COMMUNITY BASED RESEARCH ON THE INFLUENCE OF REHABILITATION TECHNIQUES ON THE MANAGEMENT OF DEGRADED CATCHMENTS

Report to the

Water Research Commission

by

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Executive Summary

1 Introduction

The uThukela catchment area plays a vital role in water provision for KwaZulu–Natal and Gauteng. Twenty five percent of South Africa's water is generated in this region (Diederichs & Mander, 2004). One of the largest water transfer schemes in South Africa, the Tugela-Vaal, utilizes water from this catchment area. The communities that live in these mountainous areas rely on the natural resources which are their only productive asset. However, the lack of effective management plans within these communal areas has had negative impacts on the conservation of natural resources. Large parts of this area are degraded and loss of grass cover on these steep mountain slopes has resulted in poor water infiltration, increased runoff and severe soil erosion. The communities not only lose land that could be used for crop production but also for livestock production. Large quantities of silt also land up in the rivers of the catchment and get washed into the dams that make up the Tugela-Vaal water transfer scheme (e.g. Woodstock Dam and Sterkfontein Dam). This silt not only reduces the capacity of the storage reservoirs, but is expensive to remove.

One of the challenges for addressing the problem of environmental degradation is the introduction of conservation measures and making people aware of the benefits through education. Community based natural resource management (CBNRM) is increasingly seen as an approach to encourage better resource management. Local communities and stakeholders must play an important part in the process if sustainable development is to be achieved.

Through the National LandCare programme, the government made the first step to involving communities in conservation. At Okhombe, a pilot LandCare project was initiated which embarked upon an intensive job creation programme which focused on the rehabilitation of degraded areas in the Drakensberg catchment area. The basis of LandCare is that land degradation is a community problem and that people will work in groups to encourage land users to assume responsibility for local problems. The main focus of the LandCare project was capacity building and training of community members in the implementation of a number of different erosion control techniques.

The LandCare project was highly successful with most of the rehabilitation areas showing clear signs of stabilization. However, one of the biggest criticisms of this rehabilitation work is the lack of quantitative information on how successful the different techniques have been. The development of adequate and appropriate tools to monitor the impact of land degradation and rehabilitation has been identified as a major need to combating soil erosion. The aim of this project was to develop a community-based monitoring system to determine the effect of rehabilitation on reducing soil erosion and run-off and increasing water quantity and vegetation cover in the previously degraded areas.

2 Objectives

- To establish land users' perceptions on soil erosion and rehabilitation in conserving water.
- To determine, with the community, the effects of different rehabilitation techniques on runoff and soil loss.
- To assist the community to establish soil conservation measures that will be socially acceptable and physically effective in communal areas.

3 Materials and methods

3.1 *Participatory Rural Appraisal Techniques*

3.1.1 *Formation of the Okhombe monitoring group (OMG)*

Since the success of CBNRM performance depends on innovative community-based organizations, the first step in this process was to develop institutional capacity of the community to participate in the project. The Okhombe Monitoring Group (OMG) which comprised 24 representatives from the six sub-wards within Okhombe was formed. The OMG took the responsibility of developing and implementing a rehabilitation and monitoring programme for Okhombe.

3.1.2 *Participatory impact monitoring workshop*

The next step in this process was to hold a participatory impact monitoring workshop at Okhombe to introduce the concept of monitoring. One of the challenging aspects of this

workshop was developing an understanding of qualitative and quantitative indicators and relating these to land care management. A number of participatory workshops were then held with the OMG where they developed objectives and indicators of land rehabilitation for the Okhombe catchment. The group then assessed the extent and severity of soil erosion in the different subwards and drew up a work plan that identified the activities to be carried out.

3.1.3 *Oral history and community perceptions of soil erosion and rehabilitation in conserving water*

Although the participatory process of documenting the oral history of the project was extremely slow, the process did provide a means for community members to reflect upon their experience in the project and to share the valuable knowledge they have acquired through their interactions with each other and scientists and the project team.

People perceive that the main impact of soil erosion has been a great reduction of land, especially for agricultural and grazing purposes. Dongas are coming closer to homesteads, community gardens and telephone poles. Massive dongas create difficulties in accessing schools, halls, stores, etc. The community attributed this to community practices such as uncontrolled livestock movements, moulding bricks, use of sledges and incorrect tillage practices. People were aware of the link between soil erosion and water stating that some of the dongas have become seasonal streams.

One of the main differences between communities with no experience of land rehabilitation and those who have had training is that the former are aware of the soil erosion problem but lack the skills and motivation to address it. The trained group have the skills, organizational abilities, and motivation to change the state of their land and confidence that “the eroded area can be healed and return to its original state” (S Shabalala). The knowledge gained has enabled the people to demonstrate that what they are doing is working.

3.2 Training Module for Community Based Rehabilitation and Monitoring Programme of Soil Erosion

The community was trained in a number of different erosion control techniques. These included physical structures (e.g. stone packs, stone lines, swales, cattle steps) and vegetative

structures such as vetiver grass planted on contour lines, trees planted in micro-catchments and indigenous and exotic grasses planted on eroded slopes.

The main focus of this project was the development of a community-based monitoring system that could be implemented by the Okhombe Monitoring Group, many of whom had little formal education. In deciding upon techniques suitable for use in this area several factors were considered:

- The technique had to be easily communicated to members of the community
- The equipment used had to be robust and of low cost
- Interpretation of the results should be straightforward, requiring little manipulation of the data collected for final presentation.

The following monitoring techniques, which fulfilled the above requirements, were tested and implemented by the OMG:

- Splash board (to measure soil detached as a result of "rain splash")
- Morgan Splash Cup (to measure up- and down-slope erosion)
- Donga profile (to measure sediment deposited in the dongas)
- Erosion standards (to measure sediment deposited)
- Plant basal cover (to measure how much soil is covered by vegetation)
- Rain gauges (to measure rainfall in each sub-ward)
- Run off plots (to measure water quality and quantity on slopes)
- Gauging weirs (to measure water quantity from catchments)

In order to detect changes that had taken place, the OMG tested each monitoring technique on an eroded and rehabilitated site so that the two could be compared.

In addition to data collection, the OMG received training on data analysis, interpretation and presentation of the data. A number of computer workshops were held in which the OMG learnt how to enter their data on to Microsoft Excel spreadsheets and present their data in the form of graphs. This resulted in greater understanding of the concepts of soil erosion and relevance of monitoring.

4 Results and Discussion

Although sophisticated techniques for quantifying the effects of erosion have been developed, there remains a need for simple techniques that can be used by rural communities to monitor the extent of soil detachment. The development and implementation of a community based monitoring programme was an on-going process throughout the five years of the project. Modifications to the techniques and data sheets were continually made by the community during this period. Since the main objective of the project was to build capacity of the rural community to collect quantitative data, it should be noted that the data collected were not high quality scientific data to which rigorous statistical tests could be applied.

In their application of the monitoring techniques, the community noted significant differences between the eroded and rehabilitated sites. For example, in Enhlanokhombe from October 2003 to January 2004 basal cover of the vegetation increased from 55 to 71% in the rehabilitated site, but decreased in the eroded site from 33 to 24%. Although the basal cover quadrat is a scientific, quantitative technique, the modifications made enabled it to be easily operated by members of the group, even those who were illiterate.

Where splashboards have been installed in bare areas, the community noted higher heights of rain splash compared with areas that have good vegetative cover. In Mpameni, from 22 November 2003 to 31 December 2004, the mean rain splash height in the eroded site (2.30 mm) was 30% higher than in the rehabilitated site (1.62 mm). Where splashcups have been installed in highly erodible areas the mass of sediment trapped has been substantially larger than for less erodible areas. The community recorded decreasing amounts of sediment being collected in areas that were experiencing increases in vegetative cover. For example, at Mpameni in 2004 there was a 17% higher sediment yield in the eroded site (128 mm) when compared to the rehabilitated site (107 mm). These data also illustrate the clear relationship between amount of rainfall and amount of sediment trapped in the cups.

One of the most effective techniques for monitoring the effects of rehabilitation on water quantity and quality were the runoff plots. The water collected from the rehabilitated sites

was clearly cleaner and lower in quantity than on the eroded sites. For example, data from the runoff plots at Oqolweni indicated that runoff from the eroded site (2680 mm) from 7 April to 26 December 2004 was 28% higher than the rehabilitated site (1950 mm). Although attempts were made to quantify the amount of silt collected in the bottle, these were unsuccessful.

The donga profile technique required significant modification as initially there was too much flexibility in the donga cross wire from which depth was measured. Nevertheless the profiles indicated considerable change in shape and sediment deposit following the building of stone packs.

In general, these techniques, although simple, are effective methods of monitoring changing vegetation and soil conditions within the area. The two techniques most favored by the OMG were the splash board and run-off plots because they were easily understood, had a high visual impact and were relatively easy to record.

The highlight of the training programme was the computer training whereby the OMG learnt how to record their data onto spreadsheets and use Microsoft Excel to generate graphs. They have used these graphs in presentations to the traditional administrative council, community meetings, school groups and local and international visitors to illustrate how effective the rehabilitation of the severely eroded areas of Okhombe have been.

In the third year of the project a new rehabilitation site at Mpameni was identified to broaden the monitoring programme from site to small catchment level. This catchment management program involved monitoring stream flow from two contrasting catchments (a grazed catchment versus an eroded catchment that is being rehabilitated).

In the early part of the 2006/2007 rainy season the streamflow in both catchments was similar, mainly varying from 0.01 to 10 m^3 per 15 mins. However, for the remainder of the period the recession of the ungrazed catchment decreased at a faster rate than the grazed catchment. The deviation in streamflow also increased as the summer season progressed. This divergence in the streamflow response was initially surprising, as it was originally

hypothesized that the ungrazed catchment would have an improved infiltration and delayed streamflow response as a result of the rehabilitation. One explanation for this response was the increased biomass in the ungrazed catchment, which would result in an increase in transpiration and hence decrease in streamflow. Total flow for the grazed and ungrazed catchments was 6 738 and 3 000 cubic meters respectively, the grazed catchment having significantly more runoff (40%) than the protected catchment. Another factor which would result in the higher runoff was the lower basal cover in the grazed catchment as opposed to the ungrazed catchment. Both catchments had zero flow in the dry winter period and therefore no conclusions on the low flow response can be made. At this stage it was too early for the effects of the rehabilitation to have any clear effect on low flows. It is a concern that the project ended at this critical stage of the experiment as the long-term effects of rehabilitation on streamflow need to be determined.

The National Water Act, No 36 of 1998, allows for the nation's water resources to be conserved, used, developed and managed. In order to achieve these objectives and at the same time create income generation opportunities for communal land users, the government may consider funding water resource management by rural communities. This initiative of Payment for Environmental Services is being developed by the Maloti Drakensberg Transfrontier project for this region. This will necessitate the development of indicators of water quality and quantity. This WRC monitoring project therefore has the potential to play a key role in future income generation for the community. The baseline data that the OMG collect will be critical in establishing indicators for Payment for Environmental Services. Although still in the pioneer stage, the payment of communities for looking after their natural resources has the potential to ensure the sustainable management of this important catchment area.

5 Conclusions and recommendations

Overall the OMG has mastered the basic scientific skills of communicating the differences made by the rehabilitation work in the form of graphs. The education and training carried out in this project was both a scientific and a social process, bringing people together, and contributing to the development of the community as a whole.

The sustainable management of Okhombe is dependent on the ability of the community to recognise and define problems and to generate and implement solutions in an ongoing, dynamic manner. One of the main lessons from the project was that social and technological issues must be integrated when developing solutions to environmental problems. From the start of the project the community were involved in decision making on topics ranging from short term planning (e.g. date of next meeting, catering) to complex issues (e.g. development of land use management plans, selecting work teams, establishing a donga committee). This has led to the ownership of the project by the community.

The monitoring results indicate that the rehabilitation by the community has made a significant decrease in soil loss and runoff. However, no single technique can be recommended for rehabilitation at Okhombe as each technique has specific advantages and disadvantages. The success of the technique depends on the extent and type of erosion, availability of material and how well it is constructed. Through the workshops and field days the work teams have built the capacity to evaluate each situation and apply the most appropriate technique.

The initiative by the Maloti Drakensberg Transfrontier project to develop a strategy for the payment of environmental services (PES) in the region has the potential to promote the effective management of these natural resources. The PES strategy will secure the supply of environmental services, particularly water resources, from the area. Identifying the indicators to monitor and certify the delivery of water services will require research at community, local and national levels. The records that are kept by the Okhombe Monitoring Group on the reduction of soil erosion and improvement of water quality will provide baseline data that will be critical for this initiative. The training that the OMG received is a starting point, from which to build further understanding and skills. These skills should be related to the development and monitoring of further indicators required by the Payment for Environmental Services initiative (e.g. water quality). There is also a need to calibrate the data collected so that it can be verified against more conventional scientific measurements.

This project has facilitated the Okhombe community to take the initiative in environmental management of their area. The process has been challenging, requiring a high degree of

flexibility and commitment by both the project team and the community. The commitment of the people of Okhombe to take responsibility of their natural resources is a crucial step in the long-term process of catchment management. Continuation of building the capacity of the OMG in computer literacy and data analysis is strongly recommended to enable them to develop independency and continue the work on their own. It will also enable them to fulfill their aim to transfer their scientific skills to the neighbouring communities that are facing the same problems.

Efforts to improve the livelihoods of people have focused on rehabilitation of the area and have addressed the symptoms rather than the main cause of erosion which is overgrazing. The Okhombe community has recently implemented a rotational grazing system to increase vegetation basal cover and grass production. This has the potential to promote the retention of water in the landscape and improve base flow. Future research to quantify the effect of communal range management on water resources is therefore recommended together with a community monitoring system to build capacity of the community in understanding the links between grazing management and hydrological benefits.

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The Okhombe Monitoring Group

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1 INTRODUCTION

The Thukela catchment area plays a vital role in water provision for KwaZulu–Natal and Gauteng. One of the largest water transfer schemes in South Africa, the Tugela-Vaal, utilizes water from this catchment area. This scheme provides valuable water to South Africa's economic hub, Gauteng, through a series of dams, canals and pipelines. Situated between the formal conservation areas of Cathedral Peak and Royal Natal National Park the area is unique in that it is one of the few 'high Berg' areas that is highly populated. Two communities that live in this northern Drakensberg area are Okhombe and Mnweni which form part of the amaZizi and amaNgwane traditional authorities. Unlike the neighboring conservation areas of Cathedral Peak and Royal National Park these communal areas have no formal management plans. The absence of effective management plans within a common property regime may have negative impacts on the conservation of natural resources (Thobela, Lax & Oettle, 1998). Indeed, large parts of this area are degraded and loss of grass cover on these steep mountain slopes has resulted in poor water infiltration, increased runoff and severe soil erosion. Huge dongas have already formed in the area. Soil erosion is seen as a major threat to water resources and land productivity. The communities not only lose land that could be used for crop production but also for livestock production. Huge loads of silt also land up in the rivers of the catchment and get washed into the dams that make up the Tugela-Vaal water transfer scheme (e.g. Woodstock Dam and Sterkfontein Dam). This silt not only reduces the capacity of the storage reservoirs, but is expensive to remove.

One of the challenges proposed by de Beer *et al.* (2005) for addressing the problem of environmental degradation is the introduction of conservation measures and making people aware of the benefits through education. These authors state that local communities and stakeholders must play an important part in the process if sustainable development is to be achieved. Community based natural resource management (CBNRM) is increasingly seen as an approach to encourage better resource management with the full participation of communities and resource users in decision-making activities and the incorporation of local institutions, customary practices and knowledge systems in management processes (Armitage, 2005). Through the National LandCare programme, the government made the first step to involving people in conservation. At Okhombe, a pilot LandCare project was

initiated which embarked upon an intensive job creation programme which focused on the rehabilitation of degraded areas in the Drakensberg catchment area. The basis of LandCare is that land degradation is a community problem and that people will work in groups to encourage land users to assume responsibility for local problems. It is assumed that community groups will participate in tackling these problems to enhance their understanding and develop solutions that will aid local decision making systems. The main focus of the LandCare project was capacity building and training of community members in the implementation of a number of different erosion control techniques. These included physical structures (e.g. stone packs, stone lines, swales, cattle steps) and vegetative structures such as vetiver grass planted on contour lines, trees planted in micro-catchments and indigenous and exotic grasses planted on eroded slopes. The success of these techniques was documented in the final project evaluation where Sistika (2004) stated that the rehabilitation activity "has probably involved more people in the project than any other, and is certainly the most recognised and understood component of the project's work. The linking of 'Thandizwe' with 'preventing soil erosion', 'improving vegetation cover', 'degraded land being rehabilitated', and the citing of benefits including ' soil erosion control', and 'swales', give some indication of the profile of this work". He further stated that "Most of the rehabilitation areas are showing clear signs of stabilization". It is apparent from these comments that quantifying "signs of stabilization" is necessary to determine more precisely how successful the rehabilitation activities have been. Similar subjective impressions of successful natural resource management projects by communities in southern Africa have been documented by Critchley & Turner (1996). Turner (1996) stated that in a gully reclamation project in Lesotho "The project's apparent lack of detailed monitoring data" makes it difficult to determine the size of the gullies worked on and how extensive the rehabilitation was.

In order to assess which rehabilitation techniques have been successful in reducing runoff and soil erosion, it is necessary to monitor and evaluate the project activities. This will enable the communities to make decisions on technologies that are sustainable. One of the challenges in implementing community based monitoring systems is the development of technical expertise (which focuses on science) that can be used by community members, many of whom lack formal education.

One of the objectives of this project was to implement community participatory monitoring whereby the rural participants record and analyze differences and change. This will provide an opportunity for learning where the people contribute to the monitoring process and are empowered to take subsequent decisions. In this way, local capacity is enhanced and the communities become involved in technologies that fit local social and environmental conditions.

The needs associated with restoring the environment have placed renewed emphasis on research into the environment and into environmental education as a means of bringing about change to the environment that will ensure a sustainable future (Le Roux, 2005). An important aspect of research is that not only those who have an interest in the research but also those who are affected by its outcomes should be involved and consulted in the research process. This report documents a case study on the implementation of a community based monitoring system to quantify the effects of rehabilitation on reducing soil erosion in the Upper Thukela catchment area.

2. OBJECTIVES

2.1 To establish land users' perceptions on soil erosion and rehabilitation in conserving water.

2.2 To determine with the community the effects of different rehabilitation techniques on runoff and soil loss

2.3 To assist the community to establish soil conservation measures that will be socially acceptable and physically effective in communal areas.

2.4 To identify and prioritize rehabilitation interventions for establishing baseline conditions in the study area.

The last objective was removed from the study plan following the recommendation of the reference group at the inaugural meeting.

3. STUDY AREA

Okhombe is located in the Upper Thukela catchment area in the province of KwaZulu-Natal, South Africa (28˚42' S; 29˚05'E, Fig. 1). The valley is located between 1000 and 1800 m

altitude and receives some 800 - 1265 mm of rain per annum. Most of the precipitation falls in the months October to March (Schulze, 1997). The summer rains from October until March make up to 82% of the total rainfall per year (Dollar & Goudy, 1999). Although it receives high rainfall, Okhombe does suffer from drought periods that affect mostly domestic animals. The area also experiences hail and thunderstorms. The high amount of precipitation that occurs in the summer period has led to significant leaching of the major soils in the area and heavy erosion along the slopes.

The mountain range of the Drakensberg is part of the Eastern escarpment of southern Africa, reaching heights of 3400 m (Montusi, 2002; Dollar & Goudy, 1999). The Drakensberg mountains were formed during the continental uplifting that took place during the late Pliocene. During the Pliocene period, the KwaZulu-Natal province used to be covered with up to 1000 m thick layers of lava from lava flows some 160 million years ago, which provides a protective capping for the underlying soft sandstone layers (Montusi, 2002). When this mass solidified, the heavy granite stone pressed onto the layers of sandstone beneath. Due to the high relief and associated steep gradients down to the Indian Ocean, significant erosion occurred. Alluvial streams and rivers deposited rubble at the base of the escarpments and carried away finer materials. Through millions of years of constant erosion by wind and water the valleys and gorges have worked their way through the basalt and then the more erodible layers (Montusi, 2002; Dollar & Goudy, 1999).

Erosion of major eastward-flowing drainage channels resulted in the formation of the basaltic lava cliffs of the main range (1800 m and 2500 m a.s.l) and a broken plateau lying below. This plateau is known as the Little Berg and the study site is situated at the foothills of this Little Berg. The Little Berg is characterised by deep ravines and swift flowing streams and ends abruptly in conspicuous Clarens sandstone cliffs. The spurs are capped with basalt and at the heads of these spurs lies the catchments that feed the main rivers. Most of the Okhombe area is steep and mountainous with the flat land characterising the upper plateau. A number of streams and the Okhombe river cut through the area and flow into the Thukela River.

The region is extensively covered by grassland with some patches of forests, shrubs and tree species. The vegetation is influenced by the burning regime and altitude and is termed fire climax grassveld (Tainton, 1999). In these areas the grassland community is secondary, and has arisen largely due to the restraining influence of fire. These fire climax grasslands are often interspersed with patches of forest or clumps of bushes (Tainton, 1999). The climax plant communities of the Drakensberg are associated with three distinct altitudinal zones (Killick, 1963). These zones are the river valleys (1250-1800 m), the Little Berg (1800 – 2500 m) and the summit plateau (2500 – 3350 m). The corresponding vegetation belts of these zones are: the Montane Belt, the Subalpine Belt and the Alpine Belt. The study site falls into the Montane Belt. The vegetation as classified by Acocks (1953) falls under the Highland Sourveld (Veld type 44a) or Moist Highland Sourveld, KwaZulu-Natal Bioresource Groups 8 (Camp, 1999).

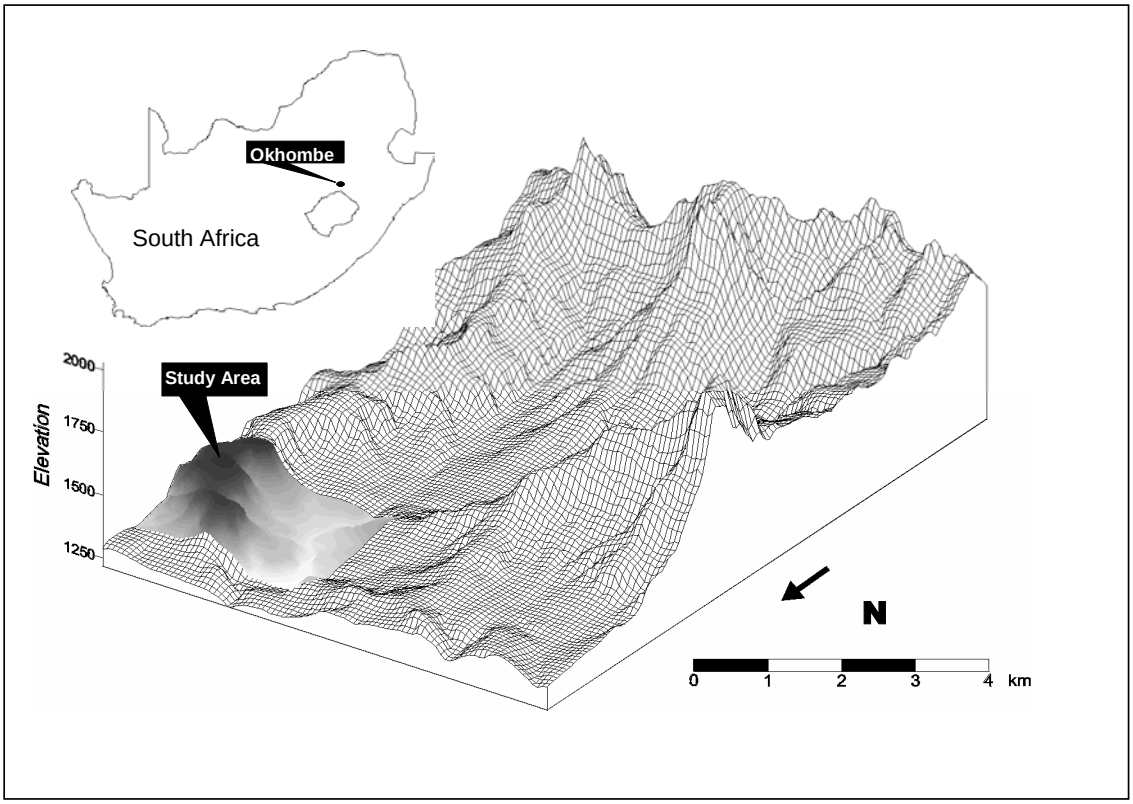


Figure 1. Location of the Okhombe catchment in South Africa (Sonneveld, Everson & Veldkamp 2005)

Temperatures in the area vary substantially with a change in season from moderate summers to cool winters. High temperatures are experienced mostly from November to February with May to July experiencing very low temperatures. The mean temperatures are between 11.5° C and 16ºC (Camp, 1999). Frost occurs in the Drakensberg from late April to early September, but is almost a daily occurrence in winter (June and July). Although snow falls often at higher elevations, the Okhombe ward seldom receives snow. The Okhombe ward (Figure 1) falls under the Amazizi Traditional Authority of the Upper Thukela, and comprises six subwards, namely, Mpameni, Mahlabathini, Ngubhela, Oqolweni, Sgodiphola and Enhlanokhombe. In general, the Okhombe community, consisting of about 4 000 inhabitants, relies heavily on the surrounding natural resources for their daily living. Approximately 4 000 head of cattle and 2 000 small stock, mainly goats, occupy the area. Grazing on the hill slopes takes place in summer (September - May) while in winter, cattle are allowed to graze the remains of crops, mostly maize stalks, in the bottom of the valley since grass has then become unpalatable. In most of the area, burning of the vegetation is a common practice, which takes place in and around August, although out of season burning during the growing season is also common.

4. MATERIALS AND METHODS

4.1 Participatory Rural Appraisal Techniques

The participatory methods used in this study built on a foundation of participatory work that had been carried out with the Okhombe community in previous projects. The key techniques used are outlined here as they laid the groundwork for community involvement in catchment management.

The initial involvement with the community was a meeting with the whole community and service providers (e.g. Department of Agriculture, KZN Wildlife, etc.) to establish links with existing projects in the area. This formed the basis for monthly Partners meetings in which the community, service providers and project team met to discuss progress in the different projects, network with the different agencies and to create opportunities to work together. The next step was a visioning workshop which was designed to create a shared vision among

the community members and to learn together about the catchment. During the visioning exercise people were asked to draw what they would like to see people doing in Okhombe if they were a bird flying over the area in five years time. The pictorial representation of the community's vision reflected: People with enough grass to thatch their houses, community members talking about the beautiful landscape with lots of trees, people ploughing, cropping and gardening. Women were working in a lush vegetable garden and selling some of their crop, collecting water from the nearby springs throughout the year and carrying plenty of firewood over only short distances. The visioning exercise provided the basis for a planning workshop in which the community and project team planned how they could work together to help the community achieve their vision.

A participatory mapping exercise was then carried out in which community members demarcated the subward boundaries, mapped the position of the houses and the number of livestock per household on the ground by using coloured powder. This activity was highly successful in creating a relaxed atmosphere, collecting relevant information and involving all members of the community in the process.

An understanding of local resource management systems and the factors that underlie their functioning is essential for finding appropriate solutions that meet the community's needs. A catchment modeling exercise was held in which the community built a model of the Okhombe catchment out of soil and plants. Community members then added the houses, fences, furrows, springs and streams, dongas and other important features using stones, sticks and coloured powder. In the next step the community and project team analysed the catchment together to learn about the system. Discussions were held on the causes of the erosion and denuded slopes, after which the community added the cattle access routes to the model. Finally, the model was used to plan where the rehabilitation measures could be applied. The model enabled the community and the team to develop a holistic picture of the catchment and to plan together what could be done after analysing all aspects of this complex situation. It also highlighted the association between the degraded areas of the catchment and the main causes of soil erosion (e.g. cattle access paths).

These participatory exercises carried out in the LandCare project formed the basis for the current project on community based monitoring in catchment management.

4.1.1 Formation of the Okhombe monitoring group (OMG)

The success of CBNRM performance will depend on innovative communities and community-based organisations (Armitage, 2005). The first step in this project was a community meeting to plan the way forward following the end of the Okhombe LandCare project. Some people felt anxious that most people in Okhombe would not participate actively in this project as there would not be any payment as this was not a job creation project like the LandCare project. However, concerned community members that were involved in the LandCare project felt that it would be a good idea to start forming a group that would focus on the environmental issues in Okhombe. This would enable Okhombe community people (adults) to impart skills gained to the youth. They felt it was important for them to be able to identify changes that have taken place in the eroded areas of Okhombe. Some people said that learning about indicators would assist them in observing if the project is indeed achieving the goal of "A green Okhombe". This was the reason given that made them want to get involved in monitoring the work that they had done in the catchment. An outline of the main issues discussed at the first planning meeting are presented below.

Who is the Okhombe Monitoring Group(OMG)?

Community members decided that representatives from each of the 6 sub-wards would form the Okhombe Monitoring Group to take responsibility of monitoring LandCare activities. Twenty four people put their names down to be part of this group. In addition, a number of people volunteered to assist the monitoring group when there were tasks to be done. Both groups were willing to work on a voluntary basis with no pay.

Individuals per sub-wards					
Ingubhela	**Mahlabathini**	**Empameni**	**Enhlanokhombe**	**Oqolweni**	**Sigodiphola**
Mr B. Hlongwane	Mr J. Ndaba	Mrs Mavundla	Miss K Dlamini	Miss Z.Mnguni	Miss N. Miya
Mr R. Sigubudu	Mr M.V. Ndlovu	Mrs Mbokazi	Mr M. Hlatshwayo	Mrs Hlubi	Mr M. Maphalala
Mrs M. Makhowane	Mrs V. Mabaso	Mr Mvemve	Mr M. Miya	Mis N Miya	Mr Dubazane
Mr D. Dladla		Miss Hlatshwayo	Miss Z. Miya	Mr M.Mbhele	Miss B. Cele
			Mr N. Miya		

What will be monitored?

The OMG decided that they would monitor both the technical and social aspects of the project. Training on monitoring techniques for soil erosion control would be carried out by the project team. Where necessary they would fix problems occurring in the rehabilitation structures so that they were maintained in good condition. Fencing would also be monitored. For example, a broken or tampered with fence would be fixed and as already suggested by the teams in the sub-wards they would put in steps that would prevent people going through the fence especially when collecting firewood & cattle herding. Socially they would look at the impact of the rehabilitation projects on their life improvement and learning.

How will monitoring take place?

The sub-groups agreed that they would monitor in the different sub-wards at the same time. Each group would monitor soil loss and water runoff using fixed sites. Fences and cattle movement would be monitored almost on a daily basis. Once a week the groups would visit work teams and assist if necessary.

The groups would write reports as they monitor and would do presentations at the community level. The group had an idea of inviting school children to some of the reporting sessions, as a way of promoting environmental awareness among the youth.

Cross visits

Cross visits would be held to other wards to promote learning and training.

Training

The OMG would assist in the training of people on rehabilitation techniques and would themselves need training on new techniques. Already individuals in Mahlabathini outside of the monitoring group had protected a rehabilitated area and they were already seeing the difference. However, some individual/s cut the fence around the site and cattle were starting to move into the site.

Through the workshops that have been run by the project the OMG felt that they would like to apply other techniques used in the Ingubhela site in their sub-wards. To understand the concepts behind soil erosion and water-uptake by trees, rain gauges would be installed in all six sub-wards. They would learn how to use the amount of rain collected in the rain gauge to explain the erosion effect of rain on the structures which they would be monitoring. They were going to choose fixed points at which monitoring would be focused.

Other activities, training & workshops required

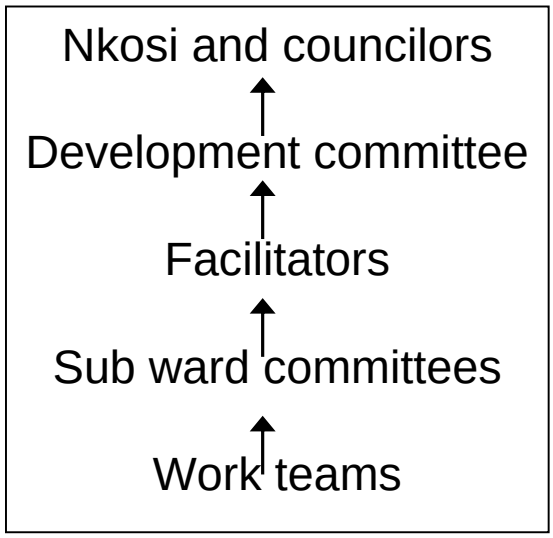
The OMG outlined further training that they required:

- Environmental awareness in Okhombe which still requires training
- The OMG requested that they accompany team members during site visits so they understand the concept behind choosing one site over the other and to learn what the work teams are required to do. They hoped they would be able to observe differences if one has used an ideal technique for erosion control over experimenting and guessing.
- Facilitation & report-writing skills
- Skills in planning & presentation of the results to the community and traditional administrative council

The training module developed for the project is outlined in Section 4.2

How the group will meet?

Mrs Mavundla who was also a member of the Development Committee, the Sub-ward Committee and School Governing Body was voted as the chairlady of the group. She would hold regular meetings with the OMG on days agreed on by the group.



Communications, Networking& Partnerships

The OMG would choose representatives within the group to report information collected on the project to the amaZizi Traditional Administrative council meetings. In order to promote and raise interest in the project to other community members in Okhombe, and outside of the ward, they would be working hand in hand with individuals responsible for different project activities. These included the livestock committee, tourism group and work teams. The OMG would also participate in project presentations to visitors to the area.

The importance of communication between different institutions was discussed. The group outlined the hierarchy of institutions at Okhombe and how the lines of communication work. They stated that all these structures are in place and there is no conflict. Communication between all levels is good. Councilors participate in meetings because they like to know the progress.

Expected Outcomes

The OMG stated that they hope through involvement and training interventions they will be able to determine in general, nature conservation measures that are simple and easily applicable to the community.

Responsibilities of the OMG

The monitoring group outlined their responsibilities:

- monitor the rehabilitation work
- organize required materials for volunteers
- attend meetings when necessary and encourage people to look after the rehabilitated areas
- notify volunteers when maintenance work was needed.

A number of planning meetings were held with the Okhombe Monitoring Group (OMG) to plan activities of the group. The OMG formed 3 groups and decided that each group would be responsible for two sub-wards. This was necessary as the distances between the sub-wards were too great for one group to monitor. The importance of mapping and prioritizing areas for rehabilitation and monitoring was discussed. Bongani Khumalo, a LandCare facilitator, offered to draw the maps.

4.1.2 Participatory impact monitoring workshop

Land degradation is a reality in the steep mountainous slopes of the Upper Thukela catchment area. Apart from contributing to the deterioration of the natural resource base and subsequent loss in productivity, it also has a detrimental effect on the livelihoods of people living in the area. The development of adequate and appropriate tools to monitor the impact of land degradation and rehabilitation has been identified as a major need to combating desertification. One of the biggest criticisms of rehabilitation work by communities is the lack of quantitative information on how successful the work has been. The aim of this project was to develop a monitoring system that could be used by community members who had little formal education, to determine how successful different rehabilitation techniques were on reducing soil erosion and run-off and increasing water quantity and vegetation cover in

the previously degraded areas. The first step in this process was to hold a participatory impact monitoring workshop at Okhombe to introduce the concept of monitoring.

The objectives of the workshop were to:

1. Discuss ways of monitoring work
2. Discuss indicators for the project
3. Plan for future monitoring of project
4. Get commitment and ownership of the project from the community

The work programme for the 2-day workshop was presented. This included:

a. Background to the project and why monitoring is needed to quantify what had changed with the communities' rehabilitation efforts
b. Presentation of posters, newspaper articles and photos so that the community could see a qualitative record of the rehabilitation process
c. Role play: A role play by team members of a sick cow versus a happy cow was carried out to generate discussion on monitoring.
d. Project cycle: The learning spiral was presented to the community (reflect, learn, implement, monitor).
e. Community discussion: Buzz groups (pairs) discuss what monitoring has taken place at Okhombe.
f. Transect walks to identify indicators
g. Plenary session to plan way forward

Outcome of role play

After the role play of the sick and happy cow the community made the following points:

a) It is important for farmers to **talk to each other**.
b) Even if there is enough food for animals their **health should be looked after**.
c) It is **important to manage** livestock by managing for good grass.
d) **Farmers should come together and form a group** to discuss management.
e) Farmers should love their livestock and **monitor** them so that if something is wrong they can take action.

f) One farmer did not love his livestock but after hearing the unhappy sound he took **action**.

Some other examples of monitoring were presented :

a) If a person takes a taxi to Bergville and the taxi goes the wrong way how do they know it is not on the right course? The person notices and **checks landmarks along the way**.
b) If cooking food need to watch the whole process (**monitor**) so the food doesn't burn.

At the end of these sessions everyone agreed that there is a need to have **close and continual monitoring in whatever you do**.

Community discussion on what monitoring has taken place:
Workshop participants were divided into pairs to discuss what has been monitored so far. This was followed by a plenary session to review what was discussed in the buzz groups. The groups indicated that some monitoring had taken place:

- Have seen silt behind stone packs
- Livestock damage to the trees has been noticed.
- Need firebreaks. Community needs to agree where and when to put them in.
- Cattle steps have been monitored and it has been noted that the cattle are using them and are not going around them.
- Fencing has been monitored.
-

After fencing, still find animals in crop fields. Mr. Hlatswayo went along the fence to check on it. He saw some places where it has been pushed over for people to cross over. That is monitoring.

It was apparent that there was some confusion over the concept of indicators and monitoring. A second role play of a sick child was carried out to demonstrate that indicators and monitoring are not a new concept. People have indicators and monitor things in their daily lives.

Points noted by community:

- Doctor sees sick child
- Doctor checks to see what is wrong
- Doctor sees symptoms
- Doctor looks carefully at sick child.
- Sick child shows doctor where throat is sore.
- The doctor is helpful. This is like the project where some people have training like the doctor and help the community. People involved in implementation show where the problem is (like the sick child).

The role play was related to the project. Changes have happened in the project. Need indicators to show what has changed.

A good indicator:

1. should be consistent
2. should be within a time frame
3. should be able to be measured by rank, scale or rating.
4. should be classifiable (quantifiable)
5. should be descriptive

Day 2

After the transect walks the workshop participants were divided into groups relating to topics that need to be monitored. The task of each group was to develop indicators.

Report Backs

- An indicator that rehabilitation is working is green grass on eroded area
- If the grass is too short it causes erosion. This led to a discussion on the importance of resting the grassland to enable it to recover from the grazing.
- An indicator that there is a shortage of water is that cattle fall into dongas looking for water

- An indicator that there is not enough food for livestock is when they move to other areas.
- The group observed the eroded slopes above Enhlanokhombe and discussed why it did not have a good grass cover. “Mnqandani” trees invaded the area and the grass does not grow under the trees.

The group that went on a transect walk above Sigodiphola came up with the following indicators:

Bad indicators

- Saw an active donga with water in it.
- The bare areas had very hard soil, especially on the cattle access routes. If it rains the water runs off quickly.
- Some swales have been damaged by livestock
- One badly constructed swale had created a donga

Good indicators

- Soil has accumulated behind the stone packs and grass is growing in the soil.
- Water movement is very slow.
- Contours have been created with tall thatch grass and soil trapped behind.
- Stone packs and swales help each other control the water flow.

Plenary feedback of indicators

It was noted that teams must be trained and people must utilize what they have learned at their homesteads. After big rains people need to inspect dongas and stone packs.

Additional points noted were:

- Grass, weeds and trees grow where the donga is closed
- Thatch grass grows tall in fenced and protected areas
- Grass grows in silt caught in stone packs
- Dongas are not eating back because they are stabilized

- Need to have something like a stick to measure how much soil has accumulated
- Need to reduce the number of trees that kill the grass
- 200 trees need to be grown in eroded areas

4.1.3 Oral history and community perceptions of soil erosion and rehabilitation in conserving water

Initially a meeting was held with members of the Okhombe Monitoring Group (OMG) to discuss the project and decide on the best way to document the community's perceptions on soil erosion and rehabilitation in conserving water. It was agreed that selected members of the OMG would document information which would then be discussed at a wider community meeting. However, the preliminary writings requested from the key community members did not materialize as the task of writing proved to be too difficult. The community members stated that they were not used to writing. They requested that the information be collected through a survey to document people's perceptions. This narrative approach was therefore adopted to collect this information. Further advantages of using interviews to obtain the information have been outlined by Trochim (2001):

- interviews are a far more personal form of research than questionnaires
- the interviewer works directly with the respondent
- the interviewer has the opportunity to probe or ask follow-up questions
- interviews are generally easier for the respondent, especially if what is sought is opinions or impressions.

However, Trochim (2001) cautioned that interviews can be very time consuming and they are resource intensive. Interviewers have to be well trained on how to respond to any contingency. Experts from the Department of Language and Culture at the University of KwaZulu-Natal were therefore contracted to carry out the training. They conducted an introductory workshop on oral history techniques to familiarise the team members with the principles and practices of collecting narrative information. Participants learnt how to carry out interviews, draft questionnaires, record interviews and the necessity of drawing up "release agreements" of the information collected.

A tape recorder was used to collect the data. All the interviews were carried out in Zulu. A combination of open and closed questions were asked in the interview (Appendix 1). All verbal information was transcribed and typed on to a computer. The interviews were all translated into English. A 'write shop' process was used to further refine the content and get wider community perspectives on the impact of the project on the people's lives.

One of the team members, a graduate student, Senzo Mthethwa, who attended the training course in oral history procedures, was responsible for carrying out the interviews. He was familiar with the Okhombe community as he had worked at Okhombe for two years. He conducted 13 interviews with the key community members, LandCare members and the OMG. The interviewing process was indeed time consuming with each interview taking approximately two to three hours to conduct, five hours to transcribe and five hours to translate.

4.2 Training Module for Community Based Rehabilitation and Monitoring Programme of Soil Erosion

The focus of this project was on capacity building of the community to enable them to manage their natural resources effectively. Initially training focused on the rehabilitation of degraded areas. Techniques included physical structures (e.g. stone packs, stone lines, swales, cattle steps) and vegetative structures such as vetiver grass planted on contour lines, trees planted in micro-catchments, indigenous and exotic grasses planted on eroded slopes.

4.2.1 *Land rehabilitation techniques*

4.2.1.1 *Swales*

A swale is a combination of a ditch and a bank constructed along a contour line (Plate 1). It slows down the flow of runoff and enables the infiltration of water running down the slope. It is also used for water harvesting. The ditch and the bank should be approximately one metre wide, and have a height of one metre from the floor of the ditch to the top of the bank.

Plate 1. Swale filled with runoff water.

Swales need to have overflows designed and constructed. The bank of the swale should be planted with vegetation to stabilize the loose soil.

4.2.1.2 *Tree planting and micro-catchments*

Trees are planted within micro-catchments to form a barrier against overland flow (Plate 2).

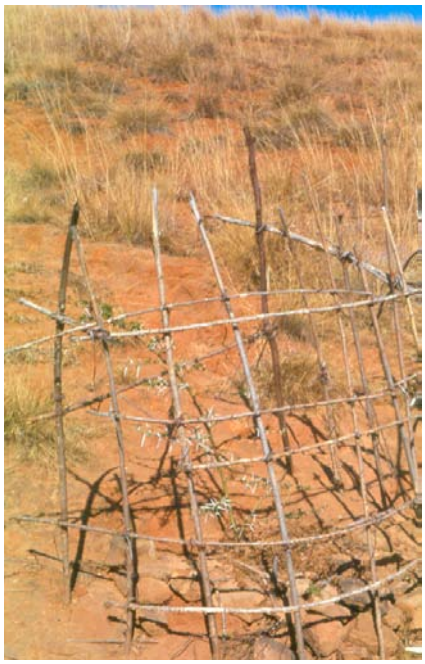


Plate 2. Tree planted within a micro-catchment

The micro-catchments are formed by placing a circle of rocks around the tree and covering the soil surface with grass. This forms a mulch which retains moisture for the growth of the tree. The community placed wattle branches around the trees to deter livestock from browsing them.

4.2.1.3 Vetiver grass

Vetiver is a perennial grass that is used in soil and water conservation (Plate 3). It is a non-invasive plant as it has sterile seeds. It has a massive root system that holds soil together and when planted in hedgerows forms an effective barrier against water runoff.

Vetiver should be planted early in the wet season. The roots of the plants are trimmed to about 5 cm and the shoots to 10 cm. Slips of 2-3 shoots (tillers) are planted 10-15 cm apart in a furrow about 20 cm deep with fertilizer and lime. The crown of the plant is buried 6-7 cm below the soil surface. The trimmed leaves are used to cover the base of the plants to form a mulch. Distance between vertical rows is about 2 m. The slips should be watered for the first 2 weeks after establishment.

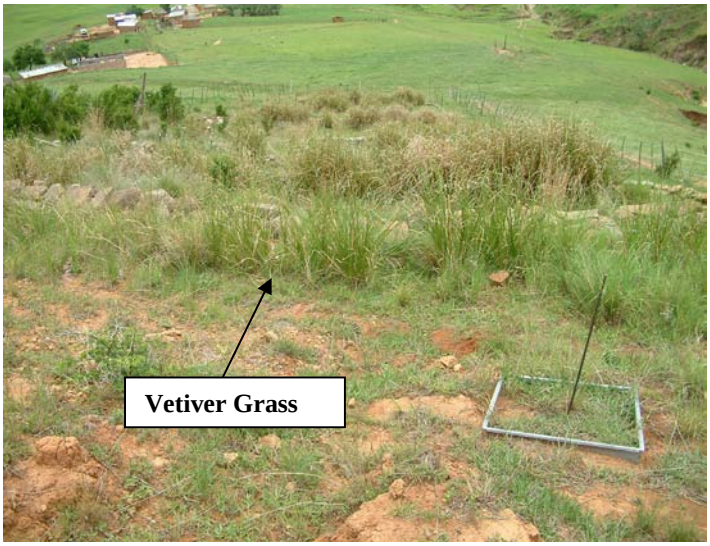


Plate 3. Vetiver grass planted along contours

4.2.1.4 *Stone lines*

Stone lines are placed on slopes along the contour to prevent erosion (Plate 4). A trench is dug along the contour line 30 cm wide and 10 cm deep. Large stones are placed on the lower

side of the slope and smaller stones were used to fill in the spaces. This enables water to seep through the stones and the soil to deposit above the trench.

Plate 4. Stone lines across an eroded slope.

4.2.1.5 *Stone packs*

Stone packs are used in dongas to slow runoff (Plate 5). A stone barrier is formed by digging a trench across the donga and packing stones close together. Keying in the stones along the bottom and sides of the donga prevents water from eroding underneath and around the sides.

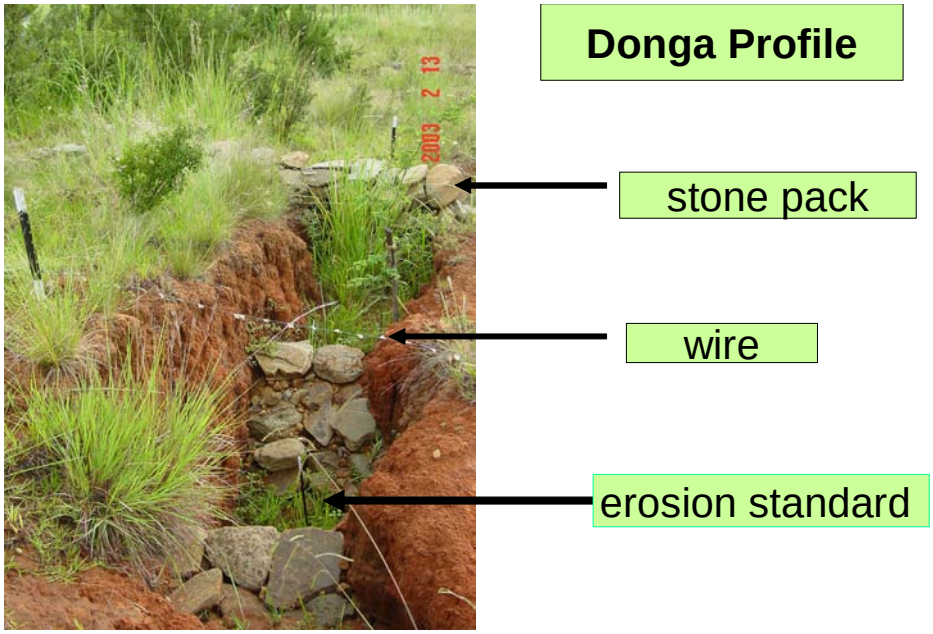


Plate 5. Stone packs across a donga.

An apron of stone is built below the stone pack so that overflow hits the stone and does not cause erosion. The center of the stone pack should be the lowest point to form a weir so that water is discharged down the middle of the structure. Stone packs should be built at wide parts of the donga so that the force of the water is lower.

4.2.1.6 *Indigenous grass plugs*

In terms of conservation, the restoration of eroded areas using indigenous grasses has many advantages. The plants occur naturally in the area and some can be utilized for income generation (e.g. the thatch grass, *Hyparrhenia*). However, indigenous grasses do not establish naturally once they have been lost from the system because of their poor seed germination. Indigenous grasses (e.g. *Hyparrhenia, Paspalum* and *Melinus*) established in speedling trays can be transplanted in areas where sheet erosion is severe (Plate 6). The seedlings are planted into shallow furrows containing fertilizer and lime. They must be watered regularly during establishment.

Plate 6. Indigenous grasses (lower slope) planted below Kikuyu (upper slope).

4.2.1.7 *Path rehabilitation*

One of the main causes of dongas is erosion from badly sited cattle paths. In Okhombe many cattle access routes go straight up the mountain, resulting in heavy runoff and overland flow. Rehabilitation of cattle routes, paths and hiking trails is essential to slow down the degradation. Stone or creosote pole barriers across paths are recommended to slow down runoff (Plate 7). Creosote poles (100-150 cm in diameter) are keyed into a shallow trench dug across the slope at a 45° angle. The poles are pegged in place with droppers cut in half and bent to form a U-shape. If the path is very wide, additional poles could be added across the slope, ensuring that the ends overlap. These are kept in place with 45 cm laths hammered into the ground adjacent to the ends of the poles. The laths are tied together with wire in the form of a figure 8. If the path is so badly eroded that the poles are not flush with the soil surface, large stones need to be lodged in below the poles and the spaces filled in with soil and smaller stones. The critical part of path construction is the siting and construction of drains which take the runoff away from the path.

Plate 7. Creosote pole barriers across cattle access routes.

4.2.1.8 *Planting of Kikuyu*

Kikuyu is an exotic grass that spreads rapidly through vegetative shoots called stolons. Vegetative material is collected from around homesteads and replanted in eroded areas (Plate 6). The application of lime and fertilizer is recommended to facilitate establishment of the grass.

4.2.2 Monitoring techniques

The detachment and transport of soil particles resulting from the impact of raindrops or rain splash is usually considered an important first step in the chain of processes leading to loss of soil and subsequent sediment transport (Mouzai & Bouhadef, 2003). Once detached, sediment is easily movable by overland flow which may often lead to the development of rills and later gullies or dongas. An assessment of rain splash detachment is therefore important in recognizing areas potentially vulnerable to accelerated soil loss so that corrective action can be initiated.

Although in recent years sophisticated techniques for quantifying the effects of rain splash erosion have been developed, much of which involves the use of rainfall simulators and complex physically based models, there remains a need for simple techniques to monitor the extent of soil detachment. In deciding upon techniques suitable for use in this area several factors were considered:

- The technique had to be easily communicated to members of the community
- The equipment used had to be robust and of low cost
- Interpretation of the results should be straightforward requiring little manipulation of the data collected for final presentation

The following monitoring techniques, which fulfilled the above requirements, were tested and implemented by the OMG:

- Splash board (to measure the height of "splash")

- Morgan Splash Cup (to measure up- and down-slope erosion)
- Donga profile (to measure sediment deposited in the dongas)
- Erosion standards (to measure sediment deposited)
- Plant basal cover (to measure how much soil is covered by vegetation)
- Rain gauges (to measure rainfall in each sub-ward)
- Run off plots (to measure water quality and quantity on slopes)
- Gauging weirs (to measure water quantity from catchments)

In order to assess the effect of rehabilitation on reducing runoff and soil erosion (objective 2), the community were trained to implement a soil erosion monitoring programme. The importance of base-line data was discussed. As the LandCare project had been operating for two years it was not possible to collect base-line data. However, it was possible to record changes that had taken place by placing each monitoring technique on an eroded and adjacent, rehabilitated site so that the two could be compared.

4.2.2.1 *Splash Board*

A splash board (Plate 8) is a simple method of measuring the extent of soil detachment (Ellison, 1944). The apparatus is constructed by attaching a central shaft to a rectangular

Plate 8. Splash board used to record height of rain splash.

board on which is drawn parallel lines equidistant apart. Each band within the board is numbered from 1 -14. The apparatus is placed within the area to be monitored such that the bottom edge of the board is approximately 5cm above the soil surface. Sediment that is detached from the soil during a rainfall event is ejected upwards some of which is trapped on the surface of the board. By noting the height of staining on the board it is possible to infer the extent of soil loss by rain splash. The higher the intensity of rainfall the greater will be the rain splash and equally the more erodible the soil the greater will be the extent of sediment detachment. In this way it is possible to develop an understanding of the factors that regulate rain splash. This technique has been particularly useful in communicating the importance of good vegetative cover as a means of combating soil detachment.

4.2.2.2 Morgan Splash Cup (Inombolo yenkomishi)

The Morgan splash cup (Plate 9) is used to measure the specific amount of sediment ejected from the soil surface. Morgan splash cups are circular "doughnut" shaped vessels roughly 15 cm in height and an approximate outer diameter of 30 cm (Van Dijk, Meesters & Bruijnzeel, 2002). The centre of the cup (15 cm) is open but surrounded by a circular wall the same height as the outer rim. The devise requires an undisturbed central sphere of soil over which the cup is placed, so that the lip of the inner orifice is level with the soil. Soil particles

Plate 9. Splash cup used to measure up- and down- slope erosion.

that are displaced by rainfall fall into the outer ring, where they are retained. The devise should be placed on level ground. The advantage of this technique is that displaced soil can be caught and measured, unlike with the splashboard. The displaced soil needs to be carefully collected using a small brush and scoop (without ever lifting the Morgan Splash cup off the ground) and weighed for record keeping. Depth of soil in a calibrated cylinder is one method of measurement. It is important to simultaneously keep accurate records of rainfall events against which soil displacement can be compared. It is important to only collect soil from the cup once the soil is dry and all excess water has evaporated. Any grass growing in the central soil area should be left to grow, as it is an indication of vegetation recovery and should reduce soil loss. If the grass gets too high it can be clipped back.

4.2.2.3 *Donga profiles (Ukujula kodonga)*

The previous two techniques were aimed specifically at evaluating the extent of soil detachment following rainfall. Gullies, which are much larger scale erosion features are extensive within the region and as before cost-effective simple techniques for monitoring gully development were needed. A common approach to assess gully development has been to measure its cross profile (Plate 10).

Plate 10. Community members measuring a donga profile.

A fixed frame of reference is constructed perpendicularly to the long axis of the gully. For this fencing standards were hammered and secured on either side of the gully to which was attached a stiff strand of wire that served as a reference. Markings spaced at equidistant apart were attached to the wire. Beginning from the left hand side and always facing upslope the perpendicular distance from the wire (reference) to the gully floor is measured. These results are then plotted either electronically or on graph paper to derive the gully cross-profile. The first measurement is taken as the reference state for the system. This procedure is repeated at regular intervals of time. It follows that if the gully is expanding then the distance from the reference to the gully floor will increase and conversely filling in will shorten the distance. Thus over time changes in gully morphology can be determined and an assessment of gully stabilisation efforts carried out by the community can be assessed.

4.2.2.4 *Erosion Standards*

An additional effective method for evaluating soil loss or gain particularly in areas behind stone walls located with gully systems has been the use of erosion standards (Plate 5). A standard fencing dropper is hammered a fixed distance into the soil. As a reference condition the distance from the top of the dropper to the soil surface is measured accurately. As sediment builds up behind the stone wall the distance of the dropper that is exposed decreases. Conversely if erosion is active then this distance will increase. Thus a temporal measure of sediment accretion or erosion is obtained.

4.2.2.5 *Plant Basal cover quadrats*

Plant basal cover is determined using a square metre quadrat subdivided into 100 squares (Plate 11). The quadrat is placed in exactly the same position for each record so that changes in basal cover can be monitored over time. The presence of plant cover is recorded in each square and expressed as a percentage. Initially squares where rooted cover was found were marked with the initials of the species found (e.g. k = kikuyu) while bare soil squares were marked with a 0. However, identification of species proved to be too difficult. The technique was simplified so that any squares with rooted vegetation present were marked with an X. This minor modification enabled illiterate people to participate in the recording of basal cover. The importance of noting the upslope and downslope sides of the quadrat on the basal cover data sheet was also emphasised. It was suggested that quadrats be placed at various

locations within the fenced area (e.g. behind the stone lines and in areas of patchy cover) as well as on the cattle path. The OMG decided to monitor the sites once every 6 months.

Plate 11. Quadrat used to measure basal cover of vegetation.

The various options for marking the top-right and lower-left corners of the quadrat were debated. In the light of the susceptibility of the materials at this site to theft, the following suggestions were made:

- Use of steel droppers, hammered in to just above the soil level and painted green so as not to attract the attention of passers-by,
- Use of pieces of wire attached to steel droppers hammered in to below the soil level with just the wire protruding,
- Use of railway sleeper bolts, or
- Filling augured holes with cement slurry to mark the spot.

4.2.2.6 *Rain Gauge (Imvula)*

Rainfall is measured with rain gauges in each sub-ward.

4.2.2.7 *Runoff plots*

Square metre run-off plots are installed in the ground and connected via a plastic pipe to a two-litre coke bottle (Plate 12). All water runoff from the plot is collected in the bottle and measured as water quantity. The depth of silt from the plot is also measured as an indicator of water quality.

Plate 12. Runoff from plots in rehabilitated and eroded sites.

4.2.2.8 *Gauging weirs*

A new rehabilitation site at Mpameni was identified in the final year of the project to broaden the monitoring programme from site to small catchment level. This catchment management program involved monitoring stream flow from two contrasting catchments (i.e. a grazed catchment versus an eroded catchment that was being rehabilitated) using portable weirs (Plate 13).

Two portable weir tanks were constructed along similar lines to a design reported by Nanni (1972). Each tank was 1.84 m long by 0.91 m wide by 0.61 m deep. The original weirs were constructed from fibre glass but following their destruction by floods in 2005 (Plate 14) they were replaced with weirs constructed with 3 mm thick steel (Plate 13). Nylon netting was

arranged on the tank side of the notch to trap debris likely to block the flow of water. A 300 mm deep 30° steel V-notch was fitted to the end of each tank. The weirs were fixed on a rocky outcrop and grouted into position with concrete. A metal flume guided the water into

the top end of the weir.

Plate 13. Portable weir in the grazed catchment. Note the flume directing the flow into the

stilling portion of the weir and the 30 ° V-notch at the outlet.

Plate14. The weir destroyed in the January 2005 storm.

A pressure transducer, accurate to within 1 mm, was placed inside each weir and fixed to a predetermined depth. This was used to measure changes in water level in the weir relative to the V-notch. The pressure sensors were connected to a single CR510 data logger powered with a 40 Amp hour 12V deep cycle lead acid battery. A Texas instruments rain gauge (0.1 mm tip) was mounted near the logger box.

Each pressure transducer was calibrated in the field and a multiplier and offset determined to give an output of the stage height in mm (Fig. 2). The linear regression of the calibration equation (height vs millvolt output) showed an R^2 of 1 (a perfect fit).

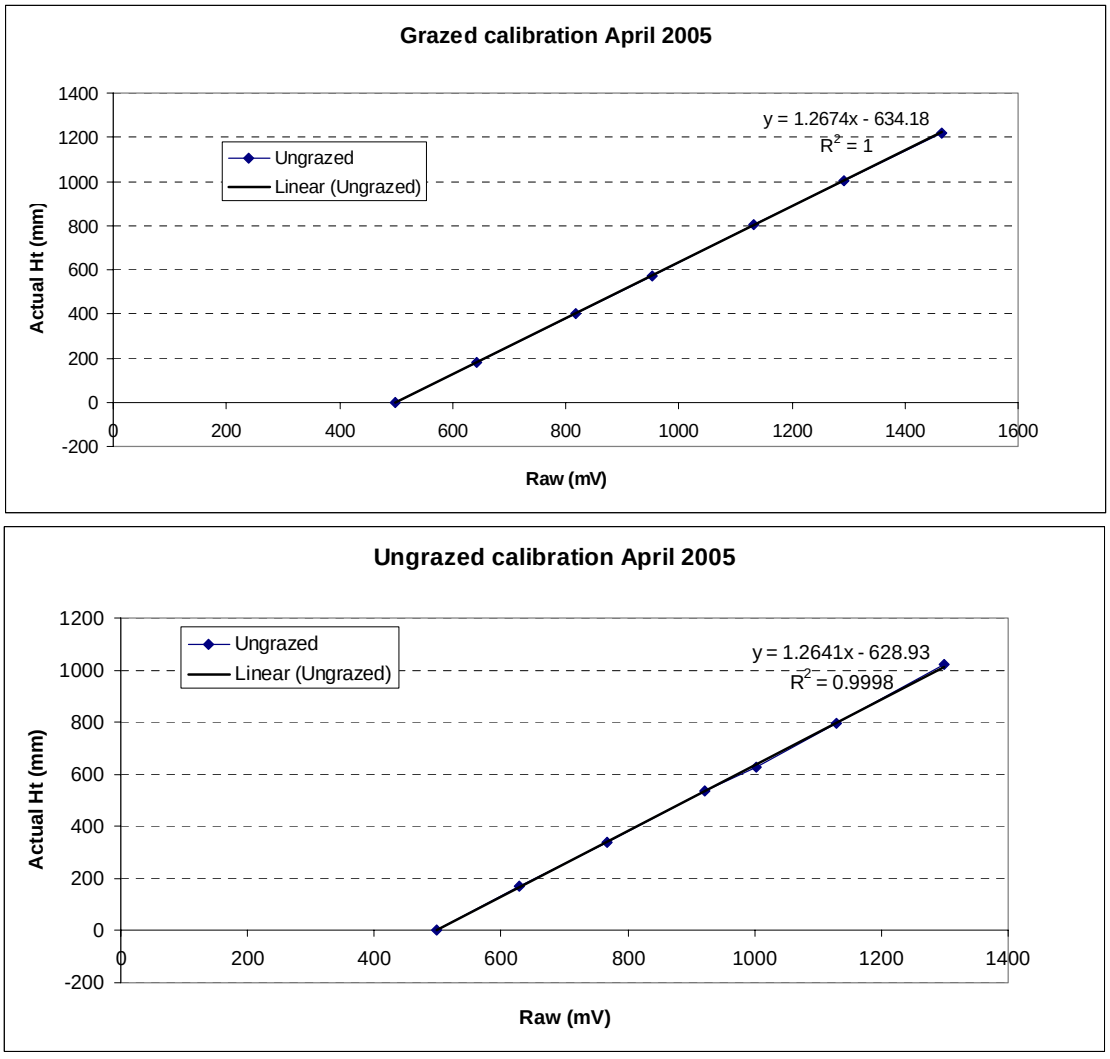


Figure 2. Calibration data for the pressure transducers used in the two portable weirs at Okhombe.

Stage height was converted to flow rate (cubic meters per 15 minutes) using a calibration equation (Fig. 2) derived from a rating table for these specific weirs. The area of each small catchment was determined using a Garmin GPS recorder. The area of the grazed and un-grazed catchments was 13 193 and 11 353 m^2 respectively. This allowed conversion of flow rate into mm equivalents for the catchments by normalizing for area.

Rehabilitation work in the catchment began early in April 2005 by OMG members. Techniques used included vegetative features (planting of vetiver grass, *Acacia* trees and *Leucaena* trees along the contour) and physical structures such as stone lines (Plate 15). The OMG reported that the lack of stones was a problem in putting up stone packs and stone lines along the upper contours and small dongas. A tractor was therefore hired to assist with stone collection from the river. Two stone packs were constructed within the site and stone lines were placed at the top of the site. The planted trees had to be watered almost everyday because of the low rainfall. Bonox wire was used to close the fence gap to prevent goats from entering the site. A gate was installed for easy access for monitoring. Monitoring techniques installed in the contrasting sites were two splash boards and two run-off plots.

Plate 15. The paired catchments showing the raingauge, stone lines and logger enclosure in the rehabilitated catchment.

The OMG cleared all the invasive poplar trees in the study site and along the streams using an environmental friendly chemical called Access.

4.3 Data collection

The community was also trained in the following:

- mapping and identification of eroded sites
- planning of rehabilitation programme
- design of data sheets
- collection of data, record keeping, filing

The design of the data sheets was an on-going process with the OMG giving valuable feedback on their structure. Some words used in the data sheet were changed after it was discovered that they were confusing when recording. The following amendments were made in the data sheets:

The changed words:

- Sub-ward to Kuphi
- Hlabathi to Inhlabathi
- Inkomishi Inani to Inombolo yenkomishi

It was also suggested that the letters A and B should be used in each sub-ward to differentiate between the bare and the grass area (run-off plots). The letter A will label the bare area and B will label the grass area. Examples of all the data sheets are presented in Appendix 2.

4.4 Data analysis

In addition to data collection, data analysis, interpretation and presentation of the data is necessary for decision-making. A number of data analysis and computer workshops were held. During these workshops the following were achieved:

- Graphs of the data collected were presented to the OMG.
- The OMG gave report backs on data collection.
- The data sheets were revised following recommendations from the OMG.

- The OMG suggested changes to the data sheets, for example: i) changing measuring points for the donga profile from 10 to 50 cm to reduce time spent monitoring and to reduce the number of pages required to monitor very wide dongas; to avoid confusion resulting from using letters to differentiate run-off plots in bare (a) and vegetated areas (b) the following Zulu names were recommended: enhlabathini (a) & etshanini (b). This would make is easier for recorders to identify the difference.
- If the OMG have a shortage of data sheets they could send any team member a "please call me "message.
- There was sometimes a problem with data collection when the recorder was sick or had to go away. The OMG members emphasized that it was important that everyone should be responsible for recording and training others to record in their absence.
- Computer training – involved the introduction of Microsoft Excel and Word to enter data on to spread sheets and generate graphs

5. RESULTS

5.1 Land rehabilitation techniques

5.1.1 *Community measurements*

Although sophisticated techniques for quantifying the effects of erosion have been developed, there remains a need for simple techniques that can be used by rural communities to monitor the extent of soil detachment. The development and implementation of a community based monitoring programme was an on-going process throughout the five years of the project. Modifications to the techniques and data sheets were continually made by the community during this period. Since the main objective of the project was to build capacity of the rural community to collect quantitative data, it should be noted that the data collected were not high quality scientific data to which rigorous statistical tests could be applied.

In their application of the monitoring techniques the community noted significant differences between the eroded and rehabilitated sites (Plate 16). Examples of the data obtained from the different monitoring techniques are presented below. The full data sets are available on the project CD.

Plate 16. Contrast between the eroded and rehabilitated sites at Mahlabatini.

Basal cover at the Jakalasi site in Ingubhela increased from 43% to 100% over a four month period following fencing and rehabilitation of the site (Fig. 3). The maximum basal cover

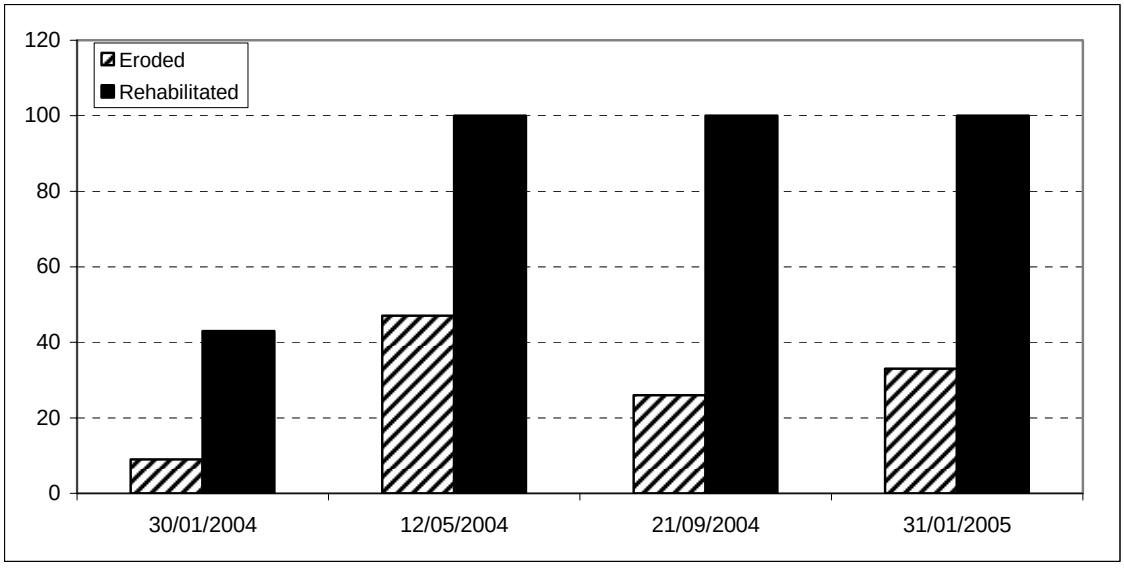


Figure 3. Basal cover (%) at the Jakalasi site (Ingubhela).

recorded in the eroded site was 47%. A similar trend was observed in Enhlanokhombe from October 2003 to January 2004 where basal cover increased from 55 to 71% in the rehabilitated site (Fig. 4). By contrast, in the eroded site basal cover decreased from 33 to 24%. Although this is a quantitative technique, it could easily be operated by illiterate members of the group. The recorder put a cross in each square on the data sheet that corresponded to the square on the quadrat with vegetation. Since there were 100 squares the percentage basal cover was simply recorded as the number of squares with rooted vegetation. It should be noted that this estimate of basal cover gives an over-estimation of basal cover estimated by standard scientific techniques.

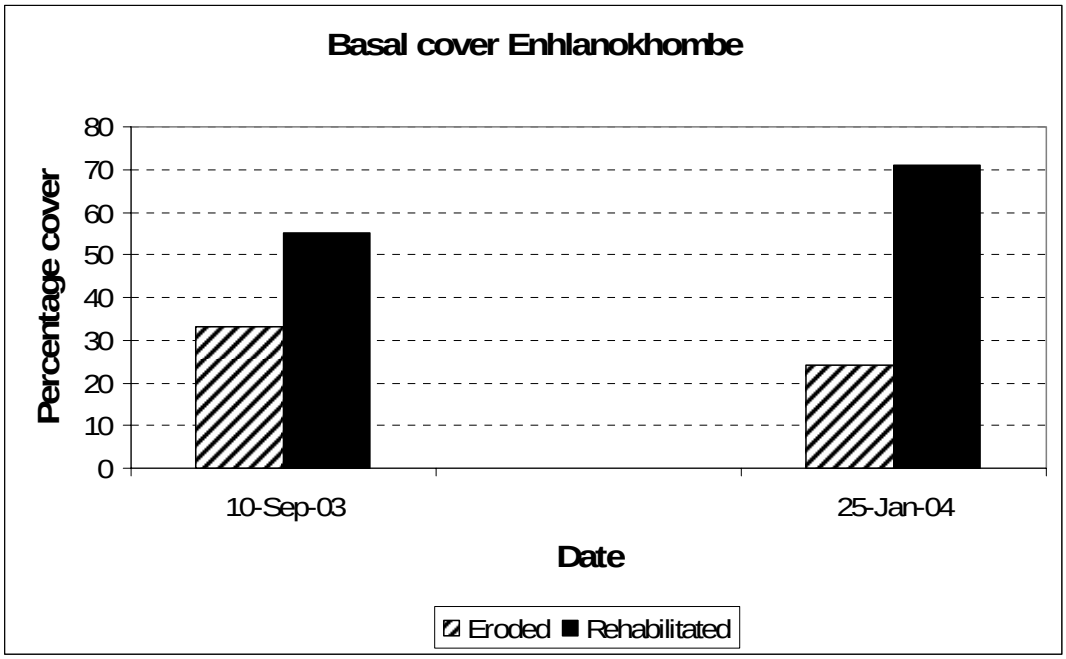


Figure 4. Percentage basal cover at Enhlanokhombe.

Where splashboards have been installed in bare areas the community noted higher heights of rain splash compared with areas that have good vegetative cover. In Mpameni from 22 November 2003 to 31 December 2004 (Fig. 5) the mean rain splash height in the eroded site (2.30 mm) was 30% higher than in the rehabilitated site (1.62 mm). Although the community were not able to represent rainfall on a secondary y axis, their graph on splash height (Fig. 6) clearly shows the effect of rehabilitation on reducing splash height.

Where splashcups have been installed in highly erodible areas the mass of sediment trapped has been substantially larger than for less erodible areas. Also the community has noted

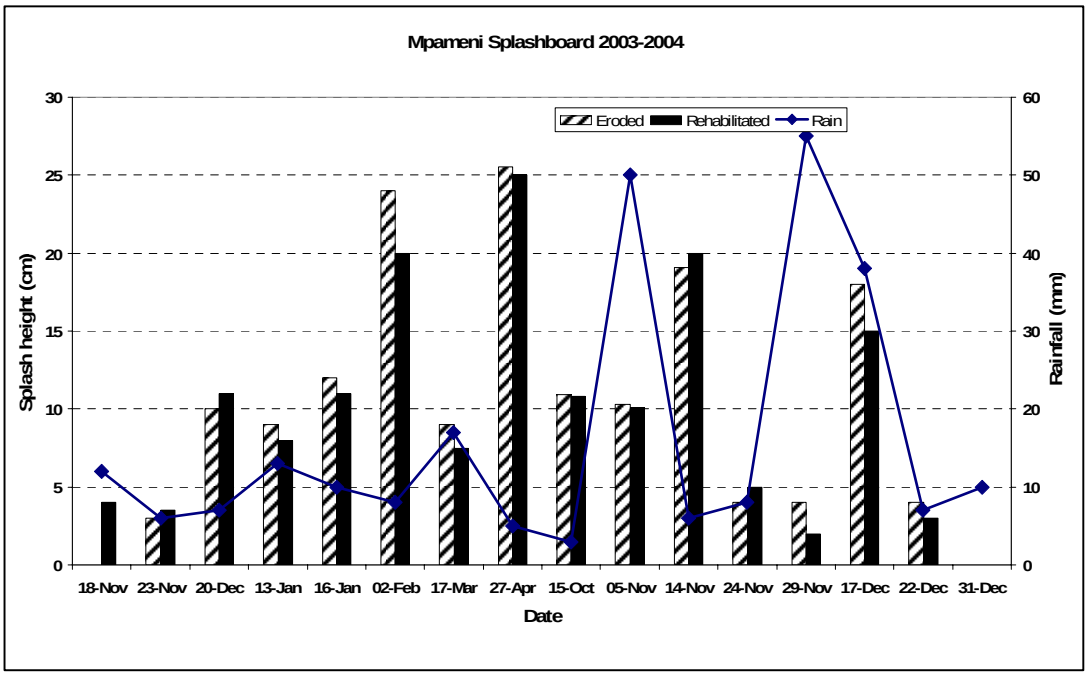


Figure 5. Splashboard data in Mpameni showing height of rain splash

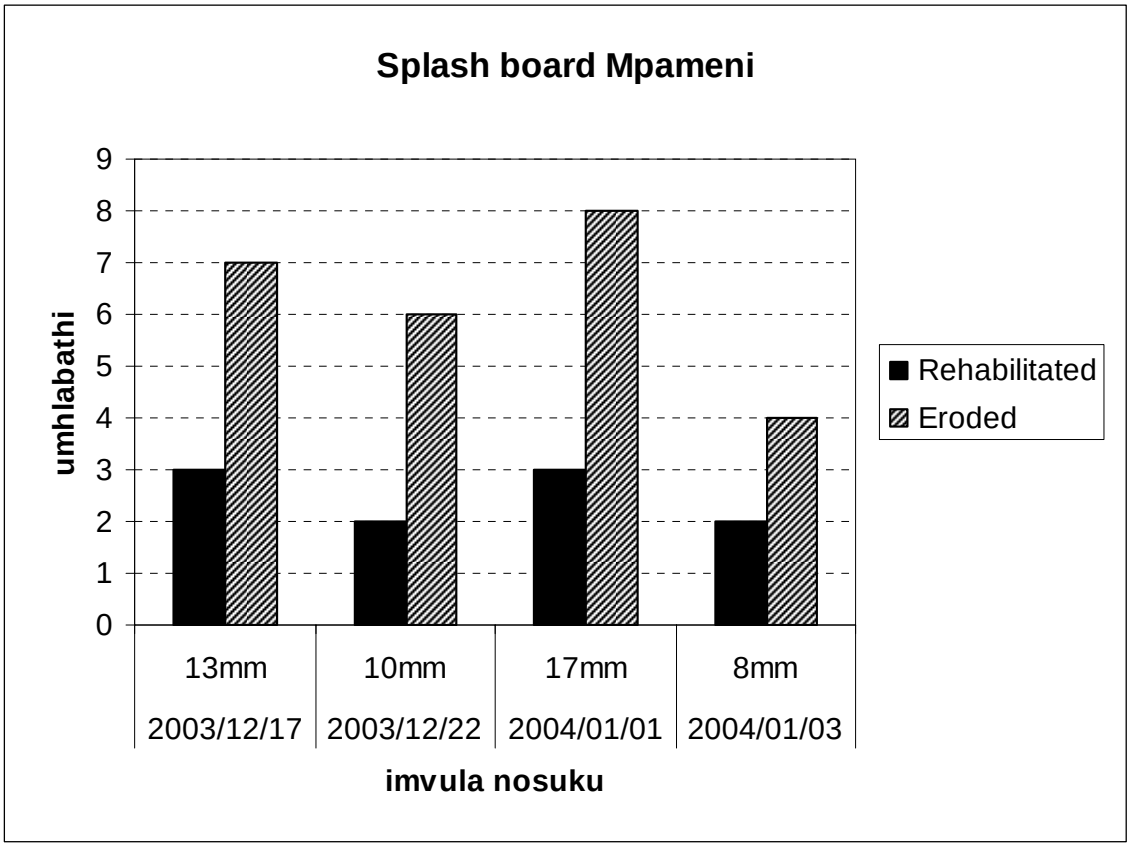


Figure 6. Community graph of splashboard data

decreasing amounts of sediment being collected in areas that are experiencing improvements in vegetative cover. For example, total sediment collected at Mpameni (2002-2003) in the rehabilitated site was 156 mm which was lower than in the eroded site (163 mm) (Fig.7). In 2004 (Fig. 8) there was a 17% higher sediment yield in the eroded site (128 mm) when compared to the rehabilitated site (107 mm). These data also illustrate the clear relationship between amount of rainfall and amount of sediment trapped in the cups. For example 27 mm sediment was deposited in the splashcup in the eroded site following the 90 mm rain event on the 15 November 2004 (Fig. 8). The donga profile technique required significant modification as initially there was too much flexibility in the donga cross wire from which depth was measured. Nevertheless the profiles indicated considerable change in shape and sediment deposit following the building of stone packs (Figs 9 & 10).

One of the most effective techniques for monitoring the effects of rehabilitation on water quantity and quality were the runoff plots. The water collected from the rehabilitated sites was clearly cleaner and lower in quantity than in the eroded sites. For example, data from the runoff plots at Oqolweni (Fig. 11) indicated that runoff from the eroded site (2680 mm) from 7 April to 26 December 2004 was 28% higher than the rehabilitated site (1950 mm). While attempts were made to quantify the amount of silt collected in the bottle, these were unsuccessful. Although on some days (e.g. 6 Sept 04) the runoff appeared to be higher in the rehabilitated site, the recorder has noted that the runoff pipe was blocked on this date. The effect of rehabilitation on decreasing runoff was also apparent at Sigodiphola (Fig. 12).

The streamflow data collected manually by the community show how streamflow declined in the winter months from a stage height of 340 mm to 140 mm in the eroded area and from 280 to 140 mm in the rehabilitated site (Fig. 13). This trend was also apparent in the electronic streamflow data collected by the research team.

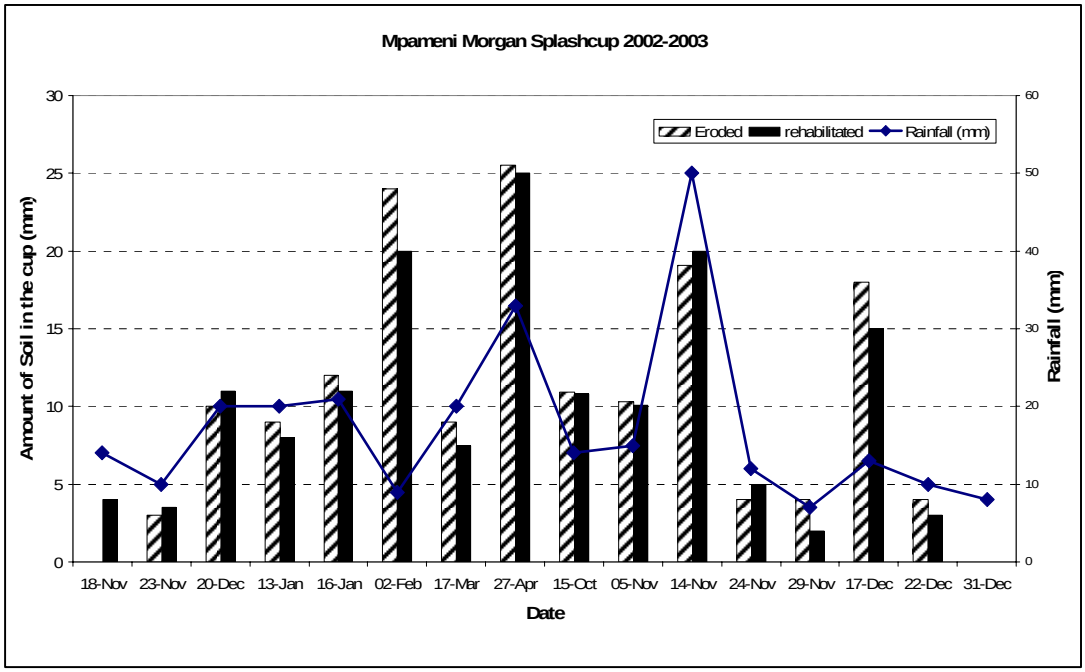


Figure 7. Splashcup sediment in Mpameni (KwaMakhowane) (2002-2003)

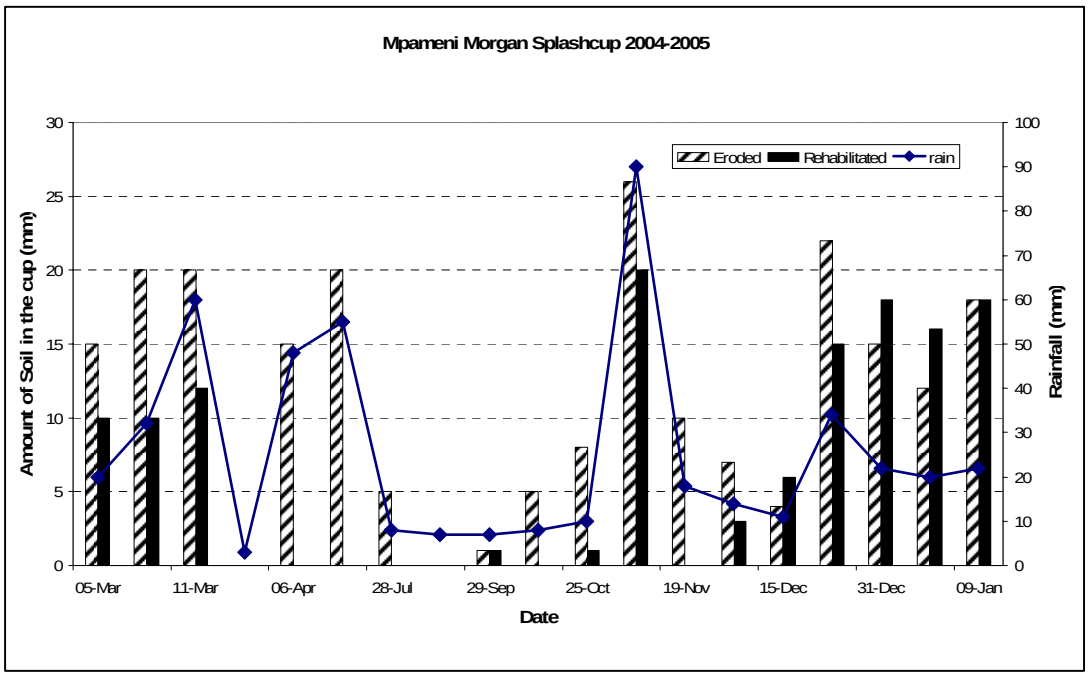


Figure 8. Splashcup sediment in Mpameni (2004-2005).

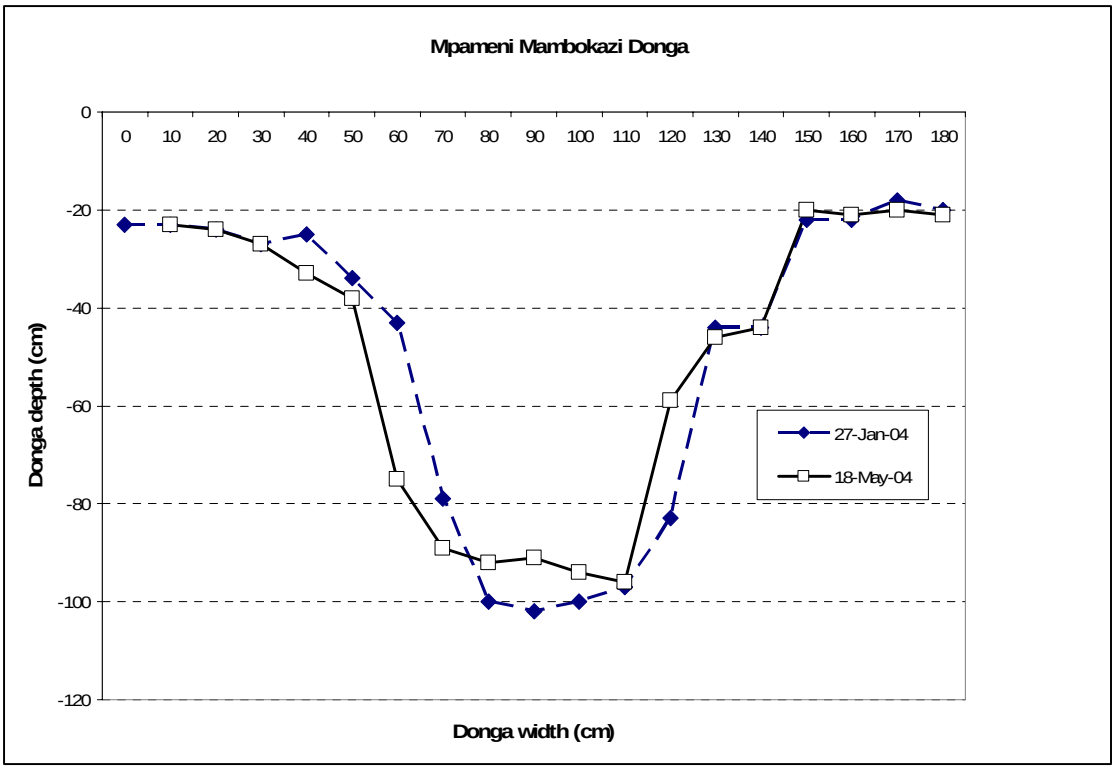


Figure 9. Donga profile Mpameni

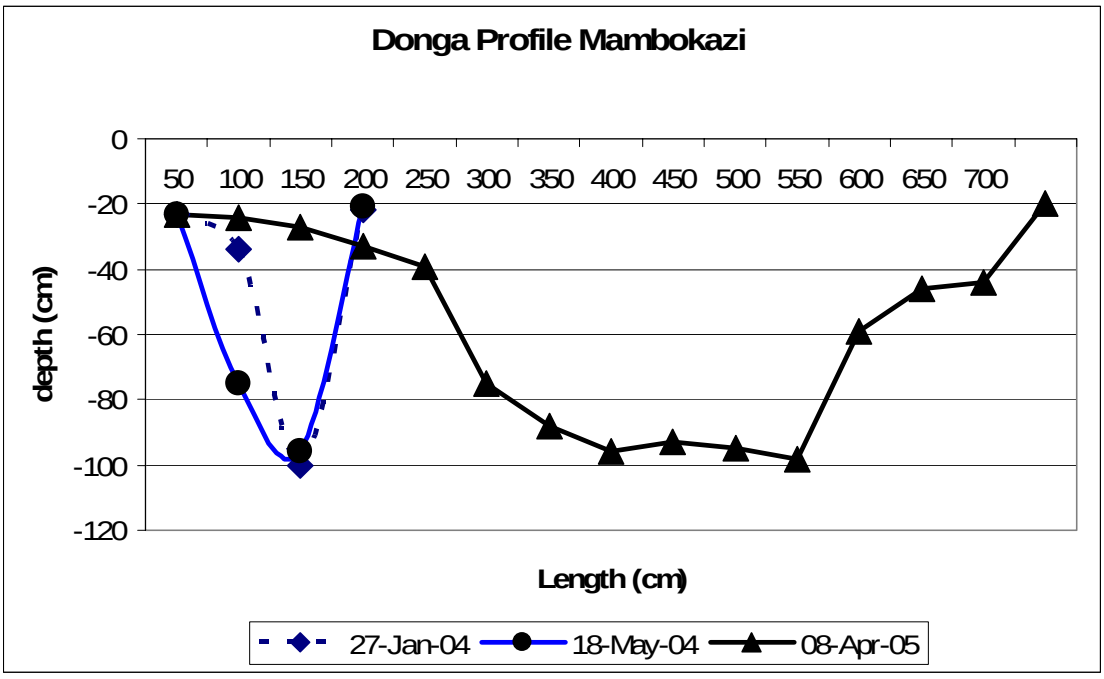


Figure 10. Donga profile Mambokazi

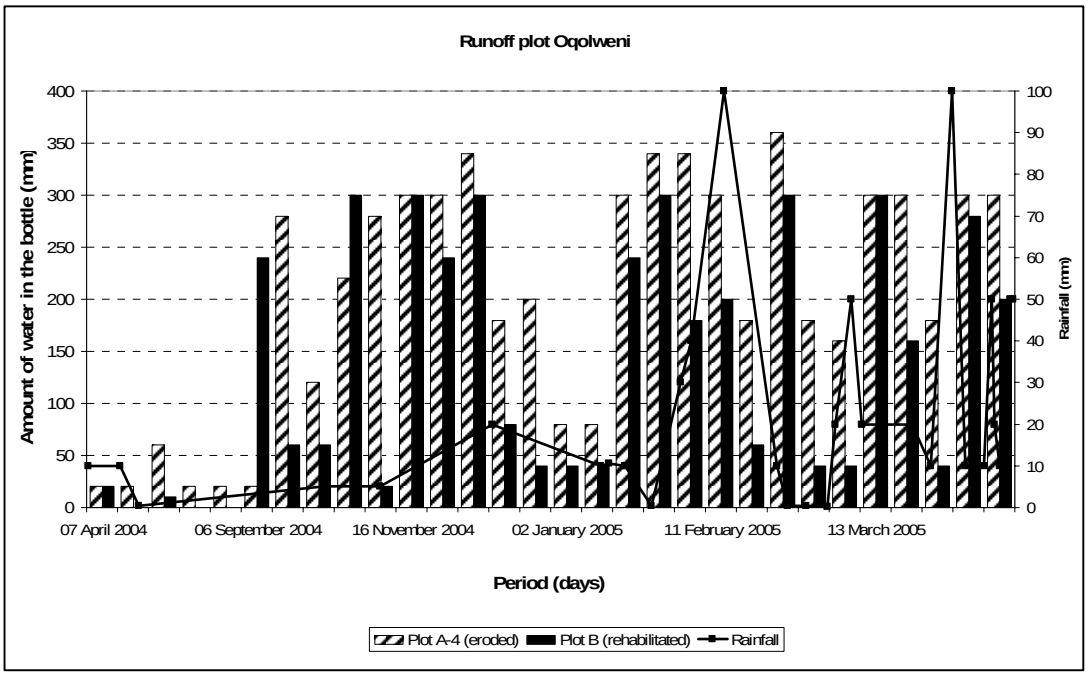


Figure 11. Runoff at Oqolweni

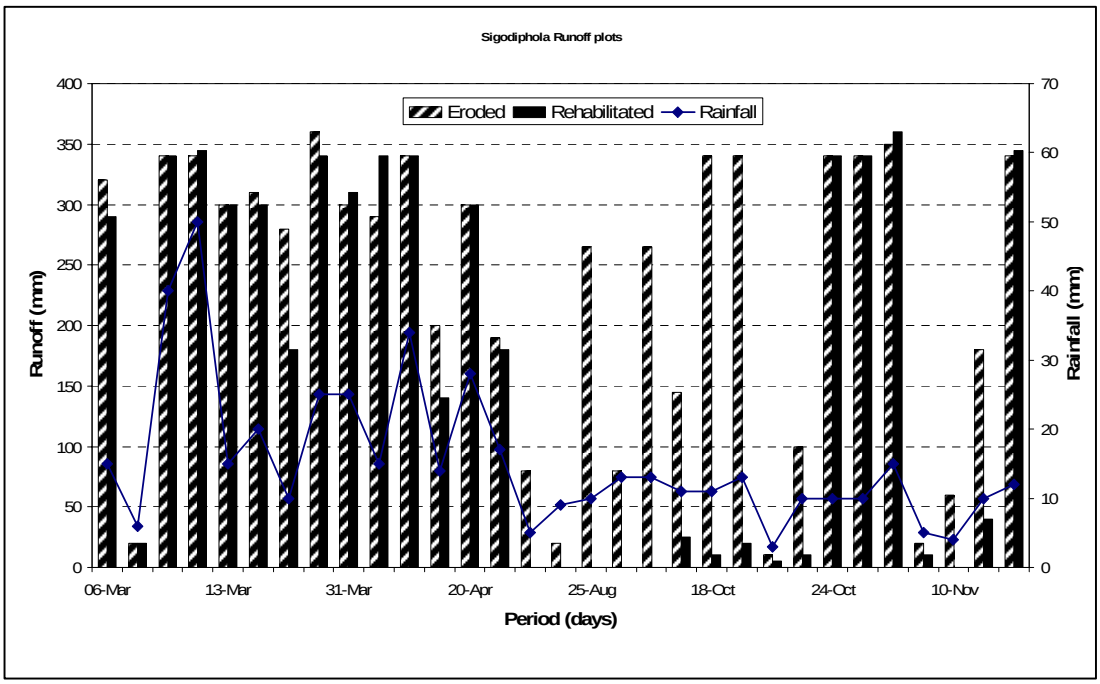


Figure 12. Runoff plots at Sigodiphola.

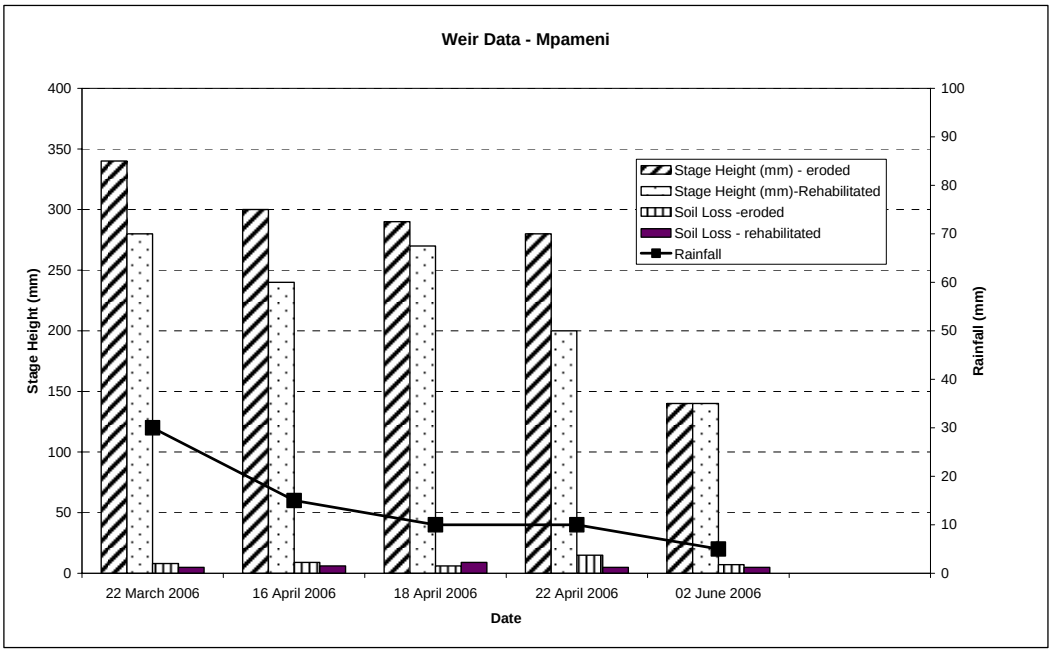


Figure 13. Streamflow data collected by the community

Although it is apparent from the graphs that further training is needed in graphical presentation of the data, the graphs have been an effective training tool for the OMG to understand the concepts of soil erosion and rehabilitation. When unexpected trends occurred (e.g. higher splash records in the rehabilitated site) the questions and debate that arose demonstrated that the community had a clear understanding of the rehabilitation process and its effect on water and soil. Observations and understanding by the community enabled the project leader to pick up a design flaw in the new runoff plots.

In general, these techniques, although simple, are effective methods of monitoring changing vegetation and soil conditions within the area. The two techniques most favored by the OMG were the splash board and run-off plots because they were easily understood, had a high visual impact and were relatively easy to record.

5.1.2 *Research team measurements - streamflow*

The weirs and weather station were installed late in 2004 but were damaged in January 2005. Data for the 2005/2006 season were not considered reliable due to leaks around the weir. We therefore present the data for the 2006/2007 rainy season.

The seasonal trend in the gauge heights for the period August 2006 to February 2007 showed that there was no streamflow in the grazed and protected catchments in the late winter (DOY 214 to 280) (Figure 14). The weirs were cleaned between DOY 269 and 279 and again in January (DOY 27) as evidenced by the sensors being in air (stage height < -200).

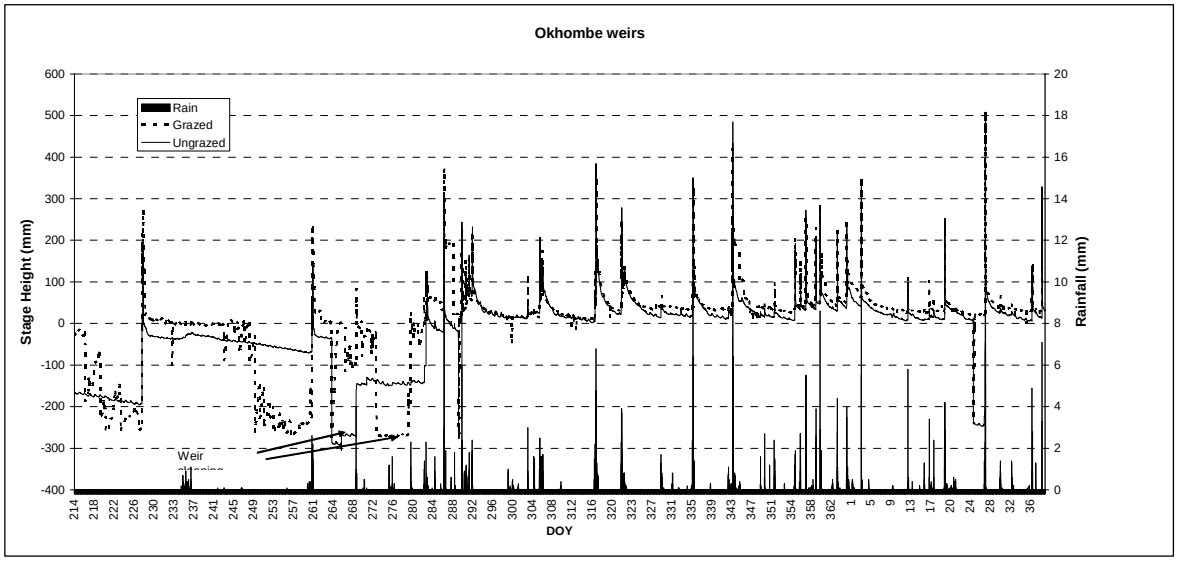


Figure 14. Stage height (mm) for the ungrazed and grazed weirs for the period August 2006 to February 2007.

Total rainfall for the three month period from August 2006 to February 2007 was high (686 mm). The first significant rainfall events began around DOY 275 (Fig. 15) and corresponded with the first significant flow events in both the grazed and ungrazed catchments (Fig. 14). From November (DOY 315) regular events on more than 20 mm were recorded and both catchments produced positive flows for most of the rainy season (Figure16).

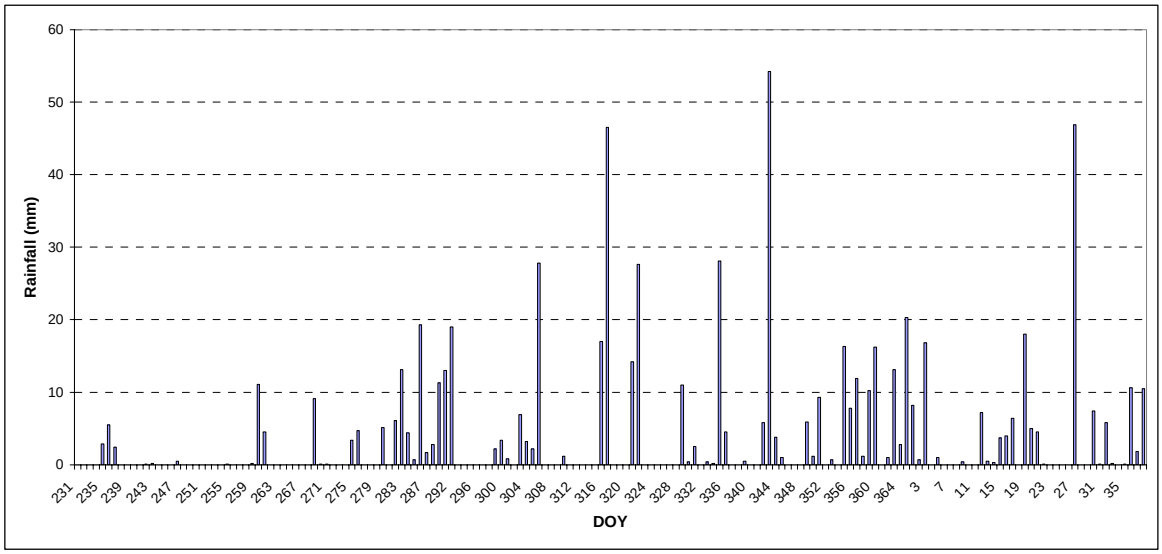


Figure 15. Daily rainfall for the Okhombe weir sites

In the early part of the rainy season (DOY 284-321) the streamflow in both catchments was similar mainly varying from 0.01 to 10 m^3 per 15 minutes. However, for the remainder of the period the recession of the ungrazed catchment decreased at a faster rate than the grazed catchment. This deviation in streamflow also increased as the summer season progressed. This deviation in the response to the catchments was initially surprising, as it was originally hypothesized that the ungrazed catchment would have an improved streamflow response as a result of the rehabilitation. One explanation for this response is the increased biomass in the ungrazed catchment, which would result in an increase in transpiration and hence decrease in streamflow. Total flow for the grazed and ungrazed catchments was 6 738 and 3 000 cubic meters respectively, the grazed catchment having significantly more runoff than the protected catchment as shown by the double mass plot of the accumulated streamflow for the two catchments (Fig. 17). The double mass curve tests for consistency and will show deviations in treatments or management by a change in the ratios (slope) of the accumulated streamflow graphs. In this study the double mass curve was plotted by comparing the accumulated streamflow at 15 minute intervals for the ungrazed and grazed catchments (Fig. 17). Changes in the streamflow response are indicated by a change in the slope of the curve. In the initial recharge period (16 October 2006 to 8 December 2006) the difference between catchments was approximately 10% (slope 1.1, R^2 =0.998) with the grazed catchment having more runoff than the ungrazed catchment. During the period 8 - 17 December a major rainfall

event occurred, with 80 mm of rain falling in the catchment area. A single event of 55 mm was recorded on the 16th of December (maximum for the season). Runoff from the grazed catchment was 8.57 times higher than from the ungrazed catchment during this period (R^2 of 0.94). Following this event the slope of the curve remained constant (slope of 1.8 and R^2 of 0.98) until the end of the recording period in February 2007. The change in slope from the initial recharge period (1.1) to the final recharge period (1.8) indicates that runoff was 40% higher in the grazed catchment than in the ungrazed catchment. This is attributed to lower basal cover as a result of the grazing which would influence the stormflow response. However, an improvement in the baseflow response of the ungrazed catchment in the low flow period will ultimately show the improved streamflow benefits of the rehabilitation measures undertaken in the ungrazed catchment. At this stage it is too early in the experiment for the changes in vegetation cover brought about by rehabilitation and excluding grazing to have had a significant impact on baseflow.

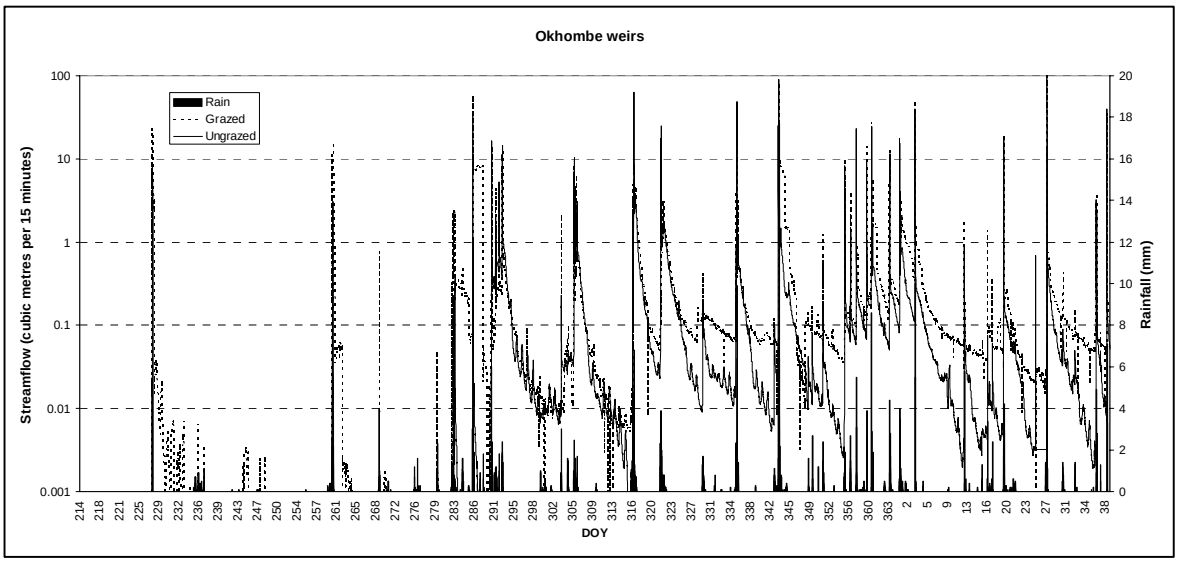


Figure 16. Streamflow for the ungrazed and grazed weirs for the period August 2006 to February 2007.

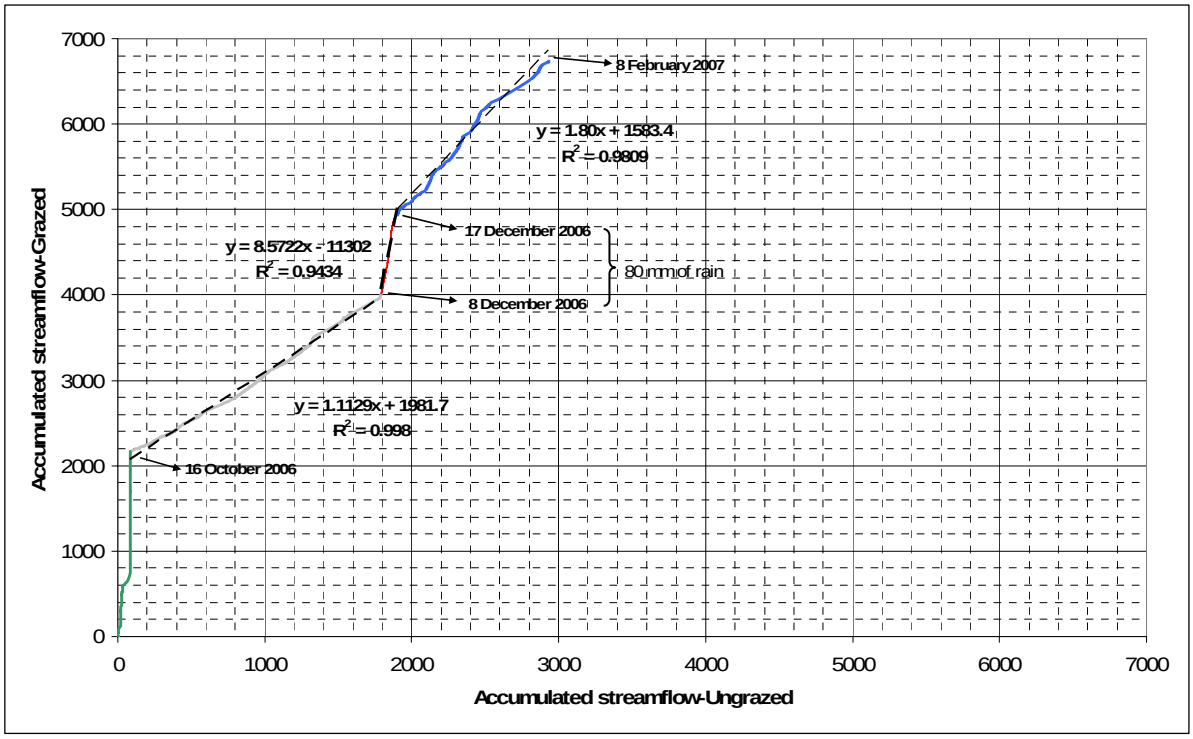


Figure 17. Double mass plot of the accumulated streamflow at 15 minute intervals for the ungrazed and grazed catchments for the 2006/2007 summer season at Mpameni.

5.2 Monitoring Techniques

The project focused on working with the community on the development of criteria for good indicators and the development of appropriate techniques to achieve these. This necessitated the development of a monitoring system which could be implemented by community members. In particular, the project focused on the development of simple, quantitative techniques for measuring erosion and run-off.

The outcomes of the workshops held with the OMG to develop objectives and indicators of land rehabilitation for the Okhombe catchment are presented below (Table 1). The criteria for selecting indicators were (in order of importance to the group):

- Applicability
- Observability
- Relevance
- Simplicity
- Acceptability (perceived)

Table 1. Desirable future outcomes identified by the community

OBJECTIVES	INDICATORS (Objective & Qualitative)
To control the extent of soil degradation & erosion within the targeted and other identified sensitive areas of Okhombe catchment by September 2005	• 40-60 % of previously degraded area is stabilizing (the previously eroded area is being covered with vegetation) • 60-70% people in the rehabilitation process are effectively applying technical knowledge within & outside of the Community • Increased employment opportunities for people skilled in rehabilitation technologies • Up to 70 % of local people including school children are pro-active in rehabilitating land at the household as well as Community levels • At least 50 % of the previously deserted land is being re-used (ploughed) • Up to 50 % yield increase in the crop fields and community gardens • Increase in accessibility to safe and clean water
To implement continuous monitoring of the rehabilitation efforts within the targeted areas and other sensitive sites of Okhombe Catchment areas by January 2003 (Continuous)	• Consistency in reporting and presentation to Community and Traditional Administrative council, of all the monitoring sessions • Effective application of acquired monitoring techniques • Community becomes more innovative in rehabilitating land • Communal problems are tabled and decided upon jointly
To promote and encourage the maintenance of all the rehabilitated structures (Continuous)	• At least 50% people portray positive change in their behavior towards land use • 50-60% of the local people show social, technical and physical willingness to support & contribute towards the rehabilitation process
To build educated and environmentally conscious communities for effective environment and land use management (by September 2003 & Continuous)	• At least 50% people reflect positive change in the behavior towards land and environment • There is increasing number of people that are aware of their own destructive actions to land & environmental and who show willingness to participate in problem resolution • 50% people effectively practice land use & conservation measures recommended by the OMG and volunteers • 50 % yield increase in the crop fields and community gardens • Increased recognition of OMG Project by other communities (local and abroad)
To Develop monitoring procedures that relate to soil conservation and rehabilitation within Okhombe)	• A number of plans that promote soil conservation, including a grazing management system, are initiated • Mastering of effective technologies and appropriation of them in rehabilitation efforts • Productive and effective relations are being established by OMG and other existing structures in the community • Increase in the number of community persons attending OMG community reporting sessions • Efficiency, perseverance & continuation of OMG and volunteers members There is at least some degree of autonomy of OMG and volunteers to make decisions & actions relating to land rehabilitation

The OMG assessed the extent of soil erosion in the different sub wards (Table 2) to enable them to prioritize areas to be rehabilitated.

Table 2: Type and severity of erosion (with reference to the maps drawn during workshops)

Extent of erosion	**Sub-ward**					
	Ingubhela	Mpameni	Mahlabathini	InhlanoKhombe	Qolweni	Sigodiphola
Gulleys (dongas) especially near the homesteads	**ΦΦ**	**ΦΦ**	**ΦΦ**	**ΦΦΦ**	**ΦΦΦΦ**	**ΦΦΦ**
Extensive erosion	**ΦΦΦΦ**	**ΦΦΦ**	**ΦΦΦ**	**ΦΦ**	**ΦΦ**	**ΦΦΦΦ**
Cattle / human movement & activities	**Φ**	**ΦΦ**	**Φ**	**Φ**	**ΦΦ**	**Φ**
Sheet erosion	**Φ**	**ΦΦ**	**ΦΦ**	**ΦΦ**	**ΦΦ**	**ΦΦ**

Φ Least severe
ΦΦΦΦ Most severe

The following rehabilitation techniques were agreed upon during the transect walk in Okhombe:

- Gabions, trees, and vetiver grass, old material such as used aluminum & old tanks will continue being used in the gullies, especially those near homesteads, as well as for building small 'bridges'
- Most parts (such as extensive erosion, as well as gullies) will need construction of stone packs, shebeleza (cutting the sides of the dongas at an angle to promote vegetation establishment on the collapsed donga walls), vetiver grass & trees
- Stone lines & kikuyu grass have worked in most parts, and will continue to be used in bare as well as less eroded areas

The OMG identified their needs to achieve their objectives:

- General technical support on rehabilitation techniques is currently not in place and should be provided, including training on swales & shebeleza
- More ideas & training on techniques are needed as stones are lacking

- Nursery construction: Collaboration with Grassland Science has been initiated for growing of tree seeds and seedlings from Okhombe, planting of a vetiver field will be pursued with local Department of Agriculture as well as other potential sources.

They also identified possible constraints to achieving their objectives and possible solutions.

Table 3: Constraints in achievement of objectives and possible solutions

Constraints	Possible solutions
• People who do not cooperate, especially important for livestock (goats & cattle) management purposes	⏩ Continuous liaising with community, involvement of LCF's and outsiders in encouragement of community involvement, traditional administrative council involvement
• Lack of stones in the catchment	⏩ Removal of stones and application of them in new sensitive sites, use of old material such as logs, old aluminum tanks, rubber tyres
• Finances to buy material such as fence	⏩ Removal of fence to the new site (rotational fencing)
• Change in group composition	⏩ Training of volunteers in the same activities as OMG members, training of school children

The research comprised 13 days of workshops, 5 days of meetings, 5 days of interviews (volunteers and community members), 5 days of informal discussions and presentations and 4 days of training (monitoring techniques and group development). Through the process the Okhombe Monitoring Group drew up a work plan that identified the areas most susceptible to soil erosion and the activities to be carried out within each sub ward.

MPAMENI

Kalumuzi donga Vetiver, kikuyu, stone lines,	**Shelembe donga** Stone pack, gabions, vetiver, trees	**Gumede donga** Stone pack, vetiver, gabions	**Skomoro donga** Stone packs, gabions, vetiver	**Jwarwa donga** Stone pack, vetiver, gabions, trees
Mavundla donga Stone pack, vetiver, gabions	**Mkhulise donga** Stone packs, gabions, trees, kikuyu	**Fixed-point** Hlatswayo: vetiver, stone pack,	**Fixed-point** Stone pack, vetiver, trees	**Fixed-point** Stone pack, vetiver, trees

The OMG identified 7 new dongas that required rehabilitation in Mpameni and recommended three dongas from the fixed site for maintenance. Details in each square are structures required for rehabilitation.

SGODIPHOLA

Kwa-Ngambu Gabions, trees, stone pack, vetiver	**Donga 2:** Stone pack, kikuyu, vetiver	**Mazibuko** Stone pack, gabions, vetiver	**Donga 4** Stone pack, vetiver, kikuyu, trees	**Donga 5** Stone pack, vetiver
Donga 6 Stone pack, gabion	**Donga 7** Stone pack, vetiver, kikuyu	**Emakatini** Stone pack, kikuyu, vetiver, gabions	**Donga 9** Stone pack, gabions, tree, vetiver	**Shabalala Fixed** point: vetiver, stone pack, gabions
Shabalala Fixed point: stone pack, gabions, vetiver	**Shabalala:Ngubane** Trees, stone pack, gabions, vetiver	**Sishi fixed** point: stone pack, vetiver, stone lines	**Sishi:** Hlombe Stone lines, stone pack	

New dongas: 9
Old dongas: 5

Ngubhela

Ngezamasoka Stone lines, vetiver, kikuyu **Masengemi**:stone pack, vetiver	**Mlangeni** Stone pack, vetiver, kikuyu	**Mkhize** Stone pack, gabions, vetiver, trees, kikuyu	**Mehunu** Stone packs, gabions, vetiver, kikuyu	**Hadebe** Trees, stone packs, vetiver, trees
Jakalasi fixed point: stone lines/packs, vetiver, kikuyu	**Jakalasi donga** Stone pack, vetiver, trees	**Jakalasi donga** Gabions, vetiver, stone pack		

New dongas: 5

Old dongas: 3

MAHLABATHINI

Mkhonza Stone pack, gabions, vetiver, trees	**Khumalo** Stone pack, gabions, vetiver	**Msomi** Stone pack, vetiver, gabions	**Mathemba** Stone pack, kikuyu, vetiver	**Maphalala** Trees, vetiver, kikuyu, gabions, stone pack
Shabalala fixed point: vetiver, kikuyu, stone pack, trees, swale	**Masengemi** Stone pack/line trees, kikuyu,	**Shezi fixed** point: **donga 1** vetiver,	**Donga 2:** Gabions, stone pack, trees vetiver	**Makhowane** Stone lines, vetiver, trees

New dongas: 5; Old dongas: 4

QOLWENI

KwaNkukhu donga

1. L=500m W =500m Stones, grass	2. L=110m W=110m Stone, grass	3. L=300m Stone, grass	4. L=260m Stone, grass	5. L=360m Stones, grass
6. L=320 Stones, grass				

KwaMakhosini donga

1. W= 360m Stones, grass	2. L=150m W=380m Stones, grass	3. L= 313m W= 380m Stones, grass	4. L=191m W= 300m Stones, grass

NB Near KwaDubazane: There are larger dongas

No old dongas identified for rehabilitation.

New dongas: 10

ENHLANOKHOMBE

I Esibonelweni: Fixed-point

1. L= 1.500m W= 190m Stones, grass	2. L= 2m W= 2m Stones, grass	3. L= 2.500m W= 300m Stones, grass

Old dongas: 3

II KwaMtabamnyama III Etsheni Elikhulu IV V KwaNgodoza

L= 3.500m W= 5m Stones, grass	L= 5m W= 5m Stones, grass	L= 6m W= 4m Stones, grass	L= 7m W= 5m Stones, grass

VI KwaSdinani V II & V1I KwaMshokobezi

L= 1.500m W= 3m Stones, grass	1. L= 2m W=3m Stones, grass	2. L= 4m W= 3.500m Stones, grass

Near Hadebe L= 3m W= 3.500m Stones, grass	**Below huge rock** L= 1m W= 50cm Stones, grass	**Old garden** L=2m W= 1.50m Stones, grass	**KwaDlamini Gate** L= 2.500m W= 2m Stones, grass

KwaGegeqezihlathi

1. L= 8m W= 1.7m Stones, grass	2. L=1.50m W=2m Stones, grass

Emsengeni KwaSgubhu

1. L= 500cm W= 1m Stones, grass	2. L= 800cm W= 1m Stones, grass

Old Gate

1. L= 2.500m W= 3m Stones, grass	L= 1.800m W= 2m Stones, grass	3. L= 1m W= 500cm Stones, grass

New dongas identified: 18

5.3 Data Analysis Workshops and Computer training

During the first two years of the project the data collected by the OMG were analyzed by the project team. The results (graphs showing the changes taking place in soil erosion, basal cover etc.) were used by the OMG to report back to the wider community and traditional administrative council (Plate 17). In order to build the capacity of the OMG to analyze their data, a series of computer training workshops were undertaken. Extracts from the notes taken during the computer training workshops are presented here as they illustrate the importance of involving the community in the data analysis.

Notes from Computer Workshop 19-22 September 05

i) OBJECTIVES OF THE WORKSHOP

a) Review of the previous workshop;

b) Filling in new members (Maskandi & Ningi) on the process;

c) Train the group in plotting the graphs and analyzing them

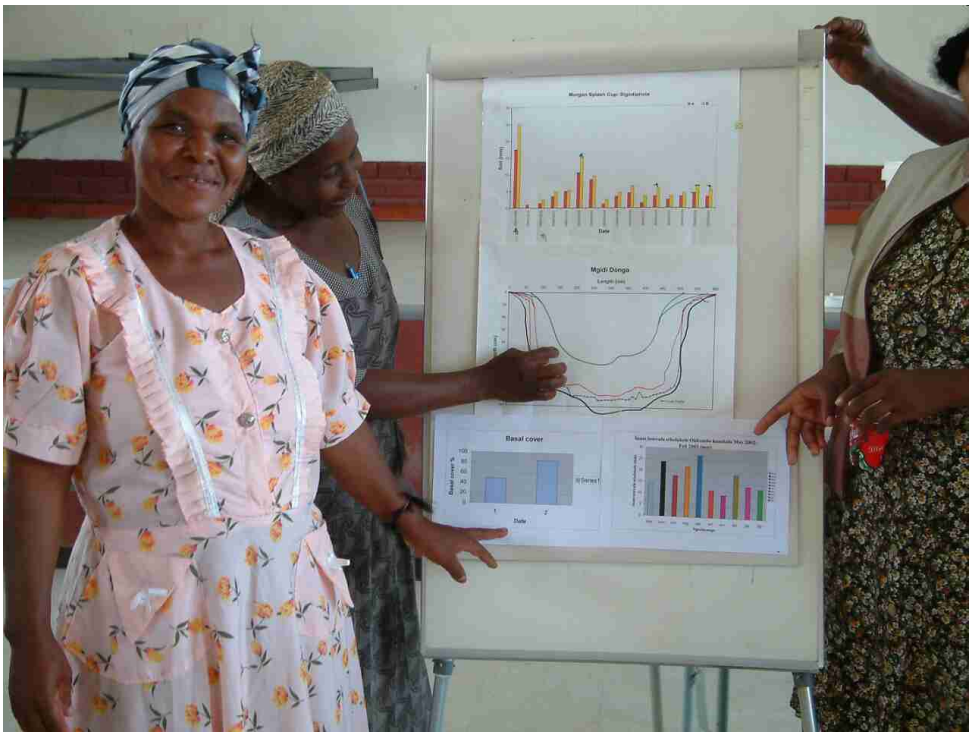


Plate 17. OMG members presenting data to the community.

ii) REVIEW OF THE PREVIOUS WORKSHOP

A. What has the group learnt so far?

Responses:

- The importance of understanding the data through graph construction
- The differentiation of graphs plotted in varying conditions (raining or not raining), situations (eroded and rehabilitated areas), and periods (dates)
- Understanding the information we have on the data sheet in terms of what is happening to the soil that we are trying to revive.

B. How would the group define the graphs?

Responses:

- Don't really know the definition but graphs are like pictures that help describe the situation that would otherwise be difficult to understand through mere numbers. For example, the description of the behaviour of depth and length of the dongas
- The graphs are representations of the data in the sheets

C. How does the group feel about the opportunity to come to the training?

- Happy for the opportunity as I would now learn more than just numbers- Ningi
- The information would be used in the field where I would now know how the data collected would look like when the graphs are plotted- Maskandi
- The opportunity is good because what we learn is for our knowledge to be put together for the next generation. They would then know what we did and what the pattern of soil rehabilitation has been over the years- Mkhululi
- The information has already been useful such as during World Bank and DEAT visits. This information is important as other people are not keen to listen but they would rather look at the graphs and understand things that way- Nhlanhla &Hlubi
- The information is important so that each of us can understand the whole process and not just graphs that have been already constructed – Themba

3. HELPING MASKANDI MAPHALALA & NINGI MIYA TO UNDERSTAND THE GRAPHS

The individual members offered to show the new members what they had done before.

Observation: Some of the group members were not keen because they said they had already forgotten how to plot the graphs and were worried that they would show incorrect information.

Some of the members noticed that using the word 'graph' was not convincing to the new members and hence they started making it easy by defining the graphs as '*umbhoshongo omude nomnance'* meaning its short and tall bars.

4 GRAPH PLOTTING

The three groups were formed as:

Group A: Themba and Hlubi (to work on the Splashboard)

Group B: Nhlanhla and Ningi (to work on Donga profile)

Group C: Mr Ndlovu, Maskandi and Mkhululi (to work on Runoff)

Although the OMG worked in groups they also alternated between groups. The aim was for the group members to work on the techniques that they had problems in understanding.
These themes were what the groups achieved:

- Ability to identify what variables need to be captured in order for the graphs to be plotted
- Identifying the graph tool (in the toolbar)
- How to save work
- Teamwork (the group members were helping each other as well)

The groups had challenges in the following:

- memorizing the various texts within Microsoft excel
- Understanding how one arrives at percentages. For example in the basal cover exercise
- The data sheets of Splash cups
- The behaviour of donga profiles in the graphs (these had to be recorded in negative numbers to prevent the profile appearing upside down)
- Flexibility to manipulate the graphs (ability to check what would work and what wouldn't work)

Some of the exercises performed by the group were saved on their diskettes. Although the group struggled with some concepts, overall they had a clear idea of how to construct graphs that they could understand.

One of the biggest problems with the project has been missing data and loss of data files. Initially the problem with using exercise books instead of the data files to record the data was that the entire books had to be taken to Pietermaritzburg for photocopying. This resulted in delays on returning the books, misplacement of books and problems with finding the correct person to return them to. The use of project flip files was implemented to solve this problem.

The problem of missing silt data from the run-off plots was solved when it became clear from discussions that the pipes were blocking regularly and silt was not going into the collection bottles. It transpired that the science workshop had out-sourced the construction of the last order of run-off plots. The contractors had changed the design and the new output pipe was too narrow.

5.4 Oral History Outcomes

Although the participatory process of documenting the oral history of the project was extremely slow, the process did provide a means for community members to reflect upon their experience in the project and to share the valuable knowledge they have acquired through their interactions with each other and scientists and the project team. These are lessons that other communities (including the research community) would likely find useful and encouraging. A sample of an interview is presented in Appendix 1. All interviews are available on the project CD.

The opinions and ideas of the 13 Okhombe community members interviewed have been summarized below into several subheadings that are relevant in assessing the impact of the project on people's perceptions of soil erosion and rehabilitation in conserving water.

5.4.1 Knowledge gained

In these interviews the interviewees stated that they have gained knowledge in a wide range of areas ranging from problem identification, possible solutions and improved land management practices. The knowledge varied from person to person according to their need for water conservation and rehabilitation of eroded areas for grazing. For some people knowledge was gained in land and livestock management. Most of the interviewees expressed the ability to understand the rehabilitation methods used in the project and have been able to teach these to other members of the community. They have learnt that soil erosion decreases the fertility of the soil and that in decreasing the soil erosion they will also be able to conserve water. They have learnt the importance of monitoring their land so that they can manage it successfully.

Members of the community involved in the project learnt how to assess the severity of the soil erosion. Through the project they learnt which methods to apply to slow down and eventually stop the erosion and that they must attend to the small dongas as they contribute to the large dongas. They have also identified the methods that have been more successful (e.g. stone lines and grass planting as opposed to swales), and have identified other areas where

further donga rehabilitation is necessary. According to Mr. Vincent Ndlovu they are applying for funding for future work on donga rehabilitation.

The monitoring has equipped them to identify whether the methods applied are successful and to monitor further progress. They have noted differences between areas that have been fenced compared to those that have not, according to the degree of basal grass cover. They have also learned to monitor the runoff plots themselves. They monitor the degree of erosion using splashboards and splash cups. The members of the community that have learnt to use these instruments to take measurements and monitor the rate of erosion are extremely grateful that they have learned the methods and they are proud to be able to teach them to other members of the community.

The monitoring they have done has also helped them create their own better methods and apply them to areas that are not included in the project. This is evident as they have learnt the importance of vegetation in preventing soil erosion and conserving water. Many of the interviewees have planted trees and grasses on their land to reduce runoff and soil erosion near their homesteads and in their gardens. Mr. Themba Khumalo has even established a method to measure splashes from the rain on the walls of his home and has planted vegetation around his house to slow the rate of erosion. The people have accepted that planting kikuyu, vetiver and trees will help in restoring the land so that food shortages for livestock can be overcome. The people have also learnt that the exotic trees in the area have an impact on the amount of available water and they accept that planting indigenous trees is more beneficial in managing the environment.

The community was also introduced to the rotation of pastures so that they can avoid degradation of livestock grazing areas which previously were overgrazed and eroded. The knowledge gained is being passed on to people in other areas and also to children in the schools. The interviewees understand that it is a long term process and they want to share the knowledge that they have gained so that soil erosion and water conservation in other areas can be controlled. Mr Mlambo commented that “Obtaining knowledge is better than nothing”.

5.4.2 Successes- positive feedback

The successes of the project, according to the interviewees, out-weigh the failures. The community members interviewed have all noted an improvement in the soil erosion and success in the rehabilitation of the dongas. They all appreciate the success of the project and are prepared to continue to work to reduce the erosion and to slow the flow of water and also to conserve the water.

One of the main successes that the community has observed is that grasses are growing in areas that were previously bare. Mr. V Ndlovu stated that “Grasses grow in places where there was nothing and we can see the difference”. They have also observed that the planting of grasses and trees has slowed the flow of water and reduced the damage that the flowing water causes. “The roots of these trees and grasses support the dongas by holding the soil” (Mrs. F Mavundla). Miss N Miya commented that “There is a lot of difference since we have used kikuyu grass and trees, it limits water speed. Trees absorb water down minimizing the chance of water creating problems”. These successes in the rehabilitation have encouraged the community members to plant grasses and indigenous trees in their homesteads to slow water flow that causes damage.

The interviewees also acknowledge that some of the rehabilitation methods used were also successful. “There was one donga where we put stone packs during LandCare’s arrival, which you can’t recognize now” (Mr. M Xaba).The fixed plots have been a great success. The volunteers that are involved in the measuring have seen a decrease in the loss of soil during rains, and the growth of the planted grasses has been good. The project has also been successful in training the volunteers to be able to continue with the monitoring.

The creation of grazing camps has also been a success in that the areas previously used for grazing cattle were overgrazed and erosion was taking place because of a low basal cover. This has been a great success in the eyes of the community as the improvement in grazing lands was mentioned in all the interviews. It was also noticed by some that the runoff of water in these areas has decreased.

Many of the members in the community that were interviewed have also found that the rehabilitation of the areas that had been eroded has helped them in other ways besides improving grazing lands. They have also found that they are now able to protect their homesteads from fast flowing water and their vegetable gardens are getting more water. The water is being retained in the soil and their crops are growing better than before. Mr Mlambo noted that "There was water, which used to come from the top passing through my yard but because of the project this is not happening anymore. In the fixed plots it is also improving. Swales also worked well, I can say we must continue working because we can see there is difference".

5.4.3 Failures – negative feedback

Although the general feeling among the interviewees is that there have been many successes in the project there have also been some failures. According to the members of the community interviewed many people in the community have found that the progress is too slow, and also that not enough of the area has been worked on.

According to Mr. M Miya the project was going to build dams, which were going to supply water for livestock. This goal was not achieved. Mr. M Miya was the only interviewee which mentioned the building of dams.

Another problem in the project is shortage of fencing and the interference of livestock on the fixed plots. The volunteers are worried that this will affect the measurements and their progress and spreading the project to other areas. Uncontrolled burning has also been a setback in the growth of the trees and grasses that were planted, and Mr. M. Mlambo feels that the progress would be better if these events were avoided.

The cutting down of the exotic tree woodlots has caused a problem in the community. The interviewees understand that they absorb an extremely high amount of water and that no other plants such as grasses can grow under them, but they feel that the indigenous trees that they have planted for wood are growing too slowly and that they are having to travel large distances to find wood and are also having to spend money on buying the wood. Some are

concerned as they have not even planted indigenous trees. “We were going to plant indigenous trees but that didn’t materialize” (Miss C. Shabalala).

There is also a feeling that there are too few volunteers that are willing to continue with the project. The problem is mainly the youth in the community that have no interest in conserving the land and rather aim for materialistic wealth. According to Mrs. P.N Hlubi there were problems because of shortage of skills.

Finances have been identified as the largest problem. The interviewees felt that the shortage of finances for job creation is slowing the process of rehabilitation down and also seems to be causing conflicts in the community. “The money has been finished but near my homestead, the process is very slow, the volunteers have not reached there yet” (Mr. M Xaba).

5.4.4 Indicators

The indicators in the project are the visible improvements in the fixed plots, grazing areas and eroded areas, and are mainly the growth of vegetation that has been planted. Interviewees commented that the original vegetation has been given an opportunity to grow since the disturbance to its growth has decreased (e.g. livestock grazing).

It was mentioned several times in the interviews that there has been a huge change in the grass growth on the inside of the fixed plots compared to outside the plots, “If grass grows in places where there was nothing we can see the difference” (Mr. S. Ndlovu). Tree growth has not been as successful although the growth of trees was mentioned by a few interviewees who stated that the roots of the trees are holding the soil together and stopping erosion. Growth of grass and trees over the stone packs and stone walls in the dongas has indicated that these methods of rehabilitation have been successful.

The monitoring equipment has enabled the volunteers to monitor progress, especially with the soil erosion. The volunteers that are monitoring the fixed plots are able to use the equipment that they have been supplied with to monitor the runoff of water and the loss of soil in the runoff. They are also able to compare the amount of runoff with the water collected in their rain gauges. “We have the rain gauge that helps us to measure how much

rain did fall on the runoff plot where we measure sediments and water in the coke bottles so I can see the difference" (Miss. Z Mnguni).

There has also been a notable decrease in the damage caused by water flow during and after rains. Furrows are no longer being caused by the runoff after the rains and this shows that top soil is being preserved, and is a positive indicator.

The importance of monitoring as both a physical and social indicator is summed up my Mrs Mavundla "Monitoring helps us check whether we are realising our objectives. For example, the splashboard, it is very easy to read and it is easy to demonstrate to other people. Runoff plots also helped us a lot and you are able to monitor many things at one time e.g. monitoring water and soil that was washed away, comparing that with the emergence of vegetation. The Morgan splash cup also helps but we are experiencing problems when it is rains heavily because you are unable to record accurately. It helps a lot to monitor your work, you feel the work you are doing is worth it and you also feel encouraged doing your work".

5.4.5 Community Organization

The community has formed several committees in an effort to address the management of land care, livestock and tourism.

The Okhombe monitoring group (OMG) is responsible for caring for the land. This group carries out the rehabilitation work and monitoring of soil erosion and water runoff and is chaired by Mrs. Florence Mavundla. The group started out with 24 members but currently only consists of 10 members, and they rely on volunteers to help them to continue with the work. Currently the number of volunteers is increasing and this is very positive as the community is taking responsibility for their land.

There are also community meetings that are held where goals in rehabilitation and ways to avoid erosion in the future are discussed. The other committees (e.g. livestock committee) acknowledged that the work that is being done by the OMG on the rehabilitation and the monitoring of the eroded sites is also benefiting the work that they are doing, and aim to do. The livestock committee is glad that there are grazing lands that can sustain their livestock

and that these grazing lands are managed correctly to avoid erosion and too much runoff in the future.

The tourism committee aims to educate tourists on the land care work that has been done and that is taking place and how the community manages the work. They want to use the training they have received to educate visitors on the methods and the importance of managing the land correctly.

The formation of the committees in the community has also enabled the community members to identify their weaknesses and to address them. One of the main topics that came up is that they need to learn how they should manage their finances in the future so that they can continue the work they are doing in the community so they can reach their goals. “The OMG still needs training, especially in financial management, organizational management and project management” (Mr. N Miya).The committees call general meetings and discuss the importance in continuing the work and also that they must avoid destroying the work they have already done.

One of the main things the community needs to work on is getting the youth in the community involved because the management of the land must be a continuous effort and the young people in the community will have to take over the monitoring and management in the future. This is why the community has the school teacher involved and she has integrated the purposes of the project and the efforts needed to have healthy lands into her curriculum. The OMG felt that their training of school children in the “adopt a donga” programme will help to spread the knowledge of the importance of soil and water conservation.

The efforts that have been taken to rehabilitate the land and manage the erosion and livestock has improved the communication in the community and improved the organization in the community.

5.4.6 Initial community perceptions

The initiation of a new reclamation project in the neighboring wards of Obonjaneni and Busingatha provided an ideal opportunity to establish the perceptions of a “control” group of

people who had not been exposed to LandCare. However, the format of the initial questionnaire could not be used as most of the questions were related to the impact of project activities on soil conservation. Nevertheless, on transect walks it was possible to document people's perceptions of soil erosion. People perceive that the main impact of soil erosion has been a great reduction of land, especially for agricultural and grazing purposes. Dongas are coming closer to homesteads, community gardens and telephone poles. Massive dongas create difficulties in accessing schools, halls, stores etc. The community attributed this to community practices such as uncontrolled livestock movements, moulding bricks, use of sledges and incorrect tillage practices. In addition, erosion is caused by municipal water supply projects where proper rehabilitation is not done, and road transport projects where trenches are dug to channel water off the road and these deepen due to heavy rainfall. Few people in the control group used erosion control structures. Some people said they were assisted by the previous government to use contours but these were no longer functional. Gabions were also used but have deteriorated as a result of the community using stones for domestic purposes. People were aware of the link between soil erosion and water stating that some of the dongas have become seasonal streams.

One of the main differences between the control group and the group who have had training is that the control group is aware of the soil erosion problem but lack the skills and motivation to address it. The trained group have the skills, organizational abilities, and motivation to change the state of their land and confidence that "the eroded area can be healed and return to its original state" (S Shabalala). The knowledge gained has enabled the people to demonstrate that what they are doing is working. Themba Khumalo stated that "the runoff plot is the important one, because when you are demonstrating it to others they are always willing to listen. They develop this love of learning, and people can see that what you have been talking about is feasible".

5.5 Community Awareness

5.5.1 *Institutional networking*

A workshop was held to establish the linkages between the OMG and other institutions in the community. It was apparent that continued liaison with and involvement of the traditional

administrative council in rehabilitation issues is critical for the success of the monitoring project. Evidence of this was observed from the response of workshop participants during the institutional linkage exercise. An illustration was made with the Traditional Administrative council circling all the OMG and volunteers as well as other community structures involved in the monitoring process. The big circle around the structures was explained as meaning no matter how dedicated the structures are inside the circle in rehabilitating the land, they would not succeed without the support of the Traditional Administrative council. It was therefore agreed that the OMG would regularly report to the Traditional Administrative council. In addition, the project leader attended a special meeting with Nkosi Miya where she presented the objectives of the project and obtained the support of the Traditional Administrative council for the project. The OMG also reported on the work they are doing at community meetings.

5.5.2 *LandCare songs & publicity*

The community has composed songs which they sing at community functions to publicize the importance of LandCare.

1. Izithunywa zethu zazinikela ukumela thina lapha Okhombe
Manje sekumele sisebenze sinakekele umhlaba

Nkosi Busisa izithunywa zethu
Siphinde sibonane

Our messengers have committed themselves to help the people of Okhombe
So now we have to work and Take care of our Land

God bless our messengers
Till we meet again

2. Wamuhle Landcare
Siyakuthanda Landcare
Uphakeme Landcare

Landcare is beautiful
We love you Landcare
Landcare is High

3. Siyakubonga Landcare
Landcare, landcare, landcare

We thank you Landcare
Landcare, landcare, landcare

5.5.3 *Adopt a donga program*

Local school pupils are involved in a program called ‘adopt a donga’ as part of raising awareness in land care management. The OMG facilitated 2 training sessions for school children on techniques for donga rehabilitation. A donga was identified near the primary school for time management purposes. The training involved Grade 5 – 7 and over 300 children attended the training. These high numbers did not allow a good level of participation. In subsequent training sessions the learners were split according to Grades to get full participation.

5.5.4 *Road Signage*

In order to publicize the successful land management projects at Okhombe a sign was designed to show the different service providers (Water Research Commission, University of KZN, Department of Agriculture and the CSIR). The sign has been put up at Maqoqa High School. An additional sign was put up on the district road turn off to Okhombe which is seen by visitors to the Ezemvelo KZN Wildlife reserve of Royal Natal National Park.

5.5.5 *Video*

An English and Zulu video on “community based catchment management” has been completed. The video has been shown to various research and community groups including

400 children from a local school. The video has been highly commended and 20 copies have been distributed to both local and international organizations.

5.5 Cross visits

The OMG has been involved in a number of activities in relation to organizing awareness raising activities and providing support to neighboring communities in the form of cross visits. The aim of the cross visits is to build the capacity of the people by enabling them to learn from others who have gained experience in catchment rehabilitation. This farmer-to-farmer approach is an effective way of promoting communication with people with similar problems and demonstrating the potential of the different rehabilitation techniques.

One of the highlights of the study was the visit by two members of the Okhombe Monitoring Group (OMG) to the Kat River project in the Eastern Cape. Mrs Hlubi and Mr Miya gave excellent presentations to the Kat river community on the rehabilitation and monitoring work at Okhombe.

The Amaswazi community visited Okhombe on the 19 May 2004. The OMG and livestock committee took the community to the sites that they were working on. The OMG members presented various monitoring techniques and explained how they are used to determine the amount of soil erosion. The livestock committee also presented their grazing management plan and showed the link between grazing and soil erosion.

The community of Potshini visited Okhombe in August 2004. The aim of the visit was to familiarize the community with the process undertaken at Okhombe towards developing a sustainable management system. The cross visit also provided a good platform for the two committees to strengthen their relationships and discuss common problems in land management. At the fixed points the Potshini community asked lots of questions on soil conservation techniques and their impact in stabilizing soil erosion. The feedback from the Potshini community was that they had a great experience through the cross visit and learnt quite a lot and they are looking forward to further collaboration.

The Obonjaneni team visited the Oqolweni fixed-points on the 13th June 2005.

The Mawuleni community in Zululand visited Ngubhela on 12th Sept 2004 to learn about donga rehabilitation techniques.

Following a visit by DEAT Okhombe was selected as a show case for community participation in environmental monitoring. DEAT submitted this case study in their international report to draw more funding into environmental community projects.

Two parliamentarians from Australia visited Okhombe on the 2nd December 2005 to see the work that has been done within the project.

Members of the OMG visited Mahotlong in Lesotho to discuss rehabilitation projects in the area. They also hosted a visit from Lesotho participants and demonstrated the rehabilitation and monitoring techniques.

5.7 Technology transfer

One of the key questions that has been frequently asked about the project is "How much technology transfer has taken place to the wider community"? In order to answer this, both formal and informal interviews were carried out by Khumbu Zuma as part of her Masters thesis. Extracts from her observations and findings are presented below:

Individuals of Mahlabathini protect the rehabilitated site

On a visit to one of the rehabilitated sites (Mahlabathini) with staff from the LandCare project and two evaluators from National Department of Agriculture (NDA) it was observed that the sub-ward community had protected the site with old fence material which they had collected amongst each other. Two community members who were involved were interviewed. Their reasons for protection of the site were that since construction of stone packs and planting of kikuyu and vetiver grass, the vegetation had reappeared to cover barren areas, which had previously showed red patches and extensive erosion.

“My interpretation of the case is that community individuals are capable of organising themselves and resources around the project that they find beneficial to them. This group had identified the stone-packing technique as one of the effective techniques. The protective measures that they implemented to protect the site indicates their commitment to the rehabilitation process”.

Mpameni individuals apply their experience of stone packs in building a ‘bridge’.

“During a transect walk I went on with the OMG and volunteers in Mpameni sub-ward we crossed a stream. In the stream there were five community members who were busy constructing a 'bridge' in the stream. I observed that the group had used stones as well as old material (an oil tank) in their construction process. Mr. Maphalala was interviewed on the objectives of the exercise and the materials they had applied. He first mentioned that the stream had only started as a small donga and that as time went on, the "small" river was created, making it difficult for people to cross. He went on to say that cattle and old people in particular, were experiencing difficulties when crossing the stream, especially during rainy days, as the stream sometimes floods. They had decided as a group to use stones to protect the tank that was placed in the middle of stone packs. Their use of stones was derived from their experience of many successes with their application of them in prevention of soil erosion. Together with the stones they had used a tank, to help water pass easily through the ‘bridge’.

During the transect walks, individually and with the group I had also observed that in their homesteads, people have selected and applied particular conservation techniques for various reasons. For example, Mr. Magwaza (Qolweni), Ms. Shoba, and Mr. Majola (both Mpameni) have all used vetiver grass as well as stones at the edge of their yards as well as in their gardens, to prevent erosion of soil as their gardens are on a steep slope. However, applications were found to be not only directly related to erosion of soil. For example, Majola responded that he also used vetiver grass to divert excess amounts of water, which moved towards his house, which he feared that it would cause the building to fall down”.

Volunteers

One of the positive outcomes of this project is the transfer of technology to a number of volunteers who have worked on the project with no pay. Some of the reasons for volunteering are outlined below:

Ms. Makhoba:

“In general, I can say I have learnt a lot from the project and I think that is the case with most of us here. I have a relative who is constructing two buildings through application of stone pack structures, a technique that he has learnt from the project. One building is for his family and the other is a chicken house. LandCare is a community project and it should continue being so. We should be thankful for it and at the same time we should keep the spirit alive if we can. I felt that I had to give back to the community in the form of volunteering. Some of us did not have time before so we could not get involved. I am sure there are other people who want to get involved but some domestic issues come up and one can not avoid that”.

Mr. Khuzwayo:

“We were not clear about volunteering at the beginning and nobody ever explained clearly but now we know that volunteering is good for one’s community because sometimes the community may even choose you when the next project arrives. We hear that there might be a funding proposal developed for more rehabilitation in this village”.

Mr. Memela:

“I have always been involved in the community activities and I wanted to get involved in this activity too. I am not triggered by the possibility of employment”.

Ms. Dumakude:

“We know that it might take some time before we get another project where we can get employed, volunteering is also difficult too because one has to leave the family. Some of us have small children to take care of, while others do not have husbands who can take care of them. In spite of that there is that hope that this project will grow and maybe we can get jobs some day. But as you know in all cases, people are not like water and will never move in the same direction. Some of the people here in the community have started to make jokes about

us. They say that if we have so much time and energy to spare without any payment then we might as well help them in their respective domestic chores. This is very difficult, especially when one is aware that there might not be any job at the end. But we have faith".

By the fourth year of the project there had been a decrease in the number of volunteers from approximately 60 to 20. In some of the discussions the decrease was associated with the fact that available funding was for resources and training and not compensation for time spent on the project. However, in the fifth year the OMG reported an increase in the number of volunteers. They attributed this to the publicity that the project received through the 50:50 television programme on the work they were doing.

The Monitoring Group

Motivation to involvement in monitoring also varied amongst the group members. The motivation ranged from benefits to the project, dedication to development, accumulation of knowledge, as well as sharing of skills in soil rehabilitation. Over half of group members were also involved in other community projects.

During the five years of the project the number of members in the OMG decreased from 24 to 10. The reasons that were given by the group regarding the decrease in number ranged from job hunting, deaths of relatives as well as OMG members and other domestic reasons (e.g. ill health). The chairperson also reported some cases of members leaving the group because they did not have enough food at home to cope with the physical aspects of monitoring. Most members, especially the youth have withdrawn because of no money. It is the older people who were at the start of the project who have stayed.

Technology transfer to the Mnweni community

One of the aims of the study was for technology transfer of monitoring techniques to take place in the adjacent communities in Mnweni which falls under the amaNgwane traditional area. Three fixed point sites were identified in each of the wards of Mnweni (Mabhulesini, Manzana and Khokhwana) for installation of monitoring techniques. The techniques were the splash board, splash cup, run-off plot, basal cover, and the donga profile. Although Mnweni has had a number of rehabilitation projects over the last ten years funded by different

organizations (e.g. Rand Water, LandCare, the Maloti Drakensberg Transfrontier project, DEAT) there have been few quantitative records kept to validate their accomplishments. Training workshops were therefore arranged and conducted by members of the Okhombe Monitoring Group (OMG). Training was mainly on installation of monitoring techniques, maintenance and data recording. Sites suitable for the equipment were identified by the Mnweni donga committee. Equipment was installed in Manzana in the presence of the Mnweni committee. The Mnweni donga committee decided to change the Mabhulesini monitoring site to the eroded site directly in front of the Cultural Centre. They felt that this would be more appropriate as the site needs to be improved for tourists and it is likely to have more visitors.

The training of amaNgwane community members by the Okhombe Monitoring Group is a good example of successful community-to-community learning and technology transfer. Communities had started to undertake cross visits to learn from each other, and share past and current experiences related to the project. Unfortunately this process ended when conflict arose with the initiation of a donga rehabilitation project by Rand Water. In an initial meeting with Rand Water and the project team, the team made a plea to create synergies rather than setting up new structures that would unnecessary compete with the project. Rand Water acknowledged that monitoring was an important part of their project and agreed that synergies could be made with monitoring their rehabilitation process. However, the technical staff implementing the project did not keep to this agreement and would not allow the donga committee to monitor their work. The Rand Water project funded by DEAT was a job creation project which provided valuable income to all employees, including the Mnweni donga committee. However, conflict arose when Rand Water would not pay donga committee members for time spent on monitoring or attending training. The initial stand by Rand Water to only appoint the Mnweni donga committee (which had 10 years experience in land rehabilitation) as semi-skilled labourers also resulted in considerable tension in the community. In spite of efforts to develop a co-operative strategy between Rand Water, the Maloti Drakensberg Transfrontier project and the WRC monitoring project this was not achieved. A decision was made to stop the rehabilitation monitoring programme at Mnweni.

Importance of communication in technology transfer

Open discussions during the field training days were critical for technology transfer and building the capacity of the community in understanding the concepts and causes of soil erosion. An extract from the notes taken during a field trip on 19 July 2002 illustrate the importance of these open discussions:

"The project team members walked up to the Enhlanokhombe rehabilitation site to meet with members of the OMG and community volunteers. The site is fairly extensive and is therefore unfenced. Many stone-lines have been constructed to combat the dongas that are there. The group gathered at the base of the rehabilitated area and introductions were made. A spokesperson (Nhlanhla Miya) then reported back on work done at the current site. Rehabilitation first began in November 2001. The cattle paths that descend steeply down from the upper grazing areas originally caused the dongas, and this problem remains unresolved, as the area is not fenced. Consequently, there are also problems with the animals eating the grass that has been planted and breaking down some of the stone walls. However, it was acknowledged that the contour fence had reduced animal movement, and consequently erosion, in the area.

The OMG raised a concern that the shrubs prevalent in this area (*Felicia fillifolia*) increased the erosion, as their roots were exposed and they were often found in badly eroded areas. A long discussion followed as to why this was not the case, and Dr. Moodley (CSIR) pointed out that the shrubs actually retarded soil loss. He showed examples where erosion had taken place on either side of a particular shrub, but where the root network of the shrub itself had bound the soil. He likened this to the roots acting as "glue" for the soil.

A second concern of the OMG regarding the shrubs was that they had deep root systems, which used high quantities of water. Closer inspection of the shrubs revealed that the root system was in fact fairly shallow and not deep enough to penetrate the water table. Mr. Xaba (CSIR) explained that other tree species found in the Okhombe valley (e.g. *Acacia mearnsii* and *Populus deltoides*) were much higher users of water, especially when they occurred near streams and springs. Dr. Everson (UKZN) suggested that it would make an interesting

project for the OMG or a school group (with the help of the CSIR) to compare the water use of shrubs and trees.

Another concern of the OMG was that there appeared to be very little grass around the shrubs and they wanted to know whether the shrubs actually discouraged the grass from growing. Dr. Everson explained that these shrubs were evidence of over-grazing (coming in when grass cover was depleted) but that they were still better than no vegetation at all. Dennis Nhlanhla added that the Ngubhela site also resembled this site at one stage, but that after fencing and rehabilitation the grass had grown well together with the shrubs. Ms Monatisa (FSG) mentioned that elsewhere in the valley it was possible to see grass and shrubs growing well together. It was agreed that cows did not eat these shrubs, and that birds distributed their seeds. Mrs. Mavundla asked whether *Eragrostis* grass would survive at this site, and Dr. Everson suggested that they try planting some to see what the survival rate would be.

The OMG made a good observation that the red soil appeared to be more severely eroded than the black soil, and they wanted to know the reason for this. Dr. Moodley introduced the concept of erodibility and Ms Monatisa suggested that this was linked to soil structure. Mr. Gush (CSIR) suggested that the black soils were more fertile (higher humus content) and were consequently less erodible while the red soils were less fertile (higher iron content) and were therefore more prone to erosion. Dr. Everson mentioned that this was an aspect that could be incorporated into an exciting community research project.

Following these general discussions Dr. Moodley proceeded to demonstrate the use of a Morgan Splash Cup as a soil erodibility measurement technique."

6 PAYMENT FOR ENVIRONMENTAL SERVICES (PES)

A baseline study on Payment for Environmental Services in the Maloti Drakensberg region has been carried out by Diederichs & Mander (2004). They reported that key government agencies have expressed a willingness to invest in the development of a payment system for the Bioregion. This is based on the strategic nature of the environmental services generated

in this region. For example, 25% of South Africa's water is generated in this area, the natural resources are the only productive asset for the mountain communities in the Bioregion, part of the area is a world heritage site and global warming is likely to generate water scarcity in southern Africa, with great demand for water security. Diederichs and Mander (2004) state that there is an emerging opportunity as various government agencies are currently seeking effective income distribution mechanisms for natural resource-based public works programmes, based on the success of the Working for Water programme. The PES initiative can also be related to catchment management agencies which are required to levy water consumers and implement catchment management. This will necessitate the identification, quantification and monitoring of management actions and services in terms of delivery.

The records that are kept by the Okhombe Monitoring Group on the reduction of soil erosion and improvement of water quality may therefore have long term benefits, both for the community and for water users further downstream in the catchment. The initiative by the Maloti Drakensberg Transfrontier project to develop a strategy for the payment of environmental services in the region will promote the effective management of the area. Although still in the pioneer stage, the payment of communities for looking after their natural resources has the potential to ensure the sustainable management of this important catchment area.

The National Water Act, No 36 of 1998, allows for the nation's water resources to be protected, used, developed, conserved, managed and controlled. In undertaking these actions the Act requires that several factors need to be taken into account including the protection of ecosystems and prevention of degradation of water resources. In addition, the Environment Conservation Act, No 73 of 1989, aims at protecting natural ecological processes against harm caused by human activities, promoting environmental education and the effective management of cultural resources, and the co-ordination of integrated environmental management programmes. In order to achieve these objectives and at the same time create income generation opportunities for communal land users, the government may consider funding water resource management by rural communities.

The intention of PES is to get down stream users or the government to pay communities in the catchment area for good quality water. This will necessitate the development of indicators of water quality and quantity. The WRC monitoring project therefore has the potential to play a key role in future income generation for the community. The baseline data that the OMG collect will be critical in establishing indicators for PES. One indicator that is not being measured is water quality. Water quality is a key service to many stakeholders (e.g. municipal, local and district government agencies, catchment management associations, Rand Water, conservation agencies, communities and the private sector. Currently there are no data on the effect of different land uses in communal areas (e.g. grazing, cropping) on water quality. If PES is to be effective there is an urgent need to develop appropriate indicators of water quality, water quantity and landscape quality. These indicators could be linked to social measures of water quality (e.g. taste, diseases, sickness, colour) as many people still collect water directly from streams for drinking. The community have different ways of cleaning water (e.g. jik, filtering etc.) and these should be documented and related to quantitative indicators of water quality. The OMG has the capacity to participate in research and education on the effect of different land management practices on water quality and quantity for the implementation of a payment system.

7 CAPACITY BUILDING

- Members of the OMG have become trainers of the monitoring techniques
- Mr Mthethwa has received training on oral history techniques
- 80 members of the Mnweni community have been trained in 6 monitoring techniques
- Capacity building of OMG to present data to the traditional administrative council and Okhombe community
- The project has focused on capacity building of the members of the Okhombe Monitoring group and volunteers. They receive continual training on different techniques to monitor soil erosion, basal cover and runoff.

- Members of the Okhombe Monitoring group have also received training on data collection. Different members are responsible for keeping regular records of the raw data.
- Training has also taken place on report backs, speaking to the public and time-keeping during presentations and meetings.
- Ms Khumbu Zuma completed her Masters degree on ”Humans are not water – a social analysis of development process of a community based monitoring system: a case study of soil rehabilitation in Okhombe, South Africa”. 2003 Wageningen Agricultural University, the Netherlands. She also presented the following seminars:

  i) “Preliminary findings and theoretical framework of MSc study on the development process of a community based soil rehabilitation monitoring system in Okhombe” (Wageningen University, The Netherlands).

  ii) “Conceptual framework and the models developed for the social analysis of the development of a community based monitoring system” (University of Newcastle Upon Tyne, United Kingdom).
- Mr Mahlodi Tau worked part time on the project and developed skills in institutional development in land management. He completed his Masters degree on “Grazing management in the communal areas of the Upper Thukela, KwaZulu-Natal”. 2005 University of KwaZulu-Natal, Pietermaritzburg, South Africa.
- Mr Joshua Xaba, a research assistant on the project, was mentored in teaching skills while participating in the environmental education part of the programme.
- School groups participated in the “adopt a donga”programme which formed part of their education programme on environmental conservation.
- The capacity of the community has been built with respect to environmental management through regular report backs, site visits and workshops. This enables them to make informed decisions on the conservation and management of their natural resources.
- Business plan development - the OMG has received training on how to draw up a business plan (estimation of labour, material and costs etc.) so that they can apply for funding for their work.

- Computer skills training

* Ability to identify basic computer programs (word and excel)
* Ability to type in the above mentioned programs
* enter relevant data into spreadsheets
* Plot graphs using excel
* Knowledge of interpreting the behavior of the graphs that have been plotted using five monitoring techniques (Donga profile, Basal cover, Runoff plot, Splashcup, Splashboard)

In order to assess the level of capacity that the OMG had achieved, different stakeholders were asked to assess their performance. Responses of the stakeholders were in turn used as a reference for identification of needs, observation of perspectives, as well as interests of the stakeholders.

Members of the OMG were asked to assess their own performance in relation to their achievements and challenges. It was agreed that knowledge and information about monitoring techniques had accumulated amongst the group members. Ms. Hele one of the group members described different types of techniques and identified those that she perceived as relevant for application in the sub-wards in which she was monitoring. However, the group commented that in some cases their level of performance (which was interpreted as visiting the fields and monitoring, and pinpointing change as well as advising the volunteers of relevant rehabilitation techniques) was threatened. For example, two community members (Heshe and Majola) whose homesteads were built near the most erosion-sensitive areas, had said they had a problem of dongas that were ‘eating’ towards their homesteads. The Department of Agriculture’s technician had advised them that the problem could be controlled by the application of gabions and promised to help them with this. However, lack of co-operation from the technician’s side had caused these community individuals to perceive the OMG as not having any positive impact in the community. They viewed the task as the responsibility of the OMG who should have taken up with the issue with the technician. When asked why he had not visited Okhombe the Department of Agriculture technician’s response was 'Okhombe people know what they want. They do what they want. I think the OMG and volunteers do not need much help. They can manage on their

own now. In my opinion I think the group has accumulated enough skills to continue on their own. The group can now advise and even recommend conservation practices that they have found relevant for application in the catchment". These comments indicate technology transfer to the OMG has been successful.

A critical dimension of capacity building of a group such as the OMG is the ability to manage and plan activities. During the assessment it was found that the group had already used different strategies for their group management. For example, they divided themselves into sub-groups to decrease the amount of work performed by the group. Assignment of particular individuals to different activities was also apparent. Five individuals (Mr. Maphalala, Mr. Nene, Mr. Dube, Mr. Hlophe, and Mr. Nala) were elected to co-operate with the livestock committee on the maintenance of fence. These individuals were also regarded as knowledgeable and informed about the fencing issues. During the study, some of the members left the group for a variety of reasons (e.g. Mr Hlophe left to serve on the Amazizi Traditional Administrative council). To overcome this problem a number of volunteers were canvassed by the OMG to join in their training in monitoring techniques as well as workshops on development of indicators. Secondly, the group also viewed their division into sub-groups as an enabling factor for them to deal with other tasks at both domestic and community levels.

Capacity building of the OMG to develop a business plan enabled them to submit a project proposal to DEAT to manage and monitor the Donga Reclamation Project. Although the proposal was not successful, the OMG have the skills to apply for funding from other agencies which may ensure the sustainability of the project.

8. CONCLUSIONS & RECOMMENDATIONS

Overall the OMG has mastered the basic scientific skills of communicating the differences made by the rehabilitation work in the form of graphs. However, this computer training in Microsoft excel is demanding, especially as the average member of the OMG has little formal education. The current training comprised one to three training workshops a year for three years. The biggest problem was that between these training sessions there was no exposure to computers. The OMG emphasised the need to get access to computers for regular

training because they were beginning to forget some procedures even shortly after each training session. It is recommended that training should be carried out with continuous access to computers to enable people to practise what they have learnt. A five year period is more realistic for achieving full understanding of data analysis especially for those community members with little or no formal education as they tend to take longer to master the exercises they are given.

Continuation of building the capacity of the OMG in computer literacy and data analysis is strongly recommended for the following reasons:

- the training promotes learning amongst the group members
- The OMG would like to develop independency to continue with the work on their own.
- The OMG wish to be able to transfer their scientific skills to the neighbouring communities that are facing the same problems as them.
- While ownership of the data has been attained, sustainability needs to be achieved. Analysis of the data and the use of graphs to illustrate the positive changes that have taken place is an incentive for those passionate about their land.

Specific recommendations in terms of the computer literacy are:

- Continue with the computer training at least three times a year.
- The group needs clarity on the data collected from the Splash cup (A's and B's) and the donga profiles which did not always follow the perceived changes after rehabilitation
- Basic Mathematics and English should be included in the training programme
- Training of others such as neighbouring community members could be a way for the OMG to remind themselves of how to plot the graphs (however, this exercise should be closely monitored by the trainer).

The sustainable management of Okhombe is dependent on the ability of the community to recognise and define problems and to generate and implement solutions in an ongoing, dynamic manner. One of the main lessons from the project was that social and technological

issues must be integrated when developing solutions to environmental problems. From the start of the project the community were involved in decision making on topics ranging from short term planning (e.g. date of next meeting, catering) to complex issues (e.g. development of an action plan, selecting work teams, establishing a donga committee). This has led to the ownership of the project by the community.

This project has facilitated the Okhombe community to take the initiative in environmental management of their area. The process has been challenging, requiring a high degree of flexibility and commitment by both the project team and the community. The commitment of the people of Okhombe to take responsibility of their natural resources is a crucial step in the long term process of catchment management. The efforts of the Okhombe and Mnweni communities in this process were rewarded when they won a silver award worth R20 000 from the Impumelelo Innovations Award Trust. The Trust rewards exceptional projects, which involve partnerships with the public sector that enhance the quality of life of poor communities in innovative ways. The use of scientific techniques as a tool to monitor and improve the water resources of this catchment area was one of the innovations for the award.

No single technique can be recommended for rehabilitation at Okhombe as each technique has specific advantages and disadvantages. The success of the technique depends on the extent and type of erosion, availability of material and how well it is constructed. Through the workshops and field days the work teams have built the capacity to evaluate each situation and apply the most appropriate technique.

At the final project meeting the group was asked to identify indicators of success of the project. Mr Ndaba noted that community members had built stone packs and planted grass at their homesteads. Mr Ndlovu stated that there has been a decrease in destruction of equipment and materials. People (especially children) and livestock no longer play with or damage the equipment.

Mrs Hlubi noted that the level of awareness is up. Rehabilitation is discussed at homes and public meetings. More and more people are aware what the OMG are doing. Mrs Mavundla said that it is not just people talking at public meetings and homesteads, but people are

planting Vetiver, diverting water, asking where they can get Vetiver. Maqoqa school encourages pupils and refers to the OMG and their work. Pupils can relate the work to what teachers are teaching. Teachers are even referring to OMG members by name in their classes.

Mr Ndaba said that it has led to an increase in the number of volunteers although these do fluctuate. It is easier to sign up people to help. Mr Ndlovu said that sometimes the volunteers take over the work.

Themba said that there has been a big decrease in damage by livestock. Since they have started working as a group with the livestock committee they have turned things around. They make suggestions to cattle owners where not to move cattle and people listen to them. They are also involved with individual livestock owners.

The OMG said that they are skilled now and can train other people and tell them what to do. Visitors to the area notice the work even if they don't know what it looked like before. People want to take what they have seen to their home countries. A visitor from Ghana was very excited by the work the OMG are doing.

Themba said that publishing the work has sharpened people's behaviour towards the OMG – they used to think the OMG were there for fun. They now know that they mean business. The 50:50 TV-programme was very important and had high value. The media has played a role in educating people. Other areas have approached the OMG to find out how it was formed and how they got their knowledge. They want more information on how to acquire skills and want specific training. Being on TV was very important. People associate people on TV as being educated. Only people with a level of education are on TV, so it shows that this level has been achieved. People not only from Ladysmith but also as far as Johannesburg saw 50:50 and have been asking where they can get training. It is not just the elders, but especially the youth that want training.

The project sign has also been important in advertising the project, especially the sign on the main road. People are asking about the sign and want to get involved in the work.

Training people at Busingatha and Obonjaneni has led to people showing a lot of interest in wanting to gain skills. It has led to 1:1 communication, not always big groups.

Everyone said they had learned a lot with the computers. They never imagined when they first started the project that they would sit in front of a computer. They thought that was only for learned people. Mrs Mavundla said that when her brother looked through her data files he commented that the standard was very high and if she had gone to school when she was young she would have gone very far. Mr Dladla commented that even though he is a Zulu person he can't write Zulu. The learning is difficult but it has had a deep effect on him.

It is apparent from these comments that the OMG is a strong group that has the respect of the community. The training they have received is a starting point, from which to build further understanding and skills. These skills should be related to the development and monitoring of indicators required by the Payment for Environmental Services initiative (e.g. water quality). In addition to the technical skills obtained, there has also been the development of a range of transferable competencies such as improved communication and negotiation skills, improved literacy and numeracy, and teamwork, all of which can help strengthen other aspects of people's lives (Sistika, 2006). The education and training carried out in this project was both a scientific and a social process, bringing people together and contributing to the development of the community as a whole.

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APPENDIX 1. Interview with Mrs. Mavundla

Name of The Interviewee: Mrs. Florence Nomusa Mavundla
Name of the interviewer: Mr. Senzo Mthethwa
Job Title: OMG Member
Date of The Interview: 11 March 2004-06-28
Time of The Interview: 13:30 – 14: 50

Summary:
Mrs FN Mavundla is the current Chairlady of the Okhombe Monitoring Group (OMG). She has been involved in many projects in Okhombe, as she says she thinks people have faith in her. This is one interview where a lot of information was gathered. In this interview Mrs Mavundla explains how the formation of the OMG took place, and also how the rehabilitation work was carried out, the importance of camps to the community and other related projects, which took place when the project started.

When asked as a Chairperson what will happen as the project has pulled out, she explained that it is not going to be easy but she foresees a good future for her team as they have abundant knowledge and experience.

English Version

SM - What is your name?

FM - I am Florence Nomusa Mavundla.

SM - Where do you live?

FM - I live in Okhombe.

SM - How old are you?

FM - I am 46 years old.

SM - Who do live with?

FM - I live with my husband and children.

SM - Where were you born?

FM - I was born in Msinga and I got married in Okhombe in 1977.

SM - Are you a member of any committee in Okhombe?

FM - I have been involved in several committees including Day Care Centres, Development and I'm currently a Chairperson in the Okhombe Monitoring Group (OMG).

SM - Anything else you would like to tell me?

FM - I think my working with the community is appreciated as I have been nominated as a chairperson of the committee. I am a person who discusses different issues with people and I am always willing to share ideas with anyone. It's a long time I have been a member in committees from 1983 and we've been working well with the community.

SM - How do you with your family make living in Okhombe?

FM - My husband use to take care of everything before. Now he is not working so I'm the one who used to get some money from the Landcare project. That's what made us able to survive but so far, we have our daughter who is working and she is the one who is taking care of us (giving us some money). Besides that, we used to sell broiler chickens so that we are able to send of our children to school. Three of our children are in high school and the other is still in primary school.

SM - What do you like about Okhombe?

FM - In Okhombe we have cropping fields although we have not been able to utilise them fully due to livestock problems. In Okhombe we also have large grazing areas where our cattle graze enabling our kids to also go to school.

SM - What is difficult about living in Okhombe?

FM - One thing, which is bad about living here, is that we don't have roads leading to the sub-wards. We don't even have electricity. People are jobless here and only part time jobs, which seldom take long, which is why most people's living standards have not improved. We have worked a lot with projects we just hope that job opportunities will come and we hope that the future holds a lot for us.

SM - When did you get involved with the Landcare project?

FM - I was in the development committee with Mr Ndlovu (Michael) so this project arrived when we were with him in this committee. We were also there when the research in the mountains was conducted and we were discussing with the researchers. We wanted to find solutions on degrading land (soil erosion) and how we could return the situation to its original state. They (researchers) came back with solutions in 1999 and they promised us that the work was about to begin. We started working and it showed that something was going to happen. Each sub-ward had its own workshop. During these workshops, we were shown maps and some pictures showing this area before. To draw our Okhombe map we used beans, maize meal (showing homesteads and livestock) to show what we have in Okhombe.

SM - What do you think the reasons were for the start of the project?

FM - Soil erosion was a problem. In their findings researchers found that in mountains water is flowing on a high speed. This speeding water ends up creating dongas, that's why Kikuyu and vetiver grass have been used to help reduce this speed. We also used stone packs, stone lines to stop this. Previously we've been using contours, we adopted using swales, which we also stopped using them because they further soil erosion.

SM - How can you describe Okhombe?

FM - Okhombe has lot of attracting and interesting things. As I was born at Msinga, I always used to see Drakensberg Mountains on the map. This area is known for its huge mountains that are rarely seen anywhere else in the country. Okhombe is also known of its craftwork (using wood and sewing). Okhombe is also known for having many peaches (almost all homesteads have got a peach tree in their yard).

SM - How do you identify a person from Okhombe?

FM - You can only identify them by language (type of Zulu they speak). It is easy to identify others, for example people from Msinga they have markings in their faces and that is the only way you identify them**.**

SM - How did you go about drawing the Okhombe map?

FM - We wanted our places that we live in to be known. We sat down and we drew the map showing the whole of Okhombe, homesteads and the mountains. Okhombe has six sub-wards.

SM - Can you remember the visioning plan that was developed for Okhombe?

FM - Five people were chosen per sub-ward to form a committee. These committees were liquidated due to their failure to function as expected. Some of these committees were working hard but there was a need to form a new committee, which was called Okhombe Monitoring Group (OMG). This committee was going to continue with the Landcare. This committee consisted of hard working people who were also committed to the work. This committee consisted of 24 members at first but as the time passes by some members retired so, we ended up being 14. This committee was committed to serving the people and making sure that every one benefits from the Landcare project. In each sub-ward, we selected 12 people but when funding dried up, we opted to use volunteers. When this was happening our volunteers decreased dramatically. The OMG committee continued with the work although they were not paid, because the aim was to see the situation change from what it is right now to returning to its original state. In previous years, there were no dongas and soil erosion as is the situation right now.

SM - What methods were used in the project to control soil erosion?

FM - We used stone packs at first taught by Kwazi and Mdu. Mdu was an expert with stone packs. He used to run on top of the stone pack and he will tell you to start afresh if not well constructed, [trying to remember and smiling]. We learned this because the stone pack stops soil from being washed away, and then we plant grass on top so that water percolates down. We are using vetiver grass with Kikuyu grass, which helps a lot in supporting the growth of indigenous grass and other vegetation. Now there is a decrease in water speed since in the dongas we've integrated grasses and trees. This shows that we can be able to avoid the spread of dongas. We've also seen that we couldn't do this work in all affected areas because these fixed sites needs fencing. Due to this, we decided to fence the fix points, which have been selected according to the way the area is degraded. In these areas, we've constructed the stone packs and we've planted some grasses. We wish to do the same in all other affected areas, the only limitation will be the fencing material. These dongas won't come near your

homestead as it has been the case. Even in your yard, you can put a stone line or stone pack, which help keep your yard in the level.

SM - How did you manage soil erosion before the project started?

FM - During the Lima project 2 families in Mahlabathini were assisted where dongas were closer to the homesteads. As of now these dongas are not active as they were. In these dongas, gabions, shebeleza, planting of vetiver grasses was carried out. We've also used shebeleza in our roads. When Landcare arrived, we already had knowledge about soil erosion and the ways to avoid it, which made it easier for us to learn. We've opted to stop using the swales as they further erode and give rise to dongas. The reason being that water in this furrow like structures is difficult to control. We even constructed stone packs in the swales to try to minimise erosion but it proved fruitless. If somebody could come with the new ideas of using these swales without creating problems we will welcome it with both hands.

SM - How did the project try to solve the problem of the lack of firewood?

FM - During the Waterwise project woodlots were destroyed even that of Inkosi although it was not finished. In my opinion, Landcare was not able to address the problem of firewood shortage here in Okhombe, despite fencing the fixed points, fencing the grazing camps and constructing the crush pens. However, we were able to learn something with the trees that we planted in the fixed points. What I've learnt is that these trees are indigenous and we can use them for firewood in the near future. Goats have been the biggest competitors to the growth of these trees. If there was land available, it was going to be good to have these trees in larger scale as to help the people of Okhombe with firewood.

SM - Can you tell me about the various ways that are being used to monitor the success of the different erosion control methods?

FM – After the completion of fencing of the fix points, we had workshops where we were trained on how to monitor our work. Terry purchased instruments like splash cups, splashboards, and basal cover with run-off plots. With these instruments, we are able to monitor difference from the time these instruments were placed in the fixed points. The most important thing that we needed was to observe whether soil erosion is minimised or increases from the time these instruments were placed. We also monitor whether grasses or vegetation is emerging where it was bare. We also monitor the increase of splashes on the splashboards. For example, in Mpameni fixed point, the splashes were at nine in the splashboard but now they are very low because of vegetation that is growing in that site. Most of the knowledge as

I've said earlier will be used to find differences through comparing. In the dongas, you have to use paper and pen for recording. The plank with numbers is used to measure the width and the depth of the donga. This plank is placed along the wire across the donga. We also use the tape to measure whether the donga is further degrading. Inside the donga is a standard which measures whether soil is accumulating in the donga. We put the measuring tape lengthwise from the marks on the plank. Inside the donga, there are stone packs, grasses and trees. The roots of these trees and grasses support the donga by holding the soil.

SM - What have you learned from the monitoring?

FM – Monitoring helps, us check whether we are realising our objectives. For example, the splashboard is very easy to read and it is easy to demonstrate to other people. Runoff plots also helped us a lot and you are able to monitor many things at one time e.g. monitoring water and soil that was washed away, comparing that with the emergence of vegetation. The Morgan splash cup also helps but we are experiencing problems when it is rains heavily because you are unable to record accurately. It helps a lot to monitor your work, you feel the work you are doing is worth it and you also feel encouraged doing your work.

SM – How has your life change through your involvement in the project?

FM - There is lot of change that this Landcare project brought. It came at a time where one of our children was schooling and I had to assist his father. I was able to buy the house needs and my husband paying at the college, as I'm talking to you she has graduated. I was also able to buy school uniform for other kids and a lot was bought from this project money. Besides what I gained, there are families in the neighbourhood who were able to build houses. In other families, hunger has been a huge problem but when the project came their lives changed. Like me, they were also able to pay schools fees for their kids. I hope this can paint a picture for you at how Landcare changed the lives of the people of Okhombe although not all people. I also think this is what encouraged them that is why they are still volunteering even now.

SM – What will happen as the project team has left?

FM - With the way we are committed, we will continue caring for our land although it is going to be tough as we will be taking responsibility. As I've stated in the beginning that we still have other fixed points, which are not fenced, it is impossible to work in because of livestock that keep coming in and messing up with the work. We hope that funding will come

from somewhere, so that we are able to purchase some of the things we work with, and we will not lose power.

SM – How have you shared the knowledge you gained from Landcare project team with other people in the community and from other areas?

FM – We are planning to teach other people like community members so that not only the OMG knows about what is happening in the mountains (Landcare work). What we would like them to know is to be able to compare and see the difference. We are also teaching and demonstrating to volunteers on how to take records and use the instruments in the fixed points. The community gets the chance to know this work in the community general meetings and these helps a lot, because we also get a chance to showcase our work and make them aware of this work. They then become aware and look after their livestock, which is sometimes a problem in the fix points. People who live near the fix points become our eyes. For example: there is one man from Mpameni who has been helping in chasing out the livestock from the fix points. We need people like this man who are willing to take the ownership of this work. Our neighbours from Ogade like the work that we are doing and they want to join us to do the same in their area. It seems they received funding from Landcare and they need us to teach them this Landcare work. We have made some plays and songs about taking care of your natural resources. Kids and the community enjoyed these plays and songs, which demonstrate what we do and what we want to achieve.

SM – Is there anything more you would like to tell me?

FM – I would say the project went well here in Okhombe although there are problems as it is pulling out. These are monetary problems because there are still things that are to be purchased. People won't lose power as the project is ending I'm saying this because we are currently experiencing an increasing number of volunteers. Teachers from Okhombe have also put it clear that they need us to teach the learners especially in the lower grades about Landcare. There is a donga near the school, which is going to be rehabilitated by OMG, teachers, and learners, which will make this memorable in children's minds, and we hope it is going to become the culture to care for land in Okhombe.

APPENDIX 2: DATA SHEETS DESIGNED BY THE COMMUNITY

1. UBUKHONA KOTSHANI / BASAL COVER

Usuku_____ Kuphi_____

	1	2	3	4	5	6	7
1	X					X	
2			X				
3					X		
4							
5							
6							X
7		X					

Where there is grass, **X** letter will be used to mark that area and where it is bare the space will be left.

2. MORGAN SPLASH CUP

H:\data sheet MORGAN SPLAH CUP

Kuphi: _____

Igama lomuntu _____

Usuku	**Imvula (mm)**	**Inombolo yenkomishi Umhlabathi (mm)**	
		A	**B**

3. SPLASH BOARD

H:data sheet SPLASH BOARD

Kuphi: _____

Splashboard Letter: A_____B_____

Igama lomuntu: _____

Usuku	**Imvula**	**Ukujula komhlabathi**	
		A	**B**

4 RUN-OFF PLOT A HLABATHINI

H: data sheet Run off A Hlabathini

Kuphi: _____

Inombolo: A _____

Igama lomuntu: _____

Usuku	**Imvula**	**Amanzi (mm)**	**Umhlabathi (mm)**

5 RUN-OFF PLOT B TSHANINI

H: data sheet RUNOFF PLOT B Tshanini

Kuphi: _____

Inombolo: B _____

Igama lomuntu: _____

Usuku	**Imvula**	**Amanzi (mm)**	**Umhlabathi (mm)**

6. IMVULA (Rain gauge)

H: data sheet RAINFALL

Kuphi: _____

Igama lomuntu _____

Usuku	**Imvula (mm)**

7 UKUJULA KODONGA / DONGA PROFILE

Kuphi: _____

Igama	Usuku	50cm	100cm	150cm	200cm	250cm	300cm

The donga profile data sheet is extended according to the width of the donga being measured.

8. WEIRS AT MPAMENI

Date	Time	Water Level		Comments
		A in fence	B out fence	