trap soil which can be returned to the garden. Upstream, many farmers are constructing bunds to prevent soil erosion. However, many of them lack the technical know-how to make strong bunds and many of the bunds are destroyed by runoff. In the midstream area some farmers have planted the bunds with *Napier* grass to strengthen them as well as to provide fodder for their animals.

Cattle, goats, sheep, poultry and donkeys are kept as a source of supplementary cash. Upstream many households use zero-grazing and provide supplementary fodder such as maize cobs. Midstream animals are grazed free-range. Animal diseases do occur but are mostly a concern in the upstream area.

In the upstream area more households grow trees compared to the midstream area albeit on a small scale. A few trees are grown as a source of supplementary income and fuelwood. *Eucalyptus* is the main tree grown because it is fast maturing. Due to land shortage it is mostly grown on marginal land such as rocky areas. Adoption of the agroforestry tree *Grevillea,* mainly planted at the edges of the fields is increasing. Downstream natural trees are abundant but being cut at a fast rate for charcoal burning.

The Ngenge watershed potentially has abundant clean water sources - rivers, streams and springs, but they are now severely contaminated with sediment. Water is used for domestic use; watering animals; for irrigation of vegetables and tree and coffee seedlings; and downstream, for rice growing. Up- and midstream, clean water is obtained from protected springs and downstream from boreholes. However, these sources of water are often insufficient, therefore some people utilise the open springs and streams.

5.3.3 Problems in land and water management

The main problems related to the management of land and water the respondents mentioned are listed in Table 5.3. Upstream, the problems most mentioned are firstly soil erosion, followed by lack of technical know-how and infertility. Infertility was said to be the result of loss of the fertile topsoil and continuous cultivation without fallow. The soil erosion problem was attributed to lack of knowledge on proper farming methods resulting from inadequate extension services in the area. Other problems frequently mentioned are diseases affecting animals and grazing land shortage. Animal diseases are attributed to lack of knowledge on best practices for rearing animals. Grazing land shortage stems from lack of access to the forest where grazing has always been carried out.

Midstream, the problem most frequently mentioned is lack of inputs such as fertiliser and seeds for planting, closely followed by insufficient land, soil erosion and infertility. Soils are exhausted as a result of continuous cultivation without fallow and erosion. Shortage of grazing land was also mentioned as a problem; but with the return of security from cattle rustling grazing is done in the cliffs overlooking the Ngenge plains.

A significant problem faced in the whole watershed is contamination of the water sources with sediment as a result of soil erosion on the fields. Downstream, sedimentation from eroded soil has raised the river bed making the river overflow its banks during the rainy season. Other problems mentioned downstream are insufficient land for cultivation, insecurity, and diseases of animals. The plains are mainly suitable for cattle keeping and with the return of security the people can now acquire animals.

5.3.4 Existing interventions in land and water management

To cope with the problems, the main interventions most respondents are carrying out are addition of manure and chemical fertilizers to improve yields, digging trenches to trap runoff; and constructing bunds to prevent soil loss (up- and midstream) (see Table 5.2). Midstream, NAADS is promoting mulching and crop rotation; planting *Napier* grass and *Grevillea* trees to strengthen bunds; and planting of perennial crops such as coffee to some selected farmer groups. To supplement the low returns from selling the harvested crop most of the households rear animals to provide milk, labour (oxen and donkeys), manure and cash from sale of the animals or their products. In the upstream area more households possess animals compared to the mid- and downstream since the upstream area was not affected by cattle rustling.

Table 5.4 shows the current sources of interventions in the watershed and the interventions that households desire are shown in Table 5.5. Considering the desired priority interventions most of the respondents up- and midstream mentioned the implementation of SWC and Government involvement in imparting knowledge and advice in proper farming methods. The people are aware of the importance of SWC but lack the capacity to implement it and therefore mention the need for the Government to assist them.

Most of the downstream people use the river water as a source of water for domestic purposes. Since the river water often carries large loads of sediment, people expect Government involvement to provide more sources of good water such as gravity water and protected springs. Rice cultivation in the newly developed floodplains was initiated with help of the NGO Action Aid. Most of the respondents said that rice growing is enhancing their livelihoods (see Table 5.2). Tree growing was mentioned as a priority intervention strategy by many of the respondents both up- and midstream.

Table 5.3.Problems in land management and water resource utilisation in Ngenge watershed, Mt. Elgon, Uganda.

Problem		**% of households***		
		Up-stream	**Mid-stream**	**Down-stream**
Land management				
Cultivation	Diseases of crops	37	18	9
	Lack of inputs: fertilizer, seed	19	73	17
	Insufficient land	24	67	39
	Lack of water	18	23	4
	Soil erosion	82	65	4
	Infertility / exhaustion	73	55	0
	Poverty	0	18	17
	Flooding	0	0	30
	Less rain	0	9	22
	Vermin and pests	0	18	17
	Lack of technical know-how	78	48	22
Animal rearing	Diseases of cattle	69	32	35
	Grazing land shortage	50	61	4
	Insecurity	0	18	39
Tree growing	Insufficient land	35	30	0
	Trees reduce crop growth	44	9	0
Water resource utilisation				
Open water	Dry season river dirty	27	9	4
	Lack clean water source	36	55	4
Protected water	Protected spring water dirty	19	15	4
	Overcrowding at source	27	18	47
	Water scarcity	33	15	4
	Long distance to the source	18	36	13
	Borehole breaks down	0	0	13
	Borehole water dirty	0	0	13
	None	0	0	9
	Other	15	30	4

Source: Household surveys, *percentage of households mentioning the issue as a problem it faced (respondents could mention from 0 to 3 different problems).

Table 5.4.Source of existing land and water management interventions in Ngenge watershed, Mt. Elgon, Uganda.

Origin of intervention	% of households*		
	Upstream	Midstream	Downstream
Government involvement - advice and training	13	43	35
NAADS	0	23	52
Self initiative	22	20	17
Inherited knowledge	7	7	0
School	24	5	4
Looking at others	27	16	17
Not exposed to intervention	53	25	17
Local Council initiative	2	0	0
Radio broadcast	2	0	0

Source: Household survey, *percentage of households mentioning the particular source of the intervention (respondents could mention from 0 to 3 different sources).

Table 5.5.Desired interventions in Ngenge watershed, Mt. Elgon, Uganda.

Respondents' priority interventions	% of households*		
	Up-stream	Mid-stream	Down-stream
None	18	0	9
Tree planting	38	41	13
Alterative farming methods	13	20	13
Animal farming, bee keeping	13	9	13
Other crops	9	36	30
Vegetable planting	2	7	4
SWC - trenches, bunds, river bank protection etc	73	52	0
Commercialisation	0	9	4
Training in coffee farming	0	5	0
Government involvement - train and advice on proper land management	80	64	70
Fishing	2	0	0
Poultry	0	2	13
Inputs at subsidised prices	13	45	39
Agroforestry	0	7	0
Fence/ protect water sources	18	39	17

Source: Household surveys, *percentage of households mentioning the issue as a problem it faced (respondents could mention from 0 to 3 different problems).

5.3.5 Factors relevant for IWM as a policy strategy in the Ngenge watershed

The factors which, according to the respondents influence the management of the land and water resources in the watershed are shown in Table 5.6. In this section, we describe the most important factors mentioned.

According to the majority of the respondents in the upstream area (73%; Table 5.6), the most important biophysical factor at play is the steep terrain of the area. Cultivating the steep slopes initiates soil erosion leading to loss of the top soils, the newly planted seed and the added fertiliser. This is in line with another study carried out to assess the erosion risk of Ngenge watershed in which these areas were identified as high or very high erosion risk areas, partly because of the steep slopes (Mutekanga et al., 2010). Furthermore, the study showed that especially in April, May and August, large areas have high or very high risk of erosion because the land is prepared for the new cropping season and has a low vegetation cover. The steep terrain up- and midstream coupled with abundant rainfall indicates the need for SWC measures to avoid soil erosion, reduce flooding and sedimentation downstream, and reduce contamination of water sources.

This clear relationship between the problems up and down the watershed, indicates the usefulness of a watershed approach. Since livelihoods depend on annual crop cultivation SWC measures need to be combined with sustainable agricultural production. An integrated approach is needed which, in line with the IWM framework, incorporates the needs and priorities of the stakeholders in decision-making for the management of the resources. Preferably, SWC efforts should involve direct benefits to the individual farmers. Planting *Napier* grass on bunds and planting *Grevillea* trees has already proven successful in not only reducing erosion from the fields but also providing other products such as fodder, firewood and improved soil fertility. A number of respondents have the desire to plant trees as well as implement SWC measures in their fields (Table 5.5). Downstream, flooding and sedimentation became a profit in that the resultant highly enriched soils are now being used to cultivate rice. Although only a small proportion of the people own the rice farms since they can mobilise the start-up capital, a significant proportion of the people also benefit by providing labour. Since the impacts of flooding and sedimentation are not in all respects negative, it will be more difficult, however, to generate payments from the downstream areas to finance upstream activities, as is often promoted in IWM approaches.

In the Ngenge watershed the main socio-economic factors influencing land and water management are lack of inputs and population pressure on both the land and water resources. The people lack capital for inputs, midstream, to improve crop yields, and upstream, to treat animal diseases. Population pressure contributes to small land holdings; declining fertility; water contamination; and grazing land shortage. Small landholdings are attributed to land fragmentation over the generations. Declining fertility is attributed to soil erosion, and continuous cultivation without fallow to meet the needs of the households from the small landholdings. Water contamination was caused by the large scale clearance of the natural vegetation, without taking into account a border around water sources thus runoff flows directly to the river. The soils become less productive and require more inputs for reasonable yields.

The people are aware of the need to institute SWC practices on their land but they lack the knowledge and skills for implementation (Table 5.6). Access to knowledge and advice is the major priority intervention of the people (see Table 5.5) and also an enabling condition for their participation in any resource management intervention. The respondents expect the District officers of Agriculture, Environment and Veterinary to provide advice and training on proper agricultural practices. The respondents also require access to inputs such as fertilizer, improved seed, tree seedlings and drugs for treating their animals.

Considering that the people are aware of the problem of resource degradation and are willing to learn better methods of resource management they are ready to cooperate in any intervention. This is in line with the IWM approach which advocates for education of all stakeholders on their collective responsibility. And this includes the government as a stakeholder so as to ensure collective agreement with the proposed objective for the implementation of IWM. However, any intervention geared towards education or sensitization of the stakeholders requires initial funding for its facilitation and that is why the people expect the government to do it.

A potential source of facilitation, which is an important component of IWM, is payment of measures ensuring environmental services upstream by the resource users downstream. In the Ngenge watershed such payments are not appropriate, as already indicated by the mixed impacts downstream and general lack of good incomes. Because of these two reasons the IWM approach does not become appropriate for the Ngenge watershed unless there is some other form of facilitation, for example from donors.

Table 5.6.Perceptions on contextual factors influencing land and water management in Ngenge watershed, Mt. Elgon, Uganda.

Factor		Influence of the factor	% of households*		
			Up-stream	Mid-stream	Down-stream
Bio-physical	Steep terrain	Soils easily washed away; Loss of top soil with seeds and fertilizers	73	34	9
	Abundant rainfall	Much runoff	24	18	0
	Reduced vegetation cover	Increased drainage causing high surface runoff; causing erosion and flooding in growing season	18	9	39
	Insufficient rain	Prevents rain-fed farming downstream as alternative to charcoal burning	9	15	22
Socio-economic	Low household income; poverty	Limited investments in alternative land management practices and SWC activities; Overexploitation of land; charcoal burning downstream	18	36	26
	Lack of capital	Insufficient inputs to improve yields – fertilizer addition, improved seeds, pesticides,	41	61	22
		Acaricides and other chemicals for cattle diseases	72	21	35
	Population pressure on land resources	Small land holdings;	29	67	17
		Declining fertility;	63	72	0
		Water contamination;	65	75	52
		Grazing land shortage	50	39	4
Institutional	Insecurity	Few animals kept	0	15	39
	Lack of Government involvement	Lack knowledge, skills, advice in proper land management practices – unsustainable land management practices, no SWC	68	39	30
	Poor infrastructure and facilities	Poor road infrastructure; inadequate markets - low returns for harvested goods	52	45	12
		Inadequate clean water sources, rivers as domestic water source	71	52	52
	Policy	People lack ownership of resources, degradation; Nature conservation: reduced access to forest resources, vermin a problem	9	9	36

Source: Household surveys, *percentage of households mentioning the issue as a problem it faced (respondents could mention from 0 to 3 different problems).

The main institutional factors influencing land and water management according the majority of the respondents are poor infrastructure and facilities, and lack of Government involvement (Table 5.6). These factors are the underlying cause of several problems people face, namely, poor road infrastructure, inadequate clean water sources, inadequate markets for their produce, and lack of knowledge and skills for productive management of their land resources. These problems affect more people upstream than mid- and downstream which is expected considering that the upstream area of the watershed is generally the most inaccessible in terms of road infrastructure. According to the respondents, this lack of knowledge and advice has contributed to the unsustainable practices. Most of the respondents said they lack knowledge and skills for proper farming methods, which will not only conserve the soil but also improve yields. Mid- and downstream, less than half of the respondents gave lack of knowledge and advice as a factor influencing land and water management. In these parts of the watershed the government agricultural extension arm, NAADS, is active as an intervention in land and water management; albeit working only with selected beneficiaries.

IWM involves integration of ideas from various stakeholders who may have their own unique goals and agendas. This poses a challenge to implementation of the IWM approach since it requires agreement on a common goal by all the stakeholders in the watershed concerning sustainable resource management. For the IWM approach to be successful any planned activities must be considered by all the stakeholders at the same time, that is, the community, local leaders and government agencies. All the stakeholders need to have the same vision for the development of the watershed and be ready to take on and fulfil their individual and collective responsibilities. The IWM approach requires the establishment of a platform or institution for bringing all stakeholders in the watershed together for collective action (Perez and Tschinkel, 2003). However, in the Ngenge watershed different parts of the watershed have different needs and priorities, reaching a common goal for all stakeholders in the watershed will be extremely difficult. Therefore bringing all stakeholders together on one platform for policy development for the implementation of IWM would not be effective.

5.4 Potentials and challenges of an IWM approach

The applicability of IWM for the Ngenge watershed is discussed in view of the key characteristics and challenges of the IWM approach described in Section 5.2.

5.4.1 Conservation of biophysical resources

IWM is a favourable strategy for conservation of natural resources since biophysically, water and soil issues are closely related. Soil erosion reduces soil fertility and is also leading to water degradation in form of sedimentation. Land use activities up-and midstream are resulting into reciprocal flooding and sedimentation downstream. This linkage between land use, soil and water resources and the interdependence between the different sections of the watershed qualifies the watershed for IWM as a strategy for environmental sustainability (Mahdi et al., 2009; Baloch and Tanik, 2008;Bewket, 2003).

5.4.2 A holistic approach to resource management

An enabling condition for IWM is the need to address rural development concurrently with natural resources management. In the Ngenge watershed, there is widespread poverty among the people in all the three parts of the watershed. It prevents investments in SWC practices. IWM is very important since in its approach resource management is aligned with socio-economic development. There are, however, constraining conditions for IWM in its holistic approach:

1. Differing local problems. The different parts of the watershed each have unique local problems which call for tailor-made interventions. Similarly, different catchments are not homogenous having different problems and possible solutions.
2. Different specialized sectors. The holistic approach of integrating the bio-physical, socio-economic, political, and institutional factors operating within the watershed is a challenge in Ugandan watersheds. It requires coordination of different specialized sectors of decision-making for resource management and activities. In the Ngenge watershed the different natural resources, forests, soil, and water are each managed separately. The forest, now a national park, is managed by UWA who aim at preservation causing conflict with the community who need access to forest resources. The water resource is managed by the water department who do not cooperate with the agriculture sector responsible for soil conservation.

3. Lack of consistent policies. There is need for consistent policies that are able to cope with conflicts that have strong institutional roots. Each sector as mentioned above, has always operated with its own policies implemented for managing the resource. As a result there is need for feasible policies which can enable the implementation of IWM in such a complex situation where sectorial management is uncoordinated (Cortner and Moote, 1994; Walther, 1987).

5.4.3 Stakeholder involvement

An enabling condition for IWM is that the local people are aware of the problem of resource degradation and are willing to learn better ways of resource management. However, the challenge is that of diverging interests among the different stakeholders - there is a challenge in ensuring a common goal by all the stakeholders in the watershed concerning sustainable management of the resources. The people in the Ngenge watershed expect the government to provide training and advice in proper land management, yet the government officials do not have that as a priority agenda in their everyday programmes. Poor road accessibility to the upslope area is considered the reason the people are not exposed to training and advice from both the government and NGOs. The district administration has not prioritized improving the road network to the area.

5.4.4 Developing a policy making platform

There are two enabling conditions for IWM.

1. NEMA platform. From an IWM perspective, NEMA provides an appropriate platform for it would bring together the policy makers at the higher levels.
2. Local Councils are strong to mobilise. Local Councils (LCs), elected by the people from among themselves - at village level (LC1); parish (LC2); subcounty (LC3); county (LC4); and district level (LC5), are well established and thus important for any developmental initiative. Most NRM initiatives are initiated at subcounty level, and then scaled-up to district level.

A constraining condition for IWM is however, that added value of cooperation in the watershed as a whole is limited since the different areas have unique priorities not exactly interdependent. In addition, the impacts downstream are both positive and negative therefore integrated interventions as advocated for in IWM are not feasible. As a consequence, a watershed platform where all stakeholders are brought together for cooperation and collective action (Perez and Tschinkel, 2003) may not be very effective. Collective efforts can, however, be supported through the local councils. The local councils are based on villages which are administrative units in a watershed. The boundaries of these villages normally follow hydrological or geomorphologic boundaries such as cliffs or micro watersheds thus reducing the complexity of the problems and possible solutions per village. These villages therefore could act as basic units for resource management in consultation with the communities.

In the neighbouring Tuikat watershed the NGO Action Aid assisted 4 villages to successfully carry out SWC activities and the positive results are evident. Such “watershed districts” have been proved to greatly enhance the success of implementation of IWM in other countries (Baloch and Tanik, 2008; Bewket, 2003; Achet and Fleming, 2009) and therefore would also enhance successful IWM implementation in Uganda highland watersheds. IWM implementation can begin at the level of the subcounty which is a more practical unit than the village in terms of size.

5.4.5 Transfer of resources to compensate for costs and benefits

This is a challenge for IWM since both down- and upstream, the people are in need of sustainable livelihoods and no payments can be effected for SWC for ecosystem services. In Ngenge watershed, part of the national park revenue can be used to support investments, however, policy is required to return of part of the revenue to the communities and this is a challenge for the implementation of IWM.

5.4.6 Long-term planning for sustainability

An enabling condition for IWM is that NEMA has the authority, technical expertise and financial resources to oversee all activities involved with land and water management, thus its function is well established. It has already successfully carried out sensitisation for river bank management along the neighbouring Atari river to protect the river from sedimentation. This river was protected because it is the source of water for the main district hospital and Kapchorwa town. An equivalent commitment to soil and water conservation in the Ngenge watershed as well as other highland watersheds would therefore accomplish significant results. There are, however, constraining conditions for IWM.

1. Need for commitment. The challenge is obtaining such a commitment for resource management in all watersheds with NEMA as the lead authority. According to Braril et al, (2006), the implementation of IWM requires a change in the mind-set of not only the resource users but also within the government administration. Such a mind-set change will not occur in the short-term, since it takes time for the stakeholders to take hold of their roles (Brarilet al., 2006).
2. Need for start-up funding. In the Ngenge watershed there is no economic ground for money transfer or payment of services as is the case in other watersheds worldwide. In these watersheds, investments downstream such as electricity generation pay for the investments in SWC upslope. Financial assistance is needed from the government as a form of public strategic investment to empower the existing local institutions for collective action and to implement IWM activities. This shows the clear responsibility that the governments could play in creating enabling conditions (Shiferaw et al., 2008). This is a challenge with the IWM approach since expecting facilitation from the government is not in line with IWM. In Ngenge watershed, government negligence in service provision for infrastructure and extension has led to lack of knowledge on appropriate resource management practices. People need the information and tools required for them to make a difference (Mullen and Allison, 1999). With the strong local governance system, efforts at empowering the people could begin with the local councils. These, in turn will demand the higher authorities - district and NEMA - to fulfil their mandates of training the communities and providing whatever is required to achieve sustainability. With the departure of ActionAid from the Tuikat watershed, there is so far no spreading of the successful SWC interventions to other areas. The District Natural Resources office can encourage local people to establish groups through which the district can empower them with training and resources - as NAADS is doing in the midstream area. In Benet subcounty, there is the Kaseko Soil and Water Conservation (KASEKO) group mobilised by one farmer, trained by IUCN on SWC practices. As a group, KASEKO was able to acquire funding through the District Landcare Chapter. Individual farmers portraying initiatives in not only sustainable agricultural practices but also entrepreneurial and eco-industrial skills should be motivated by the district with resources such as start-up capital.
3. Need for maintaining the long-term cooperation of local communities in need of quick fixes for their problems. Environmental sustainability is achieved in watersheds when natural resources for livelihood support are conserved or enhanced over time (Mahdi et al., 2009; Baloch and Tanik, 2008; Bewket, 2003). However, with IWM benefits accrue in the long-term. Since the majority of the households depend on subsistence farming for their livelihoods, initial investments in the provision of short-term benefits to the farmers such as subsidized farm inputs and improved seed is necessary to ensure their participation in the IWM programme.

5.5 Conclusion

Land and water management development in the Ngenge watershed is currently influenced by the biophysical characteristics; low household incomes; lack of Government involvement; and population pressure. The population pressure has resulted into unsustainable agricultural practices such as continuous cultivation without fallow and cultivation of very steep slopes. These activities resulted in soil erosion, fertility loss, contamination of water sources, and flooding and sedimentation downstream. SWC is inadequate because of limited investments due to low household incomes and lack of knowledge and skills for sustainable agricultural management practices due to lack of Government involvement.

In the upstream area, annual cropping is the major practice with the soils heavily eroded during planting and weeding each season. With no access to forest resources the people have no alternative income sources apart from cultivation. The main problem midstream is lack of capital for fertilisers because soils are exhausted. Downstream, flooding and sedimentation is a frequent problem but has also enabled rice growing in the sediments. The priority of the people, however, is being assisted to settle and obtain sustainable livelihoods.

The clear relationship between activities up-, and mid-, and their effects downstream indicates the need for a watershed approach to resource management. Since the agricultural practices are mainly subsistence, interventions for land and water management should incorporate improvement of livelihoods. This integrated approach also calls for involving the stakeholders in decision making for resource management which is in line with IWM. The local people are already aware of the problem of resource degradation and are also willing to learn better ways of resource management.

Farmers required more fertilizer inputs to maintain productivity due to soil erosion and fertility loss. SWC interventions should therefore be integrated with improved productivity from the small land parcels through provision of low-cost inputs and favourable markets for the crops to boost household incomes. This makes IWM a promising intervention. However, people are generally poor due to low household incomes, lack of alternative livelihoods and reducing land productivity. As a consequence, obtaining payments for measures for environmental services in the watershed is not possible and limits the potential of IWM. In each section of the watershed people have their own unique priorities which they expect should be addressed as part of any intervention. Thus the integrated nature of IWM whereby the watershed should be considered as a whole in decision-making for interventions is not realistic.

The people lack knowledge and advice on sustainable land and water management as a result of an inefficient government extension system. Government negligence has also resulted into poor services in terms of poor infrastructure and services. However the Government did implement the local councils, a successful local governance system in terms of mobilising people for any intervention; and NEMA, a well facilitated national body in charge of coordination environmental management. NEMA provides a potential platform, from an IWM perspective, for it would bring together the policy makers at the higher levels. IWM is very important since in its approach resource management is aligned with socio-economic development and it also advocates for a local stakeholder platform where all the stakeholders come together to negotiate. Due to the widespread poverty, it is doubted whether such a stakeholder platform would add value since there is limited exchange between up- and down-stream. There is, therefore, the need for funds for kick-starting initiatives such as sensitisation programmes and mobilisation of all stakeholders which is a big challenge for the implementation of IWM in the watershed.

5.6 Recommendation

From the findings of this study it became apparent that focusing sensitisation and facilitation for resource management on the following institutions will significantly contribute to finding a lasting solution to the problem of resource degradation in Ugandan watersheds.

- NEMA as the overall national authority for environmental management
- the Local Councils for their capacity as the mobilisers for the communities
- innovative farmers, who can influence their neighbours and
- organised community groups such as those being assisted by NAADS in the midstream area.

Chapter 6

Synthesis

Synthesis

6.1 Introduction

Uganda is an agricultural country with 70% of the population depending directly on rain-fed agriculture for their livelihood (UBOS, 2010). Soil erosion is a serious problem, especially in the highland areas where it is leading to persistent reduction in productivity of the land (Opondo, 2006; Nkonya et al., 2008; Tukahirwa, 1988; Isabirye et al., 2008), and to river sedimentation and flooding in the downstream areas (DSOER, 2004; NEMA, 2008). The rural population mainly practice subsistence farming which necessitates land preparation and thus exposing the soils to erosive rains. Current soil and water conservation (SWC) measures in these Ugandan highland areas are either inadequate or non-existent. Previous interventions did not bring about significant results in introducing appropriate resource management. Inadequate and poorly implemented policies on natural resource management are still leading to degradation of the natural resources (NEMA, 2008; Larsen et al., 2008), also because these policies and measures were formulated without adequate consultations with the people directly dependent on the resources. It is becoming more apparent worldwide that top-down planning approaches were hardly successful and often resulted in recommendations that were neither perceived as immediate farmer priorities nor focused on and adapted to the specific local context (EROAHI, 2005; Petts, 2006; Carter, 2008; Sanginga, 2005; Ganesh and Schmidt-Vogt, 2009). New policies and strategies for sustainable use of the soil and water resources are urgently needed to ensure livelihoods for the rural population (Opio et al., 1998; NEMA, 2005; NEMA, 2008). One such strategy proven worldwide to be effective in proper management of resources and improvement of rural livelihoods is Integrated Watershed Management (IWM). This thesis was aimed at achieving sustainable management of soil and water resources through developing applicable policies and measures using the IWM approach. Following this objective, the thesis focused on four research questions.

1. How can erosion risk in Uganda Highland watersheds be assessed rapidly to support policy development?
2. How to select and analyse relevant stakeholders in Ugandan Highland watersheds for participation in integrated watershed management?
3. How can social learning be made instrumental for integrated watershed management in the Ugandan Highlands?
4. What are potentials and problems of IWM as a policy strategy for Uganda Highland watersheds?

The Ngenge watershed, a typical watershed on the slopes of Mount Elgon in eastern Uganda, formed the case study site. The River Ngenge is one of the main rivers flowing from the forested upper mountain slopes to contribute to the River Nile. Part of the forested upstream area of the watershed is given for resettlement of forest inhabitants and for people displaced by cattle rustling from downslope, although the forest was gazetted for preservation. The settlers cut the trees for arable farming without SWC practices, causing serious erosion and water siltation, and flooding and sedimentation problems downstream. Midstream, the main issue is soil exhaustion due to lack of fallow periods. Declining yields coupled with low household incomes further exacerbate the problem of the farmers' failure to institute SWC.

This last chapter of the thesis is a summary of the insights and knowledge gained on designing participative policy making for the implementation of Integrated Watershed Management in Uganda highland watersheds. Hence, in the subsequent two sections the applicability of Integrated Watershed Management approach for the Uganda highlands is presented, with a presentation of the methodology used and an analysis of its applicability as a policy strategy. In Section 6.4 the contribution of this study to Integrated Watershed Management in the Ngenge watershed is presented and in Section 6.5 the application of the findings to other Ugandan watersheds is given. Section 6.6 is on the limitations of the study. The chapter closes with a number of recommendations for implementing IWM, both in the Ngenge watershed and beyond and for further research.

6.2 Using the Integrated Watershed Management approach for policy recommendations

In developing and applying the IWM approach in the Ngenge watershed in Uganda, this study was organized around three phases.

6.2.1 Phase 1: Acquisition of policy relevant data

Information to empirically support soil and water conservation policy recommendations is required (Nkonya et al., 2008). Up-to-date and relevant information on the circumstances in the watershed, in this case erosion risk, is needed to support the policy making process. To assure adoption, policies have to be locally relevant, and therefore should be designed with the coordination and full involvement of the involved stakeholders, each with different interests (Jembere, 2009). To provide adequate information for policy development, rapid assessment of erosion risk in the watershed was established. This was then followed by a stakeholder analysis as a means to select and analyse the relevant stakeholders who should participate in the policy making process.

Erosion risk assessment

The method of erosion risk assessment applied in this study, using rainfall, slope and NDVI, was adopted from Visser and Jansen (2006) and provided a rapid assessment of erosion risk for the study area. First the periods in the year critical for erosion risk were identified. During such periods, the areas identified as under high risk would be the focus for interventions by aiming at ensuring a good vegetation cover for the soil to minimize erosion. One of the strengths of this method is its applicability in a data poor environment. This is also in line with a similar study in Mauritius where erosion risk mapping was considered a very useful tool to identify high erosion areas and to assess temporal variations in erosion patterns for areas where data availability prohibits the application of erosion models (Nigel and Rughooputh, 2010). The advantage of this method is that the data required for carrying out the assessment as well as the GIS software ILLWIS for processing it, can be obtained free of charge from the web. With limited funding, as in Uganda, adequate information for decision-making for immediate interventions can be obtained, the only costs being the equipment and specialized personnel. The method proved straightforward and easy to apply, requiring only the temporal evaluation of vegetation cover at the moments of high intensity rainfall, and the spatial distribution of slopes in the area (Visser and Jansen, 2006). Also Zhang et al. (2010) assessed in a similar way erosion risk to identify conservation priorities for the Yongding river basin in China and concluded that this qualitative assessment method is fast and straightforward and can be used to prioritize conservation areas without the need for more complex quantitative methods. They also concluded that the method shows high potential for successful application in other areas.

Who should participate? - a stakeholder analysis

Given that the success of IWM programmes heavily depends on stakeholders' participation and their ability to take decisions, there is need to establish who are the stakeholders to take part in the design and implementation of IWM. Therefore a tool is required for selecting the key stakeholders and to this end a stakeholder analysis (SA) was applied in the Ngenge watershed. The methodology of applying the SA was evaluated for its usefulness in selecting the key stakeholders. The three-step approach employed in the SA enabled the identification of the key stakeholders. Muller et al. (2012) in their study on how to know who to include in collaborative research conclude that developing the researcher's understanding of the problem situation is a prerequisite for the identification of important actors. This is in line with our study, which started with identifying the prevailing natural resource problems in the watershed and the stakeholders involved. The stakeholder analysis not only identified the natural resource conflicts, but also laid the foundation for follow-up workshops and more collaboration among the different stakeholders in the watershed.

6.2.2 Phase 2: Establishment of the participatory decision-making platform

All the categories of stakeholders and the different levels were brought together in workshops to participate in developing joint ideas for policies and measures to manage the watershed. By bringing them together for interaction and discussion, social learning can be stimulated. The gathering of all stakeholders in workshops provides opportunities for each stakeholder's perceptions to be heard by others. The process of scenario development in the first level workshops enabled the participants to create a common vision of the future for their communities. The outcomes of the scenarios reflect the perceptions and priorities of the people, which may contrast considerably from the technical aspects of scientists, which are usually envisaged as the appropriate solutions to the problems. Action and work plan development in the second level workshops enabled thinking about and working out the feasibility of achieving the desired future. Participation in groups provided a means of collective learning when different perspectives were brought together to come up with collective strategies to solve the problem of resource management. The workshops contributed to increasing mutual understanding of sustainable NRM and on the need for cooperation to solve problems in the watershed. The organization of the workshops at two levels - community and watershed - helped to involve all the key categories of stakeholders, especially the community category. According to Sanginga et al. (2004), participation can be promoted by facilitating platforms where community members or community representatives can engage in dialogue with the leaders and other stakeholders. This was clearly done in the community workshops of the Ngenge watershed and it showed that people have their own perceptions and priorities of what they expect to be developed in the management of the resources. For example, in the downstream area community stakeholders prioritized the building of bridges over the flooding rivers so that these rivers can be crossed over; and they prioritized the need for more boreholes for water for domestic use. Downstream community stakeholders are not focusing on the upslope people to first carry out SWC, as could be expected for the implementation of IWM.

6.2.3 Phase 3: Potentials and problems of Integrated Watershed Management as a policy strategy

A characteristic feature of IWM is interdependence between the different sections of a watershed (Baloch and Tanik, 2008; Singh et al., 2002). Soil erosion up- and midstream leads to flooding and sedimentation downstream. This is an evident consequence of the physical interdependence between upstream and downstream land uses. There is a clear relationship between the problems up and down the watershed, which is an indication of the usefulness of a watershed approach.

IWM holds the potential for handling and improving existing resource management issues since it advocates the involvement of all stakeholders from the start of any program. For example in the Ngenge watershed, the law for protection of river banks applies to the banks of the main river; however, the banks of the little streams passing through the fields and bringing soil to the river have to be protected as well for lasting results. The roads are periodically resurfaced with soil without murram and therefore always washed away by rain, further contributing to sedimentation downstream. Such issues become apparent if stakeholders are involved in the interventions from the start. According to Lebel and Daniel (2009) planning has conventionally been led by government bureaucrats, relying on neat physical and institutional separation of conservation and use functions. They argue that in the tropics there is substantial evidence that meaningful joint participation of local resource users, managers and ecosystem experts leads to more informed and appropriate plans. By involving local stakeholders in decision making, the development and the implementation of a long-term vision for the entire watershed by all stakeholders in the watershed can be promoted (Baloch and Tanik, 2008; Bewket, 2003) - a key feature of IWM. Costa (2011) on using a participatory framework in Guatemala to analyse the future viability of different conservation measures in a cloud forest area concludes that farmers will only accept new measures if they are themselves involved in a meaningful way in the process of co-developing them.

IWM advocates the improvement of livelihoods as an essential part of the process of managing the sustainable use of resources. Since the majority of the households in the highland areas of Uganda are involved in subsistence farming for their livelihoods, initial investments in the provision of short-term benefits to the farmers, may be necessary to ensure their participation in and support of the IWM program (Costa, 2011). The upstream investments in SWC in the Ngenge watershed cannot be subsidized by the downstream land uses as is advocated for in IWM in literature (Bezuayehu and Stroosnijder, 2007; Ferreyra, et al., 2008). External facilitation and finances are needed, for example, from donors. Due to raised riverbeds when the rivers flood, the roads in the area become impassable, including the main road passing through to the neighbouring district of Nakapiripirit. The national roads authority can help to subsidize SWC costs for this reduces the cost of maintaining the road.

Integration as is advocated in IWM is not feasible in the Ngenge watershed because each area of the watershed has unique problems and social-economic aspects, which will require tailor made interventions for their management. Local councils, being based on villages as administrative units in the watershed, provide a means through which collective efforts can be supported for natural resource management. The boundaries of these villages normally follow hydrological or geomorphologic boundaries such as cliffs or micro watersheds and thus reduce the complexity of the problems and possible solutions per village. These villages therefore could act as basic units for resource management and as basic unit for community consultation. Such “watershed districts” have been proven to greatly enhance the success of implementation of IWM in other countries (Baloch and Tanik, 2008; Bewket, 2003; Achet and Fleming, 2009). In addition, since the existing local councils operate with relative success, they could play a key role in discussing, co-designing and implementing policy and management, rather than the creation of a new IWM platform that would bring everyone in the watershed together. NEMA could play a role in coordinating and supporting activities over the watershed area as a whole. A more general implication of the case study developed in this thesis is that the IWM approach cannot be 'rolled out' from paper, but needs to be geared to specific local biophysical and social context factors.

6.3 Integrated watershed management approach for the Uganda highlands: the state of natural resources and livelihoods

One of the key assumptions of IWM is that it pays to directly involve local farmers in training on SWC and to include the improvement of the farmer's livelihoods in designing SWC measures. In our case study area we found one farmer trained in SWC by IUCN who had effectively passed on information on SWC to neighbouring farmers. This shows the effectiveness of exposing the actual farmers to training instead of only relying on extension workers. However, this success has not been upscaled to farmers in other areas. Farmers also have their own SWC innovations, for example trapping the runoff with trenches. Since IWM is organized and designed around stakeholder involvement such innovative farmers can be instrumental in dissemination and implementation of SWC innovations. According to Bewket (2003), farmers would only participate in conservation activities in the Chemonga watershed in Ethiopia if their priorities and preferences were considered and the effects of SWC were discernible to them. This suggests that SWC technologies that yield perceivable benefits are likely to be adopted (Bewket, 2003). IWM involves integrating SWC programs with improvement of livelihoods, thus it holds potential in reducing degradation and improving livelihoods in the Uganda highlands.

A holistic approach between the physical and socio-economic aspects, as IWM advocates for, will cater for other pertinent issues in the watershed such as easy accessibility to all areas by roads; and assurance of tenure security as an incentive to invest in SWC measures. Some issues are best handled by the government, therefore there is need for government commitment for implementation of IWM. In the Balochistan province in Pakistan it was realized that the holistic approach of IWM is the appropriate

approach for effective management of natural resources (Baloch and Tanik, 2008). According to Baloch and Tanik (2008), however, government commitment and involvement of stakeholders in decision-making and dialogue are the prerequisites of such an initiative, which resembles our findings in Uganda. In Ethiopia, according to a study by Tefera and Stroosnijder (2007), the construction of dams was planned from a top-down perspective, with some people being relocated against their will, and with haphazard land-use change causing increased soil erosion and reservoir sedimentation. A holistic approach, as is advocated in IWM and has been operationalized for the Ngenge watershed, would have been much more appropriate in this situation, whereby full consideration has to be given to whether or not a project is socially, environmentally and economically justified before the implementation starts.

6.4 Contribution of this study to Integrated Watershed Management in the Ngenge watershed

In the biophysical sense IWM is a favourable strategy for conservation of soil and water resources in the Ngenge watershed and other Ugandan watersheds since land use activities up- and midstream are resulting into reciprocal flooding and sedimentation downstream. In the IWM approach resource management is aligned with socio-economic development which is very important for Ugandan watersheds since there is generally widespread poverty among the rural people. Although different catchments are not homogenous having different problems and possible solutions the Ngenge watershed is quite unique in that the different parts of the watershed each have unique local problems which call for tailor-made interventions.

An enabling condition for IWM is that the local people are aware of the problem of resource degradation and are willing to learn better ways of resource management. They, however, expect the government to provide the training and advice in proper land management, yet the district officials themselves have not fully appreciated the enormity of resource degradation resulting from inappropriate land management practices. As such the district administration despite being well facilitated by NEMA, themselves require appropriate sensitization as a prerequisite to appreciate the need to have training of people as a priority agenda in their everyday planned programmes. Availability of updated information on erosion risk and repeated sensitization is needed for the district administrators. Observations from the workshop process reveal a general lack of knowledge and appreciation by the stakeholders of the extent of resource degradation resulting from land management practices. More sensitization is needed for equipping for effective collaboration in decision-making and for implementing SWC measures.

The three steps followed to conduct the stakeholder analysis provided sufficient information for identifying the key-stakeholders and how they should be involved in the policy making process. The outcomes of the workshops, namely action and work plans are evident of the success of the SA in identifying relevant stakeholders.

For the implementation of IWM in the Ngenge watershed, firstly, NEMA provides an appropriate platform for it has the capacity to bring together the stakeholders at all levels. There is, however, need for commitment on the part of NEMA to spearhead this role in all watersheds. Secondly, to work with NEMA are the local councils which are strong to mobilize. Elected by the people from among themselves, they are well established and thus important for any developmental initiative. Most natural resource management initiatives are initiated at subcounty level, and then scaled-up to district level. A constraining condition for IWM is however, that added value of cooperation in the Ngenge watershed as a whole is limited since the different areas have unique problems and priorities, and interdependencies are not always the same. The impacts downstream are both positive and negative therefore integrated interventions as advocated for in IWM are not feasible. Initiation of IWM implementation at the level of the subcounty reduces the complexity of the problems and possible solutions per area of the watershed.

One factor that contributed greatly to the success of the workshops was linking of the workshops to the existing governance structure. The local council system has a potential positive influence on the nature of multiparty cooperation and social learning processes since the local councils are already members of the community and acknowledged as their leaders and representatives in any deliberations for policy processes. With facilitation and education in problem/task management and engagement in social exchange processes they can play a key role in supporting continual collaboration for policy making for watershed management in Uganda. The limited budgets could be focused on sensitization programmes for both the district policy makers and the local councils.

The processes of scenario construction and making of action and workplans were a driving force for stakeholder participation in the workshops. Presentation of up-to-date information from their area made it easy for them to own the process and their motivation for participation was enhanced. It is important to devise ways of facilitating ownership of the dialogue process (Hisschemoller and Mol, 2002). The participants realized that it is possible to collectively agree on the best way of management of their resources and that it is important to involve all stakeholders in decision-making for there is much to learn from each other. The participants got an opportunity to collectively agree on practical solutions to the problems in the watershed. These processes can, therefore be applied to other watersheds for bringing stakeholders together for decision-making for watershed management. Organizing the workshops following the two governance levels ensured, firstly that the priorities in each section of the watershed at community level were sufficiently considered, and secondly, each stakeholder had an opportunity to realize their full potential in the decision-making process whether community member or policy maker. Interacting with the community representatives was a source of learning for the district leaders. There is a positive indication of greater collaboration across the levels. The action and work plans provided information for consideration in the development of policies and programs to prevent degradation in the watershed. The action and workplans as obtained from the workshops where all stakeholders deliberated together were ideal requisites to the required policies.

Facilitation in form of funding is required for bringing stakeholders together for policy making for watershed management. There is need for local governments and donors to support activities which bring people together for decision making, especially at the community level. For participative decision-making for the implementation of IWM in Ugandan watersheds up-to-date data is required as input for the deliberation processes and sensitization for the farmers, local councils, district officials and NEMA.

6.5 Applicability of the findings of this study to other Ugandan watersheds

To what extent have the findings of this study on Ngenge watershed relevance for other watersheds in Uganda? A similarity of the Ngenge watershed with other Ugandan watersheds is that all have more or less similar priority conflicts between (short term) economic development on the one hand and nature, natural resources and environment conservation on the other, which require tailor-made approaches. The Ngenge watershed and others on Mt. Elgon have nature conservation with its resource management conflicts and are also characterized by severe soil erosion. Other watersheds have their particular pertinent issues for example pollution from industry such as in western Ugandan watersheds, and scarce water resources in northern Uganda watersheds. Therefore, for each Ugandan watershed the strategies outlined in this thesis, namely, collection of up-to-date information on biophysical, socio-economic and institutional aspects as input for decision-making through stakeholder collaboration are of vital importance. The Ngenge watershed was divided into three sections – namely, upstream, midstream and downstream – and each section had its own unique resource management issues. Dividing the watershed into the different sections enabled handling each section in its specific context and making the collaboration of stakeholders realistic

and beneficial in terms of obtaining the necessary information and designing appropriate interventions for each section.

Another similarity between the Ngenge watershed and others in Uganda is that through the local governments the implementation of integrated watershed management has an already established base from which it can be initiated. Presently resource management is undertaken by several different un-coordinated governmental sectors, namely environment, forestry, agriculture, lands, wildlife etc. This makes the implementation of any intervention quite complicated. The local councils, however, by virtue of their mandate, are mandated to mobilize capacity and resources across these governmental sections for any intervention and therefore – as mentioned in this thesis – the implementation of integrated watershed management could begin with empowering and involving these local councils, particularly at the LC III and LC V levels. Other existing institutions to support the implementation of IWM, apart from the LCs, are NEMA and the other relevant national institutions in charge of management of resources, such as water, wildlife and forests. They, however, will also need to be sensitized so that they appreciate the need for appropriate resource management.

One difference between the Ngenge watershed and many other Ugandan watersheds is that its boundaries are contained within one district and one country, unlike several other watersheds which are transboundary in nature, both at district and country level. These other watersheds will require collaborations across borders, which was not required for the Ngenge watershed and as a result such collaborations were not considered in this thesis. The multi-level approach for stakeholder involvement in decision-making as outlined in this thesis provides an effective means of collaboration across boundaries: the first level would involve stakeholder deliberations within boundaries and the subsequent outputs are taken as input to the second-level workshops involving stakeholder representatives across the boundaries. NEMA, NGOs, and other related partners involved in natural resource management can oversee these collaborations of stakeholders across boundaries. In this thesis it was realized that bringing different stakeholders together for collaboration in decision-making not only results in stakeholder priorities for interventions but there is also learning from each other and from the workshop process on the need for appropriate resource management.

The Ngenge watershed is also different from some other Uganda watersheds in that the downstream area has little to offer the upstream resource users to compensate for soil and water conservation measures. Different from Ngenge, the watersheds in central and north-western Uganda often have hydro-electricity generation plants which should not be hampered by reduced water levels due to upstream forest removal (central Uganda) and siltation due to soil erosion (north-western Uganda). These electricity generating plants could pay upstream users for tree planting and forest conservation to maintain water levels and soil and water conservation to reduce siltation, respectively. Hence, installing such payment for environmental services mechanisms in these other Ugandan watershed might make upstream watershed management easier.

6.6 Limitations of this study

The number of stakeholders identified to participate in the policy making dialogue turned out to be relatively large. As a result of the scope and (time and funding) limitations of this PhD study not all identified key-stakeholders could be invited to the workshops. Costs of lodging, transport, feeding and day allowances for all stakeholders were beyond the (budget) capacities of this study. In addition, it would have required to organize more parallel workshops, as the number of participants for an effective workshop is limited.

Prell et al. (2009) describe the use of another method for the same purpose: an in-depth analysis of existing social networks to determine who, of all stakeholders, are most important to participate in NRM initiatives. They looked beyond the attributes of the stakeholders to the relations between them, arguing that stakeholders in their perceptions, priorities and decision-making are greatly influenced by these networks. Thus by analysing networks they were able to categorize the stakeholders into various groups such as those with similar views, interests and priorities: those who communicate effectively to each other, those who are highly influenced by an individual, those who have similar interests, etc. (for details see Prell et al. 2009).

In this study such a social network analysis was not systematically executed, which forms a limitation of the current study. Existing networks were not analysed and therefore not identified among the key stakeholders participating in the workshops. Their influence on and congruence with farmer perceptions was not specifically captured in the workshop outcomes in this study.

6.7 Recommendations

6.7.1 Recommendations for policies for IWM

Following our case study a number of recommendations can be formulated for implementing IWM, both in the Ngenge watershed and beyond.

Networks and groups in Ngenge watershed, and also wider in Uganda, can be helpful and instrumental for knowledge exchange, implementation of SWC and influence on decision-making. Farmers (and other community groups such as women) are empowered to make decisions on resources management for improvement of their livelihoods. This is one strategy by which social learning can enhance the implementation of integrated watershed management in the Ugandan Highlands. Another strategy is to link the farmers with actors in the watershed that have the knowledge needed for SWC. An example is the IUCN trained farmer, who has successfully initiated soil and water conservation on his neighbours' farms. In the neighbouring watershed of Tuikat as a result of destructive erosion in four villages the people mobilized themselves for a solution. One of their own community members, an employee of Action-Aid, advised them to write a proposal which was forwarded to this NGO and they obtained technical assistance to institute successful SWC measures in these villages. A third strategy is to focus any efforts at empowering the people through the local councils. The local councils represent a well-established local governance system, which is strong in mobilizing the communities for any intervention. The majority of these local councils, however, need advice and training on sustainable land management practices so that they are able to direct the people in sustainable interventions. District environment and agriculture offices lack genuine commitment and motivation and there is a need for the communities to be sensitized on their role to demand accountability from these officers. For all these strategies, government commitment in providing an enabling environment (policy, legal and institutional) at the national level is required (Jembere, 2009) and has been realized partly through the establishment of NEMA. However, unless NEMA is empowered to be able to recognize their superior and supportive role in sustainable land and water resource management, the implementation of IWM will most likely not be successfully achieved. Implementation of an IWM program requires a change in the mind-set of resource users but also within the government administration. And such a mind-set change will not occur in the short-term, since it takes time to garner experience and for the stakeholders to take hold of their roles (Braril et al, 2006). Emerson et al. (2011) rightly argue that generating and sustaining capacity for joint action is a function of four elements, namely, institutional arrangements, leadership, knowledge, and resources (funding etc) and that principled engagement and shared motivation are supported with the development of these elements.

6.7.2 Recommendations for further research

The impact and long term effectiveness of the policy making dialogues on improved stakeholder involvement and interactions and actual implementation of outcomes of the workshop processes were not established due to the limited scope of the PhD study. Considering that the local councils are elected every five years there is uncertainty on continuity of interventions in cases where new officers are elected. Thus there is need for studies on the influence of politics on the implementation of the IWM programme. There is also need to establish the possibility for enabling policy and logistical support for the multi-stakeholder (workshop) dialogues. The applicability of this approach to other areas of Uganda should be tested especially on the other watersheds on Mt. Elgon with a focus the district of Mbale where severe landsliding is common.

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Summary

Soil erosion is a serious problem in Uganda especially in highland areas where it is leading to a reduction in productivity of the land. People in the highlands mainly practice subsistence annual cropping which necessitates opening up the soil for land preparation, thus exposing the soils to erosive rains. Current Soil and Water Conservation (SWC) measures are either inadequate or non-existent. Apparently, previous SWC interventions did not bring about significant results in better management of the land. There is thus an urgent need for a new strategy for solving this problem and to ensure the livelihoods for the people. One strategy which has worldwide been proven to be effective in proper management of natural resources is Integrated Watershed Management (IWM). IWM not only protect the environment but also leads to improvement of rural livelihoods. This thesis was aimed to achieve effective management of soil and water resources through developing a policy for the implementation of IWM. The Ngenge watershed, a representative watershed on the slopes of Mount Elgon in eastern Uganda, is the case study site (Chapter 1).

To support policy development for IWM, there is need for up-to-date information on the status of the natural resources which is presently lacking in Uganda. Data is required to focus interventions where most needed, particularly in a situation with insufficient financial and human resources. In this study (Chapter 2), a rapid, user-friendly method for assessing erosion risk, which yields information to aid policy development and decision making for sustainable natural resource management was tested. Erosion risk was analysed and mapped using rainfall, slope and NDVI (Normalized Difference Vegetation Index). This method of erosion risk mapping provided a quick and straightforward means for identifying priority areas for interventions for soil and water resource management. Appropriate maintenance of the soil and water resources for sustainable utilisation is required, because in Uganda most of the population derives their livelihood directly from the land. Results of the field erosion survey and analysis of NDVI from satellite images of the years 1980, 1990 and 2000 indicate an overall increase in erosion risk in the study area. This is demonstrated by the continuous decrease in the area under vegetation cover. Therefore it is necessary to institute SWC mitigation measures which encourage the vegetation cover of the soil. Interventions should also focus on avoiding further reduction in forested area, to reduce the risk of downstream flooding. Policy makers should use part of their resources in the acquisition of satellite images, in manpower for their interpretation and in fieldwork to acquire additional data on areas of particular interest. NEMA (National Environmental Management Authority of Uganda) has already ensured that these resources are available at district level so that this work of monitoring erosion risk (among other environmental issues) is facilitated.

For policy making, stakeholders have to be brought together to deliberate on an appropriate policy for the management of their land and water resources. In this study (Chapter 3) a three step approach was used that enabled proper identification of key stakeholders. At community level it became apparent that there was a need to identify existing networks and knowledge levels among the stakeholders because these factors influence the decision-making of the stakeholders. Through group discussions there was knowledge exchange that empowered the farmers (and other community groups such as women) to make decisions on resources management for the improvement of their livelihoods. This is one strategy for the implementation of IWM. Another strategy was to link the farmers with actors in the watershed that have the knowledge they need. The results of our SA (Stakeholder Analysis) provided policy makers and project managers with a guideline on who should be involved for the effective implementation of an IWM programme in Ugandan watersheds.

The deliberation process on appropriate land management was facilitated by organizing workshops at two levels (Chapter 4). The levels followed the existing levels of local government whereby the first level workshops involved the community members and the second level workshop the community representatives and policy makers at district level. These multilevel workshops aided in ensuring that all the

different stakeholder categories were well represented and all had the opportunity to express themselves: firstly at community level in each of the different sections of the watershed and secondly, at watershed level with the policy makers and representatives from donors and the National Government.

By bringing stakeholders together in workshops to participate in the development of joint ideas for action on watershed management, social learning was stimulated. The workshops provided an opportunity for each stakeholder perception to be heard by the others. A process of scenario development in the first level workshops enabled the participants to create a common vision of the future for their communities. Action and work plan development in the second level workshops enabled thinking about and working out the feasibility of achieving that desired future. People in the different sections of the watershed have their own perceptions of what they expect in the management of the resources. For example, downstream, they want bridges over the flooding rivers so that they can cross over. They also need more boreholes for drinking water for domestic use. They are not focusing on the upslope people carrying out SWC measures as would be expected for the implementation of IWM. Participants were able to realise an appropriate planning for land and water management provided that the process was not too complicated. It should involve coming together and simply reflecting on and coming up with what can be done in the face of a problem. The outcomes of the workshops, namely the action and work plans were evidence for the success of our SA in identifying the correct stakeholders. Calls by the policy makers for more of such workshops and also involving more of the stakeholders implied that there was general satisfaction with the workshop processes and the participation of the stakeholders.

Following the IWM approach, the watershed was divided for our study into three sections: upstream, midstream and downstream (Chapter 5). In the upstream area, annual cropping is the major practice causing heavy erosion during planting and weeding each season. With no access to forest resources the people have no alternative income sources apart from annual cultivation. Poor road infrastructure has reduced accessibility impeding provision of social services and extension. More easy accessibility would enable ecotourism which could provide alternative household incomes. The main problem midstream is lack of capital for fertilisers which are needed because soils are exhausted. Downstream, flooding and sedimentation are frequent problems but this has also enabled rice growing in the fertile sediments. The priority of the people here is being assisted to settle (the area has been unsafe till recently) and obtain sustainable livelihoods. The clear relationship between activities in the up- and midstream sections and their effects downstream indicates the need for a watershed approach to resource management. Since current agricultural practices are mainly aimed at subsistence, interventions for land and water management should incorporate improvement of livelihoods. Most people are poor due to low household incomes, lack of alternative livelihoods and reduced land productivity. SWC interventions should be integrated with improved productivity from the small land parcels through provision of low-cost inputs and favourable output markets for the crops to boost household incomes. This combination makes IWM a promising intervention since in its approach resource management is aligned with socio-economic development.

The integrated approach calls for involvement of stakeholders in decision making for resource management. This advocates for a local stakeholder platform where all the stakeholders come together to negotiate. However, due to the widespread poverty, it is doubted whether such a wide stakeholder platform would add value since there is limited exchange between up- and downstream. Local people are already aware of their local problems of resource degradation and are also willing to learn better ways of resource management. However, in each section of the watershed people have their own unique priorities which they expect should be addressed as part of any intervention. Thus the integrated nature of IWM whereby the watershed should be considered as a whole in decision-making for interventions is not realistic. And since people are poor, obtaining payments for measures for environmental services in certain sections of the watershed is not possible and limits the potential of IWM.

In the past people have not been advised on sustainable land and water management as a result of an inefficient government extension system. Government negligence has also resulted into poor services in terms of infrastructure and social services. However the Government did implement the local councils, a successful local governance system in terms of mobilising people for any intervention. Also NEMA was created, a well facilitated national body in charge of coordination of environmental management. NEMA provides a potential platform, from an IWM perspective, because it can bring together the policy makers at the higher levels. Considering the socio-economic situation in the watershed, there is, however, a need for funds for kick-starting IWM initiatives such as sensitisation programmes and mobilisation of all stakeholders which is a big challenge for the implementation of IWM.

From the findings of this study it became clear (Chapter 6) that focusing on sensitisation and on facilitation of resource management by a number of Uganda's institutes will significantly contribute to finding a lasting solution to the problem of resource degradation in Ugandan watersheds. Firstly, by NEMA as the national authority for environmental management and by the Local Councils for their capacity as the mobilisers for the communities. Secondly, by the innovative farmers, who can influence their neighbours and the organised community groups such as those being assisted by NAADS (National Agricultural Advisory Services).

Samenvatting

Bodemerosie is een ernstig probleem in Oeganda, vooral in de hooglanden want het leidt tot een vermindering van de productiviteit van het land. Een juist onderhoud van bodem en water voor duurzaam gebruik is essentieel voor Oeganda, want het grootste deel van de bevolking ontleent haar levensonderhoud direct van het land. Twee maal per jaar wordt de bodem bewerkt als voorbereiding op het groeiseizoen. Hierdoor wordt de bodem blootgesteld aan de erosieve krachten van de regen. Bodem- en waterconserveringsmaatregelen (BWC) zijn in de Oegandese hooglanden ofwel onvoldoende of afwezig. Eerder beleid m.b.t. de implementatie van BWC interventies heeft niet geleid tot significante resultaten in een beter beheer van het land, met als gevolg een dalende bodemvruchtbaarheid en productiviteit. Er is dus dringend behoefte aan een strategie voor het efficiënt implementeren van BWC beleid. Een strategie die wereldwijd zijn effectiviteit in stroomgebied beheer heeft bewezen is Integraal Stroomgebied Beheer of wel 'Integrated Watershed Management' (IWM). IWM leidt ook tot verbetering van de bestaanszekerheid op het platteland. Dit proefschrift is erop gericht om een doeltreffend beheer van bodem en water te bereiken door het ontwikkelen van beleid voor de uitvoering van IWM. Het Ngenge stroomgebied, gelegen op de Mount Elgon is representatief voor stroomgebieden in de bergen in Oeganda en is het onderzoeksgebied voor deze studie (Hoofdstuk 1).

Om de ontwikkeling van beleid voor IWM te ondersteunen, is er behoefte aan up-to-date en actuele gebiedsinformatie welke op dit moment ontbreekt in Oeganda. Gegevens zijn nodig om interventies te richten op die gebieden waar dat het meest nodig. In het bijzonder in een situatie van onvoldoende middelen is een snelle, gebruiksvriendelijke methode voor het beoordelen van veranderingen in het erosie risico nodig. Het erosie risico werd geanalyseerd en in kaart gebracht met behulp van informatie over regenval, helling en NDVI (Normalized Difference Vegetation Index), Hoofdstuk 2. Deze methode van erosie risicokartering biedt een snelle en eenvoudige wijze voor het identificeren van prioritaire gebieden voor interventies voor bodem- en waterbeheer. Resultaten van een veld erosie onderzoek en analyse van NDVI uit satellietbeelden van de jaren 1980, 1990 en 2000 wijzen op een algemene toename van het erosierisico in het studiegebied. Dit blijkt uit de continue vermindering van het gebied onder dichte vegetatie op steile hellingen. Daarom moeten maatregelen worden geïnstitutionaliseerd welke een verbetering in de bedekking van grond met vegetatie bevorderen. Interventies moeten zich ook richten op het vermijden van verdere verkleining van het bosareaal, om het risico op overstromingen te verkleinen.

De verkregen informatie is getest op zijn bruikbaarheid voor beleidsontwikkeling en besluitvorming voor een duurzaam beheer van natuurlijke hulpbronnen. Voor beleidsmakers is het nodig om middelen te investeren in de aankoop van satelliet beelden, in mankracht voor hun interpretatie en in de verzameling van veldwerk gegevens. Oeganda's NEMA (National Environmental Management Authority) heeft hiervoor al middelen op district niveau beschikbaar, zodat het inzicht op erosie risico als zijnde een van de milieu risico's wordt vergemakkelijkt.

Voor een juiste beleidsvorming moeten alle betrokken partijen bij elkaar worden gebracht om te beraadslagen over het meest geschikte beleid voor het beheer van land en water. In deze studie (hoofdstuk 3) is een 3-stappen aanpak gebruikt voor de identificatie van de belangrijkste betrokkenen. Het is gebleken dat om de groep belanghebbenden/stakeholders adequaat te identificeren het nodig was om de bestaande netwerken en kennis vast te stellen. Deze factoren bleken invloed te hebben op de besluitvorming van de stakeholders. Door middel van groepsdiscussies heeft er uitwisseling van kennis van boeren en andere maatschappelijke groeperingen, zoals vrouwen plaatsgevonden. Dit heeft het vermogen van de individuele stakeholders om beslissingen te nemen over het beheer van de natuurlijke hulpbronnen voor de verbetering van hun levensonderhoud versterkt. Dit is een goede strategie gebleken voor de implementatie van IWM. Een andere strategie is om de boeren te koppelen aan die actoren in het stroomgebied, die de kennis die de boeren nodig hebben. De resultaten van deze SA (Stakeholder Analysis) bieden beleidsmakers

en project managers een richtlijn over wie betrokken moeten worden voor de daadwerkelijke uitvoering van het IWM-programma in Oegandese stroomgebieden.

Het beraadslaging proces werd vergemakkelijkt door het organiseren van workshops op twee niveaus, Hoofdstuk 4. Deze niveaus volgden de huidige niveaus van de lokale overheid. Het eerste niveau betreft de leden van de gemeenschap en het tweede workshop niveau bestaat uit vertegenwoordigers van de gemeenschap en beleidsmakers die betrokken zijn op district niveau. Deze multilevel benadering heeft geholpen om ervoor te zorgen dat alle verschillende categorieën belanghebbenden goed vertegenwoordigd waren en allen de gelegenheid hadden om zich te uiten. Ten eerste op het lokale niveau in elk van de verschillende delen van het stroomgebied en ten tweede, op stroomgebiedniveau met de beleidsmakers en vertegenwoordigers van de donoren en de nationale overheid.

Door stakeholders samen in workshops deel te laten nemen aan de ontwikkeling van gezamenlijke ideeën voor de aanpak van het beheer van stroomgebieden, kan sociaal leren ('social learning') worden gestimuleerd. De workshops boden de gelegenheid voor elke stakeholder om te worden gehoord door de anderen. Via een proces van scenario-ontwikkeling konden de deelnemers aan de lokale workshops een gemeenschappelijke visie op de toekomst van hun gemeenschap creëren. Actie- en werkplanontwikkeling in workshops op het tweede niveau zorgden voor denken over en het uitwerken van de haalbaarheid van het bereiken van de gewenste toekomst. Mensen in een stroomgebied hebben hun eigen perceptie van wat ze verwachten van het beheer van natuurlijke hulpbronnen. Stroomafwaarts bijvoorbeeld, willen de mensen bruggen over de rivieren zodat ze die veilig kunnen oversteken. Ze willen ook meer waterputten voor huishoudelijk gebruik. Ze zijn niet gericht op het eerst uitvoeren van bovenstroomse BWC maatregelen zoals zou worden verwacht bij de uitvoering van IWM. Het proces om met behulp van workshops een planning voor land- en waterbeheer te realiseren moet niet al te ingewikkeld zijn. Het gaat vooral om het bij elkaar komen en het eenvoudig nadenken over en het bedenken van wat kan worden gedaan in het zicht van een probleem. De uitkomsten van de workshops, te weten de actie en werkplannen bevestigen het succes van de gebruikte SA in het identificeren van de juiste stakeholders. Beleidsmakers vragen om meer van dergelijke workshops waarbij ook meer betrokkenen worden ingeschakeld. Dit bevestigd de algemene tevredenheid over de workshop processen en de deelname van belanghebbenden.

Naar aanleiding van de IWM aanpak, werd het stroomgebied verdeeld voor deze studie in drie delen: boven-, midden- en benedenstrooms, Hoofdstuk 5. In het bovenstroomse gebied, is jaarlijkse gewasproductie zonder gebruik van BWC, de gangbare praktijk waardoor de bodem sterk wordt aangetast tijdens het planten en wieden elk seizoen. Zonder toegang tot de bossen hebben de mensen hier geen alternatieve bronnen van inkomsten. Slechte wegen verminderen de toegankelijkheid van het gebied. Dit beperkt de verstrekking van sociale diensten en voorlichting. Een betere toegankelijkheid zou ecotoerisme stimuleren, een alternatieve bron van inkomsten. Het grootste probleem middenstrooms is het gebrek aan kapitaal om meststoffen te kopen die nodig zijn omdat de bodems uitgeput zijn. Benedenstrooms zijn overstromingen en sedimentatie een veel voorkomend probleem. Echter rijst teelt is mogelijk in dit gebied dankzij deze overstromingen.

De duidelijke relatie tussen de activiteiten in het boven en middenstroomse gebied en de effecten daarvan op de omstandigheden benedenstrooms bevestigt de noodzaak van een stroomgebied benadering van het beheer van de natuurlijke hulpmiddelen. Omdat de gangbare landbouwpraktijken voornamelijk gericht zijn op zelfvoorziening, dienen interventies voor land- en waterbeheer te leiden tot verbetering van de middelen van bestaan. De mensen zijn over het algemeen arm door de lage inkomens van de huishoudens, het ontbreken van alternatieve middelen van bestaan en het verminderen van de productiviteit van het land. BWC-interventies moeten worden geïntegreerd met interventies t.b.v. een hogere productiviteit van de kleine percelen. Dit maakt IWM een veelbelovende interventie aangezien zij in haar aanpak van resource management in lijn is met de gewenste sociaal-economische ontwikkeling. En

ook omdat het pleit voor een lokaal platform waar alle belanghebbenden bij elkaar komen om te onderhandelen.

De geïntegreerde IWM aanpak vraagt om betrokkenheid van alle belanghebbenden bij de besluitvorming voor het beheer van bodem en water. Als gevolg van de wijdverspreide armoede is het echter twijfelachtig of een dergelijk platform een toegevoegde waarde heeft, omdat er weinig uitwisseling is tussen boven-en benedenstroomse gebieden. Lokale mensen zijn bekend met de erosie en sedimentatie problematiek in hun directie omgeving en zijn ook bereid om betere manieren van land en water beheer te leren. Echter, in elke sectie van het stroomgebied hebben de mensen hun eigen unieke prioriteiten die ze willen aanpakken als onderdeel van een interventie. Dus het geïntegreerde karakter van IWM, waarbij het stroomgebied moet worden beschouwd als één geheel in de besluitvorming voor interventies is niet realistisch. En aangezien mensen arm zijn, is ook het verkrijgen van betalingen voor maatregelen voor milieudiensten is niet mogelijk hetgeen de mogelijkheden van IWM verder beperkt. De mensen zijn slecht geadviseerd over duurzamer land- en waterbeheer als gevolg van een inefficiënt systeem van overheidsvoorlichting. Nalatigheid, op het nationale niveau, heeft geleid tot slechte dienstverlening op het gebied van infrastructuur en andere diensten. Maar de regering heeft wel gezorgd voor een succesvol lokaal bestuur in termen van het mobiliseren van mensen voor een interventie en heeft NEMA gecreëerd, een goed gefaciliteerde nationale instantie die verantwoordelijk is voor de coördinatie van het milieubeheer. NEMA biedt een potentieel platform, vanuit een IWM perspectief, voor het samenbrengen van beleidsmakers op de hogere niveaus. Gezien de sociaal-economische situatie in het stroomgebied, is er echter vooral behoefte aan middelen voor het op gang brengen van lokale initiatieven zoals sensibilisering programma's en mobilisatie van alle belanghebbenden. Dit is een grootste uitdaging voor de uitvoering van IWM.

Deze studie laat zien (Hoofdstuk 6) dat als een aantal instelling zich meer zouden focussen op sensibilisering voor en facilitering van het beheer van de natuurlijke hulpbronnen, dit aanzienlijk zal bijdragen tot het vinden van een duurzame oplossing voor het probleem van de hulpbronnen in de stroomgebieden in de Oegandese hooglanden. Dit betreft in de eerste plaats NEMA als de nationale autoriteit voor het milieubeheer en de lokale raden in hun hoedanigheid van het kunnen mobiliseren van lokale actie. Maar het betreft ook de innovatieve boeren, die invloed kunnen uitoefenen op hun buren en op georganiseerde groepen in de gemeenschap. Een voorbeeld zijn groepen in het midstroomse gebied die worden ondersteund door de NAADS (National Agricultural Advisory Services).

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C E R T I F I C A T E

The Netherlands Research School for the
Socio-Economic and Natural Sciences of the Environment
(SENSE), declares that

Fiona Mutekanga

born on 1 April 1966 in Mulago, Uganda

has successfully fulfilled all requirements of the
Educational Programme of SENSE.

Wageningen, 9 October 2012

the Chairman of the SENSE board

Prof. dr. Rik Leemans

the SENSE Director of Education

Dr. Ad van Dommelen

The SENSE Research School has been accredited by the Royal Netherlands Academy of Arts and Sciences (KNAW)

KONINKLIJKE NEDERLANDSE
AKADEMIE VAN WETENSCHAPPEN

The SENSE Research School declares that **Ms. Fiona Mutekanga** has successfully fulfilled all requirements of the Educational PhD Programme of SENSE with a work load of 49 ECTS, including the following activities:

SENSE PhD Courses

- Environmental Research in Context
- Research Context Activity: Organizing three community workshops and a participatory policy workshop for Integrated Watershed Management (8th January 2009 in Entebbe, Uganda)
- Understanding Global Environmental Change: Processes, Compartments and Interactions
- Policy Evaluation Methodology

Other PhD and MSc Courses

- Writing Grant Proposals
- Integrated Environmental Assessment: Regional Management
- Impact Assessment of Land and Water Management
- Techniques for Writing and Presenting Scientific Papers
- ArcGIS 9 - Distance Learning by GeoDesk Wageningen UR
- Citation Analysis for Staff
- Working with Endnote
- Training on organising workshops for participatory policy making with stakeholders

International Presentations

- *Using remote sensing to analyse land use change and its influence on erosion risk in the Uganda Highlands; the case of the Ngenge watershed, Kapchorwa District.* Oral presentation at the 6th International AgroEnviron Symposium, 28 April 2008, Antalya, Turkey
- *Facilitating participatory decision-making for Integrated Watershed Management in the Ngenge watershed in the Eastern Uganda highlands, a stakeholder-based process using scenario construction.* Poster presentation at the Impetus Conference on Global Change in Africa, 4-6 June 2009, Cologne, Germany

SENSE Coordinator PhD Education and Research

Mr. Johan Feenstra

Curriculum vitae and author's publications

Fiona Mutekanga was born on 1st April 1966 in Kampala, Uganda. She completed her secondary education from Gayaza High School, Kampala, in 1985. Fiona obtained her BSc degree in Science (Botany and Zoology) from Makerere University in 1988 and a postgraduate diploma in Education from the same university in 1989. On completion of university she was taken on by the government as a graduate teacher and taught in Kabale Secondary School from 1990-1991 and at the National Teachers' College, Kabale, as a Tutor from 1991-1992. In 1992 she was transferred to Kyambogo University (then Uganda Polytechnic Kyambogo), Kampala, as Lecturer in the Faculty of Science. She is involved in lecturing undergraduate students and developing the curricular in Ecology, Soil Science, and Environmental Science, Management and Technology. In 1998, she obtained a government scholarship for a Masters's programme in environmental science at Makerere University specializing in developing indicators for soil and vegetation degradation in the southwestern Uganda highlands. In 2004 she joined other fellow members of staff to set up the Kyambogo University Specialists with the aim of raising awareness for environmental issues and carrying out various environment management activities mainly at the university. It is as a result of these activities at the university that she was earmarked for the Wageningen University Sandwich PhD fellowship at the Land Degradation and Development Group in 2005. The fellowship was sponsored by NUFFIC in support for environment management capacity building in tertiary institutions. Her PhD research focused on participatory policy development for integrated watershed management in the Uganda highlands which was carried out in Kapchorwa on the slopes of Mt. Elgon. The PhD programme also provided an opportunity to attend various academic courses at Wageningen University, namely, Impact Assessment of Land and Water Management, Integrated Environmental Assessment - Regional Management, and Policy Evaluation Methodology. During this period she would lecture the courses Ecology and Soil Science and Environmental Science to undergraduate students at Kyambogo University.

She has published a peer reviewed article and already submitted a number of others and made a number of oral and poster presentations in Uganda and two in international meetings.

Fiona Mutekanga is married to Norman Mutekanga and has two children.

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Publications

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