SUSTAINABLE CONTROL OF INVASIVE ALIEN VEGETATION: PERCEPTIONS OF STAKEHOLDERS OF THE EMPOFANA RIPARIAN REHABILITATION PROJECT

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ABSTRACT

The eMpofana riparian rehabilitation project (eMRRP) is a pilot project started by Umgeni Water (UW) to demonstrate how effective the removal of invasive alien vegetation is in improving the water yield of a catchment. The disturbance of the country's vulnerable wetland and riparian zones is a major factor contributing to water stress. The study area was eMpofana riparian areas of KwaZulu-Natal midlands.

The study was conducted to establish perceptions of property owners and project employees on eMpofana riparian rehabilitation project with regard to control of invasive alien vegetation. Apart from these two categories of stakeholders, others whose perceptions were included in the study are one official each from MONDI, SAPPI, the National Working for Water Programme (WFWP) and KwaZulu Natal Nature Conservation Services. However, property owners and project employees were the main respondents of study.

Although all stakeholders play a crucial role in the project, property owners were selected because clearing takes place on their properties. Similarly project employees perceptions were vital as they are physically involved in clearing invader species and are direct beneficiaries of the project through job creation.

To enable interviewees to give their perceptions on various steps on the project cycle, the following key issues were selected; Awareness, Process, Water, Biodiversity, Tourism, Capacity building, Support, and Sustainability of control of alien invasive plants. Based on these key issues, a questionnaire was drawn. There were fifty-two respondents: 25 property owners and 27 project employees.

The approach used in the study was survey research, and social science methods were employed. Survey research was chosen for this research because of its capacity to provide appropriate data on perceptions of stakeholders of the eMpofana project. The method is useful in a variety of situations such as providing solution to a problem of public policy, provide required data for managing a business or simply for testing hypotheses developed by scientists in the social world.

The questions on awareness of the eMpofana riparian rehabilitation project (eMRRP) and the National Working for Water Programme (WFWP) revealed low awareness

levels of the two projects. Almost half (48%) property owners indicated little awareness of the national WFWP and almost the same percentage i.e. 42% had little awareness of the provincial WFWP. Also 96% of eMpofana project employees indicated no awareness of the WFW national level and 70% said they were not aware of the WFW provincial level. Given that WFW is a national programme with over 200 alien plant control programmes countrywide, one wonder why awareness was so low among the respondents.

As for involvement in the project conceptualisation, none of the respondents interviewed indicated involvement in that project phase. However all the project employees indicated that the project was successful (85% very successful and 15% successful).

Fifty six per cent property owners indicated very strong support mainly because of re-establishment of biodiversity through ridding the riparian areas of invader species. Ninety-five per cent of the project workers indicated that UW solely supports the eMpofana project and that that support is mainly financial.

As for job creation, 88% project workers were of the view that eMpofana riparian project was very successful in creating jobs.

It is worth noting that both property owners and the employees shared the same view on water users and project employees being the main beneficiaries of the project. The impact of clearing invader species on water by the eMRRP was rated as being very significant. Moreover, 52% employees and 44% property owners felt that the project's main beneficiaries were water users in the cities and property owners themselves.

As for linkage with the National WFW programme, the perceptions of property owners and project employees revealed a general preference for eMpofana project to continue running independently. On successes achieved in various project phases, most property owners felt the planning phase of the project was the most successful, even though most of them were not involved in the phase.Thirty per cent of the employees felt execution was successful followed by financing, 30%.

As the responses from both property owners and employees show, most respondents (property owners and project employees) were of the view that the project goal of reinstating biological diversity was very important. The property owners were of the view that the re-establishment of the naturalness of the area would contribute favourably towards tourism in the area, which they rated very high. The rating explain why property owners also rated biodiversity conservation and the naturalness of the area equally high.

On the other hand, Umgeni Water's top priority is water security and the differing priorities between UW's and eMRRP could be seen as a weakness of the project. However, as a holistic view of biodiversity conservation necessitates protection of water resource in the area, the difference could be synchronised to become a strength of the eMRRP (*see recommendations*).

The eMRRP has opportunities on a number of areas such as the opportunity to participate in the national campaign on control of invader species by teaming up with WFWP and other stakeholders. Also joining this partnership would accord eMRRP stakeholders the pride of contributing to the national campaign on control of invader species.

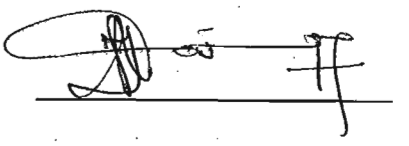
Although there is marked success made by UW in planning, financial support, job creation, gender equity in the eMRRP, there is need to address sustainability of the project.

In conclusion, it is clear that the eMRRP started off with most stakeholders having low awareness of its activities and those of WFW Programme. However, by clearing invasive alien plants in eMpofana riparian areas, the project has gained support from property owners and its employees. Property owners support the project mainly because of possible re-establishment of naturalness of the area (biological diversity) and the employees give their support mainly because of the employment that they receive. However, the goal of sustainability of the eMRRP is likely to remain elusive as long as priorities are not harmonised: property owners' priority (based on benefits drawn) is biodiversity conservation whereas that of UW is water security.

PREFACE

The research work presented in this dissertation was carried out in the Centre for Environment and Development and Institute of Natural Resources, University of Natal from February 2000 to August of the same year, under the supervision of Professor C M Breen.

The studies represent original work by the author and have not otherwise been submitted in any form for any degree or diploma to another University. Where use has been made of the work of others, it has duly been acknowledged in the text.



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This study would not have been possible to carry out without the financial support from Umgeni Water-special thanks to them. In particular Mr. Stan Jacobs, the Project Manager, deserves special mention for being supportive throughout the study period.

I am deeply indebted to my wife Margaret and our two children, for their understanding, moral, and spiritual support and for allowing me to leave them back home to study in South Africa- *Ni ngatho.*

Dave and Sue have stood with us and I thank them.

Above all, I am truly thankful to the Almighty God for His mercy and providence.

DEDICATION

This dissertation is dedicated to Winnie and Helen and all their age mates. To them, decisions made today on sustainable use of natural resources mean so much.

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ABBREVIATIONS AND ACRONYMS

eMRRP	eMpofana Riparian Rehabilitation Project
UW	Umgeni Water
RDP	Reconstruction and Development Programme
NGO	Non-Governmental Organisation
WFWP	Working for Water Programme
CMA's	Catchment Management Agencies
KZNNCS	KwaZulu-Natal Nature Conservation Services
DEAT	Department of Environmental Affairs and Tourism
DWAF	Department of Water Affairs and Forestry
GEAR	Growth Economic and Redistribution
PPRI	Plant Protection Research Institute
SAPPI	South African Pulp and Paper Industry

CHAPTER ONE

INTRODUCTION TO THE STUDY

1. INTRODUCTION

The study of sustainable control of invasive alien vegetation, as carried out by eMpofana riparian rehabilitation project eMRRP, formally started in March 2000. Prior to this, literature search on related areas of study was done starting December 1999. The period between March and April was spent in familiarisation with study area, conceptualisation of the project, questionnaire design and making appointments with potential respondents by telephone. The fieldwork took place in the first three weeks in May and data analysis was done in June.

The intention of this chapter (Chapter one) is to introduce the subject and subsequent chapters. There are seven chapters in all: Introduction, Rationale for the study, eMpofana Riparian Rehabilitation Project (eMRRP), National Working for Water Programme (WFWP), Research methods applied, Results, Conclusions and discussions and Recommendations. In addition, the chapter discusses the aim of the study.

1.1 Rationale

The rationale for carrying out this project has three dimensions: firstly, because invasive alien vegetation is a real problem in the country (DWAF, 2000). It threatens biological diversity and impedes availability of sufficient quantity and quality of water among other resources. Secondly, invasive vegetation in water catchment areas need to be removed to protect streams and rivers which receive water directly from precipitation and through surface runoff, inter-flow and ground water discharges (Townsend, 1980).

Surface runoff is precipitation water that flows across the surface of the ground to the river or stream *(ibid.)*. How much arrives there varies with rainfall intensity, rate of evapotranspiration and ground permeability. For instance an area that receives precipitation of 1000 mm, only 400 mm will typically reach the river or stream and this could be reduced further to 200 mm if short vegetation is converted to tall vegetation (DWAF, 2000).

Thirdly, sustainability of the eMRRP is of paramount importance and Umgeni Water (UW) needed to have perceptions of stakeholders on the project, established. Also there was need to understand the rationale behind the high cost of control of invasive alien plants in a bid to promote sustainability of the process. To determine sustainability, the study undertook to establish stakeholders' perceptions in seven key areas namely, Awareness, Process, Water, Capacity building (Job creation), Biodiversity, Support and Sustainability of the project.

The choice of these sections was to enable the various steps in the project cycle to be considered by the interviewees.

1.2 The eMpofana Riparian Rehabilitation Project

The eMpofana riparian rehabilitation project (eMRRP) is a pilot project started by Umgeni Water in August 1999 to demonstrate how effective the removal of invasive alien vegetation is in improving the water yield of a catchment (Umgeni Water, 2000a). The area covered extends from Nottingham Road and the surrounding areas, through Balgowan, to Midmar Dam via the Lions River (Figure 1).

Umgeni Water (UW) initiated the (eMRRP) in support of the National Working for Water Programme to engage in control of invasive alien vegetation in eMpofana riparian areas. By so doing UW seeks to provide affordable water cost effectively in a sustainable manner to all residents of its area of operation in an environmentally friendly way (Umgeni Water, 2000b). This is because control of invader species is considered a cost- effective strategy compared with building more dams and other infrastructure (ibid.). It is hoped that sustainability of the project would be achieved through working with stakeholders so as to achieve compromise and consensus rather than resort to prosecution (U2000/00/0196). The eMpofana project is described in detail in Chapter 3.

This study also discusses the National Working for Water Programme (WFWP), as eMRRP shares objectives with the national programme.

1.3 The National Working for Water Programme (WFWP)

The programme works under the auspices of the Department of Water Affairs and Forestry (DWAF) with an annual budget of approximately RI 50 million (Versfeld *et*

al., 1998). The programme is geared towards creation of employment opportunities for the under privileged as well as providing sufficient quality and quantity of water in the country. However, social upliftment has tended to overshadow biodiversity conservation and provision of sufficient water as discussion in the text will show.

To achieve the stated goal of job creation, water security and biodiversity conservation, the programme aims to maintain environmental integrity through control of invasive alien vegetation and, in so doing, to increase water availability.

The vegetation consumes over 3000 million cubic metres of water annually, propagates negative impacts on biological diversity and decreases land productivity (van Wilgen *et al.,* 2000). In its attempts to reverse the escalating degradation caused by invasive alien plants, the programme expends mainly on personnel and equipment.

At provincial level, the objectives of the national WFWP are appropriated accordingly. For instance in KwaZulu-Natal, 350 contractors under whom recruitment of local people onto the project is done, execute control of invasive alien plants (Curry, 2000, pers comm.). Key issues taken into account include gender equity, employment of youth and disabled persons. The methods of control used are mainly mechanical and chemical.

1.4 Methods applied by eMRRP to control invader species

The methods adopted by Umgeni Water (UW) in controlling invasive alien vegetation at the eMpofana Riparian Rehabilitation project (eMRRP) were, aerial mapping, projection of costs, communication with property owners beforehand, engaging contractors and recruiting labour (Umgeni Water, 2000b). The contractors and labour were drawn from local communities. The contractors had to be literate, residents of Lions River Magisterial District and registered in terms of the Fertilizer, Farm Feeds and Agricultural Remedies Act in order to apply herbicides

1.5 Aim of the Study

The aim of the study was to establish the perceptions of stakeholders on the eMRRP with a view to assessing the sustainability of control of invasive alien vegetation.

The subject matter of the study was based on the belief that invasive alien plants are a problem and that they have to be brought under control. Also it is assumed that sustainability of control of invasive alien plants in eMpofana riparian zones is dependent on the full participation of stakeholders especially property owners, on whose land clearing takes place. In addition, giving local people responsibility makes them more than mere participants, as they become owners of that which accords them responsibility (Swanepoel, 1996)

As stakeholders of the eMRRP share in the spin-off benefits from the project's undertakings, their perceptions form the main thrust of this study.

CONCLUSION

The chapter serves as an introduction to the study and the seven chapters that the study deals with.

The rationale for the study is based on the premise that invasive alien vegetation is a problem to water, land and biodiversity in the country and that it must be controlled. It was for that reason that the eMRRP was formed to demonstrate how effective control of invader vegetation is in improving water yield in eMpofana riparian areas. By engaging in control of invasive alien plant process, eMRRP also aim to create jobs: something WFWP is out to do as well.

The chapter introduces the two programmes, and puts it clear that whereas eMRRP's emphasis is increase in water yield, the WFWP's is social upliftment. Otherwise, the objectives of the two are the same, clearing of invader plants being the principal one.

Next, the chapter introduces the approach used by eMRRP to control invasive alien plants. The first step was to consult with property owners in eMpofana catchment area with a view to getting their views and consent. Secondly aerial mapping of the entire area was done then appropriate contractors and employees were hired.

The aim of the study was to establish the perceptions of stakeholders on the eMRRP with a view to assessing the sustainability of control of invasive alien plants.

CHAPTER TWO

2. NATIONAL WORKING FOR WATER PROGRAMME

2.1 Introduction

In order to set the research framework it was important to establish what the National Working for Water Programme (WFWP) objectives are and how the eMpofana Riparian Rehabilitation Project (eMRRP) fits into the national campaign on control of invasive alien plants. The topics discussed in this chapter are; aim of WFWP, Institutional capacity, Invasive alien plants, Biodiversity conservation, Strength and weakness of the programme, Control methods, Follow up and Clearing costs.

As discussed in Chapter 1, job creation and provision of sufficient quality and quantity of water in the country is uppermost on the agenda of the national WFWP. The programme aims at controlling invader vegetation which consumes over 3000 million cubic metres of water annually, adversely affects land productivity and biodiverstity (van Wilgen *el al.,* 2000)

In KwaZulu-Natal province (in which eMpofana catchment is situated), the 1996/7 annual report (DWAF, 1997) put it that the national programme spent R 34.81 million (DWAF,2000). Out of this amount, R 20.87 million was spent on salaries and wages, R 5.07 million on transport (90% of transport money was to those who had contracted the programme to transport workers in their areas), and R 1.19 million was spent on community crèches *(ibid.)*

2.2 Objectives of the Programme

According to Versfeld *et al.,* (1998) the objectives of the national WFWP are:

- to determine the nature, extent and distribution of alien invaders in South Africa at a national scale;
- to assess the impacts which these invaders may have on the water resource;
- to assess the costs of managing the current problem of alien invaders (in bringing them under control) and the costs of maintaining the landscape in a condition where invasive species are kept under control;

- to assess the costs of failure to bring alien invaders under control, i.e. to assess the consequences and costs of unchecked further invasion;
- to determine how long it will take to achieve satisfactory control;
- to prioritise the areas that should be targeted first in a national programme to control alien invaders. Water is viewed as the primary issue upon which this prioritization will be based, but other implications must be considered;
- to identify gaps in the national knowledge base, and to determine research priorities;
- to use scenario planning in determining how to take invader control programme forward into the long-term future (e.g. the clearing of lightly vs. densely invaded areas);
- to develop a vision for the future with regard to the clearing of alien invading plants.

From the objectives stated above it can be noted that the core concern of WFWP is the relationship between expansion of alien invasive plants and water supply and how this may be used to advance social upliftment. Also the objectives demonstrate the programme's efforts in working at the nexus between environmental, economic and social needs. This is because development or social upliftment cannot be achieved in a climate where stability of the three spheres is not feasible.

2.3 Aim of WFWP

The aim of the programme is enhancement of water supplies by empowering local communities to carry out catchment management projects that focus on the control of alien invasive plants (Department of Water Affairs and Forestry Business Plan, 1997/8).

2.4 Institutional capacity

Dr Guy Preston, who provides the leadership of the programme, is a special adviser to the Minister in charge of Water affairs and Afforestation. The scientific advice for the programme and projects is provided by the CSIR. Also, the Plant Protection Research

Institute (PPRI) gives supportive advice (Jelinek & Breen, 1997). Although the State President is the Patron of the National Water Conservation Campaign (within which WFWP falls), the Director General (DWAF) has the ultimate responsibility of the programme *(ibid.)*. This presents a separation between leadership and management of the programme.

The programme also seeks to draw broad participation and membership that comprises:

- RDP office;
- the Department of Public Works;
- the Department of Agriculture;
- the Department of Labour;
- the DWAF;
- nongovernmental organisations;
- trade unions;
- civic organisations; and
- DEAT.

As yet there is not sufficient participation from government departments and this may not contribute favourably to the programme intended outcome i.e. social welfare, environmental sustainability and water (Jelinek & Breen, 1997). However, the WFWP enjoys support from some private sector organisations such SAPPI and MONDI Forests.

Having started control of alien vegetation in 1985, MONDI's efforts on control of invader species are well known (Gardener, 2000, pers. Comm.)

Presently, MONDI teams up with WFWP having signed a partnership agreement with the programme. Under the agreement MONDI will clear 80% of alien plants in its areas of operation in five years and 100% in ten years. Gardener, himself familiar with

WFWP both at national and provincial levels, rates the programme's activities as 50% social and 50% environmental. He, however, feels that the programme needs to concentrate on water for purposes of remaining focused and achieving set goals.

2.5 The problem: invasive alien vegetation

The problem posed by invasive alien vegetation in South Africa is an enormous one as the plants affect almost 10 million hectares (8.28%) of the country (Moosa, 2000). The plants cause a 7% (about 3 300 million cubic metres) loss of annual flow in South Africa's rivers. The invading vegetation grows at a rate of 5% annually, which means if no control were done their impact would double in 15 years (Versfeld *et al.,* 1998).

According to DWAF (2000) the species were introduced into the country from various destinations: 64 species from Central and South America; 26 from Australia; 14 from North America; and 25 from Asia and 19 from Europe. The total number of species introduced into the country is 161: 38 herbaceous; 13 succulent and 110 woody (DWAF, 2000). These species are regarded as invasive and forty-four species among them are declared noxious and law requires their removal, while the rest (31) are said to be invaders whose spread is to be controlled *(ibid.).*

2.5.1 Spread of invasive alien plants

Invasive alien vegetation comprises a range of grasses and trees that were introduced into South Africa mainly for stabilization of sandy substrata and for commercial purposes.

The species do not invade in their countries of origin as they are kept in check by a host of pathogens and co-evolved invertebrates (van Wilgen, *et al.*, 2000).

Also, as result of coming from similar environment, these species mature without much hindrance and produce large quantities of viable seeds (Versfeld *el al.,* 1998). The species invade mainly the riparian zones of the country but in particular the provinces mostly affected are Western Cape *(Hakea* species and *Pinus* species in the mountains and *Acacia* species in the lowlands), Eastern Cape (Black wattle), and KwaZulu-Natal (Black wattle, Pine, Syringa, Lantana, and Bramble).

The evergreen characteristic of many invader species coupled with their higher

biomass and faster growth enable them to consume more water than indigenous riparian species (Versfeld *el al.* 1998). The rate of colonization by invasive alien vegetation has costly impacts on natural resources such as loss of biodiversity, reduced grazing land, competition over arable land, introduction of mono-culture, soil erosion as alien plants may have weaker root systems and fire hazard because of increased fuel biomass. However, invader species have some benefits such as provision of shade, medicine, fodder and fuel wood.

2.5.2 Process of invasion

Invasive alien vegetation can be grouped as transient i.e. those that leave no persistent descendants and naturalized whose descendants become part of the local flora (Mark, 1996). The invader species that have greater consequence on their new habitat are those that differ markedly from indigenous species in their utilization or acquisition of resources (Luken & Thieret, 1996). The main struggle between species is accessibility to water, light and nutrients thus alien woody plants overshadow the indigenous ones whose heights allow them to utilize less resources in comparison. The overshadowing of invader species over the indigenous ones is also strengthened by their continuous evergreen characteristics (DWAF, 2000).

The process of invasion can be divided into two parts namely expansion and densification (Versveld *el al.,* 1998). Expansion can be described as dispersal from existing invasion to creation of satellite colonies whereas densification is increase in density of existing population on the same patch (ibid.). Densification, according to Boucher (1995) increases slowly at initial stage of invasion but increases exponentially subsequently up to 100% cover. The study by Boucher further showed that densification takes about 70 years from invasion to 100% cover on terrestrial landscapes, whereas in riparian areas densification takes about 50 years to reach 100% cover. However, Versfeld (1997) presents a different view in that except in the case of *Acacia mearnsii,* the study showed no evidence that invasion in riparian areas is faster than that on terrestrial landscapes.

2.5.3 Preferred invasion habitats

There are primarily two habitats that invasive alien plants prefer: moist terrestrial landscapes where such plants occupy whole regions and, riparian zones where

invasive plants colonize riverbanks and alluvial areas (Versfeld *et al.*, 1998).

2.5.4 Landscape invasion

Landscape invasion in the country is confined to areas with a minimum 500mm rainfall with exception of coastal areas where fog may provide conducive environment for invasion (Versfeld *et al.*, 1998).

The species *Acacia mearnsii* is by far the largest landscape invader mainly found in Mpumalanga (I 046 482 ha), KwaZulu-Natal especially in the midlands (190 542 ha) and Eastern Cape (344 535 ha). *Acacia dealbata* mainly invades high altitude regions of the Eastern Cape.

Apart from the *Acacia* species, other tree alien invaders are *Eucalyptus* species. These invade mainly Eastern Cape (164943 ha), Natal-Natal (167 418 ha), Northern province (865 547 ha), and Western Cape (608 976 ha). The Cactaceae invade and landscapes with *Opuntia* being by far the greatest invader whereas *Cereus* invades the savanna biome. *Acacia,* as indeed the case with other landscape invasive alien plants, are affected by burning and intensive cultivation. Their main limitation is scarcity of rainfall in the South African landscapes (Versfeld *et al.*, 1998).

Other than woody invasive plants, there are short-lived herbaceous plants such as grasses, which are considered invaders too ((Versfeld *et al.*, 1998). Some of these species are grown in degraded land for rehabilitation and some for agro-forestry, but they nevertheless are invading plants. However, the reason there is not much emphasis on their invasion is because the amount of water that they consume is not more than the indigenous plants that they replace *(ibid.)*

2.5.5 Riparian areas

According to Versfeld *et al.* (1998), the most prominent riparian invaders are the *Acacia* species although they also invade moist grasslands such as highveld and mist-belt grasslands.

The general mode of invasion is unidirectional, downstream and especially during floods. It is therefore reasonable to assume that most river systems are prone to invasion and that rivers in high rainfall areas will be susceptible to higher rates of

invasion.

Most riparian areas in the country have been invaded by alien plants with the worst hit being the wetter regions from Western Cape through to the Northern province, in particular the rivers of the moist subtropical coastal belt and the low veld. Extensive invasions and the formation of dense stands in riparian zones appear to be largely limited to perennial rivers. The exceptions are species such as *Nicotiana glauca,* which survives as seeds even in ephemeral river systems, and *Prosopis. Prosopis* is a phreatophyte and, therefore appears to be limited largely to major river systems (e.g. those with regular seasonal flow) and their alluvial plains, except for areas with >300 mm per year (Milton, pers. comm. 1996, quoted in Versveld *et al.,* 1998).

With *Prosopis* species invading flat alluvial floodplains, one of the main problems that they pose is formation of thickets that are hard to penetrate. Also, although they thrive in areas with above average rainfall, they do not do well in high rainfall areas (Harding & Bate, 1991). To control their spread would call for urgent measures before formation of such thickets. According to Versveld *et al.* (1998), the rate of expansion of invaded areas in Mpumalanga and KwaZulu Natal is 5-20% per year. At this rate of expansion, transition from sparse to densely colonized areas could occur rapidly thus affecting biodiversity.

2.6 Biodiversity conservation

Conservation of biodiversity includes its associated values such as water, soil, fragile ecosystem and landscapes (Upton & Bass, 1996). It therefore follows that the presence of invasive vegetation alters both biotic and a biotic features mainly due to exacerbation by fire and their shadowy large stands. As most indigenous plants are intolerant to shade and competition from alien species, they reduce in vigour or simply die out (Luken & Thieret, 1996). Also, alien plants in the riparian zone adversely affect species richness and environmental indicators such as dragonflies (Samways, 1999). It is considered imperative that the country makes every effort to conserve such biological diversity among other species.

2.6.1 Impacts of invasive alien plants on biodiversity

Invasive alien vegetation ranks second among threats to biodiversity: the first one

being direct habitat destruction (DWAF, 2000). The adverse impact on biological diversity is mainly due to displacement caused by competition, reduced structural diversity, increased biomass and disruption of the prevailing vegetation dynamics (ibid.)

2.7 Water

With a worldwide consumption of water doubling every 20 years, there will be huge pressure exerted on aquatic ecosystems since fresh water covers less than half of 1% the earth's water, the rest being sea water, ice or ground water (Barlow, 1999). Locally, unless trends in water usage are not reversed, South Africa may reach limits of its usable freshwater within the first fifty years of this (new) century. In this regard a key element for maximising water supply in the country is the removal of invasive alien vegetation (Rowlinso, 1999)

2.7.1 Water loss and alien invasive plants

According to Macdonald *et al.* (1986), increase in afforestation and total biomass influences the magnitude of reduction in stream flow. For instance, *Eucalyptus* was found to deplete more water than *Pinus* in time and space. It therefore follows that the removal of these invasive woody plants would result in increases of water in the river system. In 1996 a study by the Department of Water Affairs and Forestry estimated that 33 229 ha cleared in the previous year will result in an increase of 17.5 million cubic metres of runoff annually (Jelinek & Breen, 1997).

A study by Dye and Poulter (1995) in Mpumlanga showed that stream flow in afforested catchments is sensitive to the presence or absence of invasive woody plants in the riverine system. Further, water use by pines from the riparian zone was up to three times that of pines (same age and density) on landscape sites, which shows just how sensitive riparian areas are (Scott and Lesch, 1995). It is noteworthy that the water savings gained from removal of alien woody vegetation from riparian zones can only attain sustainability if trees removed are replaced with alternative vegetation that uses less water.

2.7.2 Water utilisation by plants

According to Schulze (1995), water utilization depends on plant characteristics such

as rooting, depth, canopy structure, leaf area and site characteristics e.g. available soil moisture and evaporative demand. Not much information is available on water savings, attributable to removal of alien vegetation in riparian areas. However, a study carried out on Midmar dam shows that an increase of about 11 million cubic metres would be available if all wattles were removed from the riparian zones of the Midmar dam catchment (Jelinek & Breen, 1997).

2.7.3 Causes of water shortage in the country

Presently, water shortage in South Africa is approximately one billion cubic metres and is caused mainly by invasive alien plants and also low value crops (Jelinek& Breen, 1997). With the current demand of 3%, the shortage would reach 1.34 million cubic metres in ten years. It is such urgency of the matter that makes removal of alien vegetation an imperative.

There is need for concerted efforts from government, NGOs and the community. For instance if public administration and rural deforestation cleared 700 000 and 300 000 ha respectively at almost zero cost in another 10 years, there would be an increase of about 1.00 billion cubic metres of water. That increase would help meet the current rate of demand (Jelinek& Breen, 1997).

2.7.4 Water consumption in the country

South Africa experiences an annual 50 billion cubic metres run off subject to a high variability of rainfall. About 40% of the amount i.e. 20 billion cubic metres are the total water usage in the country (Jelinek& Breen, 1997). Other water usage points are:

- irrigation approx. 54% of total water in the country;
- ecological requirements 19%;
- Urban use 11%
- Forestry 8%; and
- Mining and industry 8% (*ibid.*)

Note that constructed dams (in some parts of the country) hold 27 billion cubic metres

but all this water does not adequately meet water requirements in some regions.

2.7.5 Alternative sources of water

According to Jelinek & Breen (1997) alternative sources of water under discussion include shipping of fresh water from Zambezi and Congo rivers in tankers and ships as well as tapping icebergs for fresh water. These are costly and more viable methods are conservation measures, re-use of water and re-alocation of water.

2.8 Strengths of the WFW Programme

According to the 1997/98 annual report the WFWP has cleared 220 884 hectares with a follow up clearing of 55 731 hectares and created 42 059 jobs (Naude, 1999). In KwaZulu-Natal province, the strengths of WFW are considered to include successful eradication of invasive alien plants, community empowerment, and support from landowners and gender equity. The provincial programme is said to have 60% women workforce as well as having women contractors (Curry, 2000, pers. comm.).

Being a public works project, WFWP does create jobs that are offered to local communities on a temporary basis. The programme aims at exposing workers to various skills so that they are better able to find employment elsewhere upon their departure from the programme (*ibid.*).

In addition, WFWP runs various community projects such as HIV/ AIDS awareness campaigns, environmental awareness, gender equity, literacy programmes, and crèches to cater for children whose parents are employees of the programme for the period they remain employed. The fees charged for the crèches are R4.00 per pays for caretaker's child per day, which salary (Curry, 2000, pers.comm.). Sustainability of the project, comm.). Also, as a way of ensuring MONDI supports the WFWP in its community development initiatives (Gardener, 2000, pers comm.). Of the initiatives that have endeared the WFWP to the communities, job creation stands out (DWAF, 2000).

2.8.1 Job creation

Of the job opportunities created by the WFWP nationally, 53% are held by women, 20% are held by 16-25 year olds. The remaining opportunities are for disabled

persons. Selection of employees has not been without problem as indicated in one project where the project manager tended to employ people from his community only (Jelinek & Breen, 1997). Further, the programme offers multi-skilling for its employees so that they can find jobs outside the programme in the event of its completion *(ibid.)*

2.8.2 Gender equity

Although there have been problems in some projects with regard to gender equity and working relations, the programme has worked hard to ensure gender equity. Also there is need to train more women for senior/managerial positions (Jelinek & Breen, 1997), Other than these benefits drawn from the WFWP, others include direct benefits to the underprivileged communities in terms of community halls, sporting facilities, supply of water to dams and sporting facilities *(ibid.)*.

2.8.3 Recruitment of workers

It is the responsibility of contractors to hire workers. The workers are employed on a one-worker per household basis. The workers are then exposed to an induction course on what WFWP is all about and on methods of alien vegetation control. It is at that point that a steering committee is selected to oversee the project in that particular locality (Curry, 2000, pers. comm.).

2.8.4 Job security

The WFWP contractors hire workers for one month after which the employees leave. However, such employees may remain employed provided another contract is available and the contractor funds them suitable to carry on (Curry, 2000, pers. comm.).

2.8.5 Contractors

In Natal-Natal the WFWP has worked with 350 contractors who in turn, each employ 20 workers from local communities. The criteria for selecting contractors are that they must be literate and hold no other job. The actual selection is done by a steering committee drawn from local community members.

Although efforts are made to contract local people, it is not a requirement and

contractors can come from elsewhere. Efforts are made to uphold gender equity on contractor selection. At the moment no contractor is certified in terms of Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act 36 of 1947) but negotiations are being held with Pretoria Technikon with a view to finding a solution. (Curry, 2000, pers. comm.).

2.9 Weakness of the WFWP

Some of the problems cited as weakness of the programme are abuse of alcohol and other drugs, loan sharking, inconsistency in the allocation of Poverty Relief Fund and problems of monitoring and evaluation of the project (Naude, 1999). Also, according to Dr. Guy Preston (Programme leader), the programme lacks a coherent strategic plan and research that accompanies such planning (ibid.).

2.10 Control methods

The methods employed by WFW projects are mechanical and chemical depending on type, size and density of the plants. For instance ring barking is carrying out on wattle whereas spraying is preferred for control of bug weed and bramble. The chemicals used include Chopper and Garlon (Pitchford, 2000, pers. comm.).

It was the view of Gardener (pers. comm.) that a combination of chemical and mechanical control be applied. However, he cautioned that only experts must apply chemicals at least in the initial stages. In addition, fire should be used as means of control. However the use of fire would be hazardous on areas where ring barking has been done and plants are either dying or have already fallen down, as this would increase fire intensity.

2.10.1 Ring barking

The aim of ring barking (as opposed to clear-felling) is mainly to cause gradual death to the plants while trees stand to enable a gradual smooth shift from alien to natural vegetation with minimal damage to the environment. The gradual death is achieved by making an incision around the circumference of the tree as close to the ground as possible and then applies chemicals after which the tree is left to die on its own. If the tree is very small, it is felled and left to members of the local communities to use for domestic purposes.

However there is a possibility that some wood remains on the ground for long period of time (Pitchford, 2000, pers. comm.). The logs left in such a manner pose a great danger as fuel wood in case of fire outbreak and or logjam incase of flood. They also make follow up difficult.

2.10.2 Biological control method

As discussed above, invasive alien vegetation may grow rapidly once introduced, due to the absence of predators normally associated with the country of origin. The basis for development of biological control methods is to return such plants to being naturalized and non-invasive (van Wilgen *el al.,* 2000). The method involve use of species-specific predators or other invertebrates, usually from country of origin, and has the potential to return aggressive invader plants to being non-invasive naturalized alien, environmentally benign and also cost-effectiveness (van Wilgen, 2000). Also, the method is cost effective and is environment friendly. However, the method has opponents who argue that there is a potential danger of the predators attacking non-target plants as one landowner in eMpofana argued, " what will the predators eat after they are done with target vegetation? Won't they turn to crops?"

According to van Wilgen *et al.* (2000), WFWP places emphasis on integrated control with substantial research on biological control method. He further put it that to date 103 biocontrol agents have been released in the country to counter 46 species of weed out of which 22 have been put under complete or near complete control. Also 350 biocontrol agents have been put into effect in new environments globally, out of which only ten have affected non-target species *(ibid.).* It is hoped that biocontrol can be extended to include *Acacia mearnsii and Pinus* species that have been hitherto been excluded due to their commercial value (van Wilgen *et al.,* 2000). Also, an estimated R 19 million has been spent on biocontrol research in the last three years, of which R 9 million was investment from the WFWP.

Other methods of control discussed elsewhere in the text include mechanical, and chemical.

2.11 Follow up

According to Curry (2000, pers.comm.) WFWP does follow-up in 3-year cycles and

performs at least two follow-ups. The first step is to clear plants that may have escaped the first round of clearing. This is then followed by control of re-growth manually and with herbicide spraying. As for MONDI, follow up is done using mechanical (hand pulling) and chemical means of control.

2.12 Cost of clearing invader species

WFW spends about R2000 per hectare to control alien invasive plants (Curry, 2000, pers comm.). The cost mainly refers to ring barking and application of chemicals around the site so cut.

CONCLUSION

From the foregoing, it is clear that the aim of the national WFWP is management of water, tariff structure, water research and education in line with RDP and GEAR, a macro-economic government policy (Jelinek & Breen, 1997).The programme is headed by the Director General (DWAF), with the state president as the patron.

The problem that the WFWP seeks to tackle is that of invasive alien vegetation whose spread mainly affects riparian areas of the Western Cape, Eastern Cape, KwaZulu-Natal and Mpumalanga. The vegetation is a threat to land, biodiversity and water resource in the country as it consumes over 3000 million cubic metres of water in the country annually, (van Wilgen *et al.,* 2000).

There are primarily two habitats that invasive alien plants prefer: moist terrestrial landscapes where such plants occupy whole regions and, riparian zones where invasive plants colonize riverbanks and alluvial areas (Versfeld *et al.,* 1998). In their colonisation process, alien plants in the riparian zone also adversely affect species richness and environmental indicators such as dragonflies (Samways, 1999).

So far the WFWP has achieved success in job creation and training as well as gender equity. However, the programme lacks coherence in strategic planning and research (Jelinek & Breen, 1997). Follow up is usually in 3 year cycle and is carried out in two rounds; the second being hand pulling or spraying of chemicals on those plants that may have escaped the first clearing or re-growth.

As for cost of clearing invasive vegetation, it is pegged at R 2000 but this varies from one method of clearing to the other.

CHAPTER THREE

3. EMPOFANA RIPARIAN RERABILITATION PROJECT (EMRRP)

3.1 Introduction

One of the premises on which eMRRP was founded is to reduce the disturbance of the country's vulnerable wetland and riparian zones which is a major factor contributing to water stress (Umgeni Water, 2000b).

The eMRRP subscribes to the Conservation of Agricultural Resources Act (43 of 1983), that was established to curb destruction of water sources, and the introduction and spread of alien invasive plant. The Act requires landowners to either eradicate invasive alien vegetation on their property or keep them effectively controlled (DWAF, 2000). For this reason, property owners in the area are encouraged not only to run their own alien plant removal initiatives, but also to support the eMRRP. Although there are other ways of increasing supply of water such as construction of dams and importation of water from nearby catchments areas, improving conditions of catchment area is arguably currently the most cost effective (Umgeni Water, 2000a)

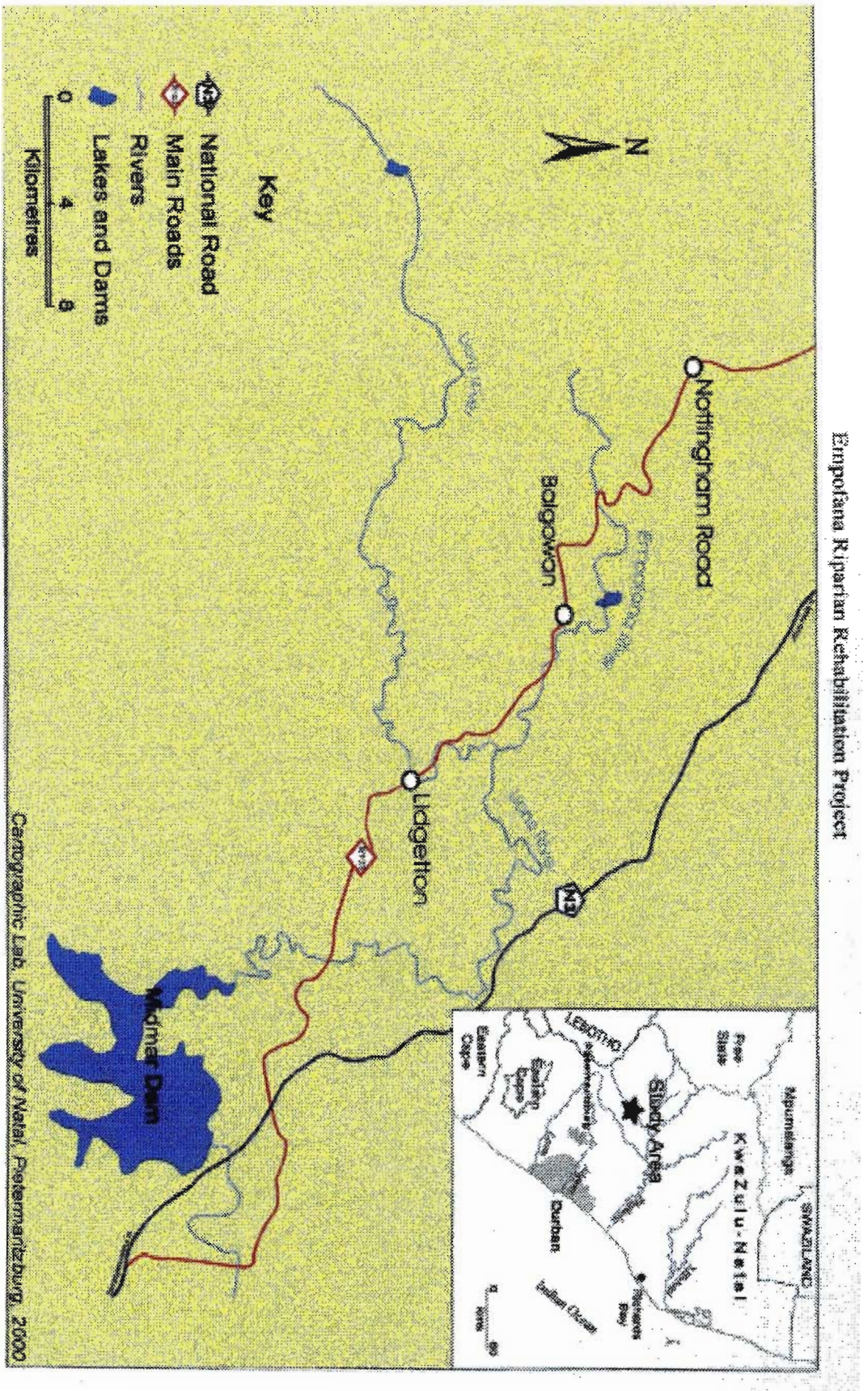
Umgeni Water (UW), is one of the largest water authorities in Africa and supplies water to a population of 4 million people who live in an area 24 000 square kilometres in KwaZulu- Natal province (Umgeni Water, 2000). The water authority commits itself to supplying water to all people in its area of operation at affordable price. In order to meet the water demand UW has to locate additional sources of water.

The hydrological studies carried out at the start of the project showed that if cleared of alien invasive plants, the riparian areas in the Midmar catchment have the potential to raise extra I 1,000,000 cubic metres annually (Jelinek & Breen, 1997).

3.2 The Study Area

The study area is the eMpofana catchment extending from Nottingham Road and surrounds, through Balgowan, to Midmar dam via the Lions River (Figure I). The area is in the midlands of KwaZulu-Natal, referred to as the 'garden province' being kept thus by farmers' "enormous effort, ingenuity, persistence, vision, courage and unique aesthetic sense" (Edward, 1991).

Figure 1: Map of the study area



The province has three main distinguishable economic regions: coastal, midlands and the northern region. The coastal region is dominated by monocultures of sugar plantations and forestry and the northern region is under extensive land-use, stock ranching and maize growing mainly for cattle feed (Mazower, 1991). The area under agriculture in the midlands makes up 4.7% of the total farmed area in the country, and it is notable that livestock production is a very important part of agriculture both in terms of production value and land-use (Erskine, 1982).

The land within the study area has a very high agricultural potential rating, with Nottingham Road having a mean annual temperature of 14.7 and Lidgetton 15.9 (Guy & Smith, 1995). As will be discussed latter, these temperatures are suitable for spread of *Acacia mearnsii.*

Nottingham Road area has an annual rainfall of 844mm and other locations in the study- area experience annual precipitation of between 905mm to 986mm *(ibid.).*

The climate in the area is suitable for invasive alien plants such as black wattle *(Acacia mearnsii)* and by 1950 the area contained 80% of the South Africa's wattle holdings (Mazower, 1991). *4cacia mearnsii* thrives in well-drained dystrophic soils and with temperatures between 0 and 22 degrees Celcius, and altitude of more than 500m (Martin *et al.,* 2000). The tree is sensitive to frost but it does not thrive in humid and warm climate.

Acacia mearnsii is an evergreen exotic species from Australia. It has a fine leaf crown that bears yellow puffball flowers. The seeds are contained in typical leguminous pods and the plant can produce between 2000 and 540 000 seeds per square metre annually (Campbell, 1993). Due to its bark, a mature tree is fire resistant and its seeds are resistant to both disease and insects. The seeds germinate readily upon being exposed to fire and can remain viable in the soil until fire comes along.

Even after burning of the outer cover of the tree has taken place, the wattle has the capacity for re-growth in the following season of growth (Grenfell, 1976). The tree has a high capacity for water consumption, which is estimated at 200 litres of water daily (Environmentech, 1999 www.csir.co.za/world/plsgl/Dl Project).

3.3 Rationale for initiating eMRRP

Umgeni Water initiated the eMRRP in line with the national WFWP to pursue similar goals: provision of water, jobs and restoration of biodiversity through control of invasive alien plants. It is the view of UW that the project must be founded on business principles and methodologies that are sound, and that water security be paramount otherwise it would not be justifiable to its customers (Umgeni Water, 2000b). Also, it was for the purposes of seeking to remain accountable to their customers and the need to be focused on attainment of water security (as opposed to prioritizing social upliftment through job creation as WFW projects do), that UW chose to carry out eMRRP on their own (ibid.). The alternative was to contribute money towards Working for Water projects carried out by DWAF.

The goal of this study was to establish, through getting to understand stakeholders' perceptions, the sustainability of the control of invasive vegetation in eMpofana riparian areas. It was assumed that the sustainability of the eMRRP largely depends on how well it is received, understood and supported by stakeholders, especially property owners on whose land clearing takes place.

In intiating eMRRP, UW aims to contribute towards the provision of affordable water, cost effectively, in a sustainable manner to all residents of its area in an environmentally friendly way (Umgeni Water, 2000b). For this reason the project aims to clear invader plant species from the riparian areas defined as being approximately 30 metres wide both sides of the rivers and streams over a distance of 220 kilometres. Removal of invasive alien vegetation will improve quantity of water flowing from catchment and increase efficacy on use of water and reduction of 'waste'

3.4 Objectives

According Umgeni (2000b) the stated objectives to be achieved if the project aim is to be realised are:

- physical removal of invasive alien plants from the riparian zones and wetlands in the eMpofana River catchment and the lower reaches of the Lions River
- ensuring the support and active participation of all the Land owners on a four-year programme

- the project visibly and instantly demonstrates to the participants the effectiveness of the removal of alien plants in raising the flow levels of the streams

- to ensure that property owners are involved and support the programme in a four year programme

- educating land owners, school children, community members, Umgeni staff and the general public about the importance of wetlands and catchment area conservation

- striving towards the re-establishment of indigenous grassland along the rivers banks by setting an example through the method applied as well as rehabilitating with indigenous grasses

- awareness creation among property owners, school children, community members, Umgeni staff and the general public on the importance of conserving catchment and wetland areas

- ensuring that investment in the project is based on business principles and on a demonstrated return on investment.

From the stated objectives, it can be noted that the core concern of the eMRRP, as indeed is that of the national WFWP is the impact of expansion of alien invasive plants on water supply, biological diversity and social welfare. It is for that reason that the programme works at the nexus between environmental, economic and social needs. This is because development or social upliftment cannot occur in a climate where one or more of these are not sustainable (Goodland, 1975).

3.5 Approach

The approach that was adopted by Umgeni Water (UW) in controlling invasive alien vegetation at eMpofana Riparian Rehabilitation project (eMRRP) were, aerial mapping, projection of costs, communication with property owners, engaging contractors and recruiting labour (Umgeni Water, 2000b).

The aerial mapping was used to determine distribution and density of invasion in the area and to project labour and costs of controlling alien vegetation. Having done the projections the area was divided into discrete units that were assigned to professional

tree-felling contractors. The contractors had to be literate, residents of Lions River Magisterial District and registered in terms of the Fertilizer, Farm Feeds and Agricultural Remedies Act in order to apply herbicides. Similarly, the labour was drawn from the local communities having met quality specifications as issued by Umgeni Water. Also, through a communication programme that was set up, landowners were informed of the intended removal of alien vegetation well ahead of time and their support was solicited.

3.5.1 Control of invasive alien vegetation

The method of control adopted by the eMRRP is clear felling, which is followed by application of herbicide, depending on species and requirements of particular geographical locations. The method is preferred because of desirability for early re-establishment of grassland and for ease of accessibility during follow-up operations (Umgeni, 2000b). Clear felling makes follow-up cheaper and removing and or burning cleared wood reduces the danger and severity of fire. Ring-barking which causes accumulation of fuel-wood debris increases fire hazards and reduces accessibility. It does, however, reduce the need for use of herbicide and also reduces disturbance and germination of seeds in the ground. In addition, fallen wood can cause logjams and destruction of infrastructure such as bridges down-stream in the event of floods (DWAF, 2000). In regard to wood that is already fallen in the rivers, the eMRRP used tractors and other mechanical means to draw it out. Unlike the WFWP, the eMRRP has not yet implemented biological methods of control.

It was to achieve stated objectives of water security, and related benefits of biodiversity conservation and job creation timorously i.e. August 1999 to September 2000 and to facilitate manageable subsequent follow ups that UW opted for clear felling (Umgeni, 2000). However, cooperation among stakeholders is vital, especially where infestation spreads across properties of several landowners, because invading plants are not limited by cadastral boundaries. Although control management must be done on individual land parcels, a resource-sharing approach in a given area is required to achieve cost effective and durable control results.

3.5.2 Clearing cost

Umgeni Water has allocated R 5.2 million for control of invasive alien vegetation in

the eMpofana catchment. However, the cost of controlling invader species in the Midmar dam catchment (Figure: 1) will be a lot more. The clearing cost for Midmar catchment, in which the eMpofana project falls is R 39 million. (Umgeni Water, 2000b). These estimates are based on initial clearing of all weed species within 30 metres of each bank of the rivers, follow up and handing over to landowners after a period of four years. Each clearing team comprises of a contractor and a group of ten persons and the average cost per hectare of initial clearing is R 9 393. The cost for follow-up is estimated at R 1143 first follow-up, R 914 second, R 686 third follow-up, R 457 fourth and R 343 for fifth follow-up (Umgeni, 2000b).

Clearing costs include capital costs (equipment), operating and maintenance costs (salaries and wages, running expenses, herbicide, transport, and protective clothing). The size and density of species to be cleared (dense, medium, sparse, scrub or wetland) determine the method to be used on initial clearing and follow-up. For instance, black wattle *(Acacia mearnsii)* has a continuous seed release cycle and its hard-coated seeds can remain viable buried in the soil for a long time. As a result of this, felling and burning stimulates abundance of seedlings that need to be cleared manually, by hand pulling, or with use of herbicides. This type of clearing is time consuming and labour intensive (van Wilgen *et al.,* 1996).

3.6 Benefits of clearing

If no control of invasive alien vegetation took place in the riparian areas in another 15 to 20 years, the rate of infestation would double (Versfeld, 1998). In this regard, the eMRRP demonstrates clearing of invader species would not only be a viable financial alternative to investing large sums of money in infrastructure such as water transfer schemes and building dams (Umgeni, 2000a) but has other benefits such as:

- increased water to Midmar dam.
- A job creation KwaZulu- Natal Midlands is said to have a 70% unemployment level.
- awareness creation. Stakeholders and tourists to the area are educated on good ecological practices and the importance of clearing invader species from riparian areas.

- improvement of the aesthetics appeal as Midlands has great tourist potential
- conservation of biodiversity.

3.7 Rehabilitation

One of the short term negative results of clearing, stacking and burning as carried out by the eMRRP is that for sometime cleared land remains bare with increased erosion potential which might not be aesthetically appealing. In the long term however, it can be argued that adverse effects brought about by invasive alien plants include increased soil erosion, displacement of indigenous plant communities, and disruption of ecosystem processes (Chapman, 1992; DWAF, 2000). The spread of alien plants is exacerbated by the fact that in their new habitat, there may be no predators or diseases to regulate population growth. As a result, the alien plants rapidly grow out of control. Also, the native vegetation may not be able to sufficiently compete for nutrients, water and space and so they are gradually excluded.

The eMRRP aims not only to increase water flow to Midmar dam but also to return lost ecosystem functions and components. Although it would be too ambitious to aim at returning controlled areas to their pristine conditions (mainly because it would be difficult to establish what the pristine conditions looked like); restoration should return areas to their natural states (Federal Interagency Weed Committee http://refugees.fws.gov./FICNfNEWFiles/Goal3.html). In the eMpofana catchment area, indigenous grasses arguably form the natural vegetation that would occupy most riparian zones (Umgeni Water, 2000). Thriving natural vegetation in controlled areas would help to ward off invader species.

Since follow-up processes are relatively less costly especially after clear felling as is the case with eMRRP, they provide opportunity for groups to work together on control, re-vegetation and reinstatement of disturbed ecosystem processes. These opportunities also act as forum to educate and demonstrate to the local communities the biological, social, and economic benefits of restoring natural vegetation.

CONCLUSION

The eMRRP was initiaed by (UW), one of the largest water authorities in Africa in line with the national WFWP to pursue similar goals: provision of water, jobs and

restoration of biodiversity through control of invasive alien plants.

The approach used by (UW) in controlling invasive alien vegetation was aerial mapping, projection of costs, communication with property owners, engaging contractors and recruiting labour (Umgeni Water, 2000b). The method of control applied was clear felling which is followed by application of herbicide, depending on type of species, size and needs of a particular geographical location.

The cost of clearing a hectare infested with alien vegetation is about R 9 393 (Umgeni Water, 2000b).

The rehabilitation of the areas cleared will not only increase water flow to Midmar dam but also will return lost ecosystem functions and components. To achieve this, either natural vegetation will be allowed to re-colonise the areas on their own or planting indigenous plants where necessary will be done.

As for sustainability of the project, it is hoped that if stakeholders become sufficiently supportive, and re-establishment of natural vegetation is achieved, it will become much more feasible.

CHAPTER FOUR

4. RESEARCH METHODOLOGY

4.1 Introduction

The approach used in this study to establish perceptions of stakeholders of the eMpofana Riparian Rehabilitation Project was survey research, and social science methods were employed. Survey research is useful in a variety of situations such as providing solution(s) to a problem of public policy; provide required data for managing a business or simply for testing hypotheses developed by scientists in the social world (Hoinville & Jowell, 1977). Survey research was chosen for this study because of its capacity to provide appropriate data on perceptions of stakeholders of the eMpofana project. It is hoped that such data will inform decision-making on Umgeni Water's core business, water, in respect of control of invader plant species, as well as making a contribution to the wider body of knowledge.

In survey research the researcher may use a written questionnaire, which may be mailed or used in person to ask questions and then write answers without manipulating the situation (Neuman, 1997). As Neuman further states such manipulation is evident in physical science (experimental technique) where two samples are selected but only one is given a 'a treatment'. The difference noted thereafter between the two is said to be resulting from that treatment.

4.2 Survey Research

Surveys are used to gather information on areas such as attitudes, behaviour, beliefs, opinions, knowledge, expectations, characteristics and the change the variables cause in people over time (Babbie, 1992; Schutt, 1996; Neuman, 1997). The method is a vital tool in gathering information for research and decision-making (Hoinville & Jowell, 1977). Also, the combination of research techniques contained in surveys make them excellent vehicles for measuring attitudes and other variables especially when the population is a large one (Babbie, 1992).

A variable is a measurable difference used to measure a designated characteristic or attribute of a person or a phenomenon (Blum & Foos, 1986, Neuman, 1997). In other words a variable is measured by its attributes. For instance behaviour is a variable

whose attributes are bad, good, or moderate. Similarly, peoples' attitude is a variable whose attributes can range from strongly support of to no support at all. Given that this survey is on establishing the perception of stakeholders on eMpofana project, measurement of their attitudes as is done in surveys is an integral part.

The stakeholders identified are property owners (or their resident managers), project employees, contractors, Umgeni Water staff, National Working for Water Programme (WFWP) staff, KwaZulu - Natal Nature Conservation Services (KZNNCS) South Africa Pulp and Paper Industries (SAPPI) and MON-DI officials.

4.3 The nature of the problem

The fact that the study examines peoples' views, points to the difference between social sciences and physical sciences in that humans are rational, historical and normative beings (Mouton & Marais, 1994). As Mouton further contends, the rational aspect refers to the fact that human beings possess the ability to reason out facts about their existence, make independent and free decisions concerning their future, and have the ability to interpret and define behaviour in a proactive manner.This means people are able to interpret their surroundings and act according to interpretations they ascribe to them (Hammersley, 1993).

The historical aspect means that humans have a past, present and a future and that although they create history; they are themselves product of history (Mouton & Marais, 1994). What this implies is that stakeholders of the eMRRP are part of the history of the eMpofana catchment and that that history shapes their cognitive processes that in turn determine the nature of the present and future activities in the area.

For instance, some landowners argued that the reason they have not taken responsibility to control invasive alien plants in their riparian areas is because the vegetation was already there at the time they bought or inherited the farms. Another reason given for not clearing invader species is that state land around them had the vegetation standing unmanaged and so why would they incur expenses ridding their farms of invader species. The latter argument introduces the fact that human beings are normative beings in that although history supports various views, individual stakeholders choose what they regard as proper and desirable in line with their norms.

The reasons for approaching different categories of stakeholders was the need to access diverse views, and that the self-sustenance of the process of invader alien species control in eMpofana catchment requires support from as many stakeholders as are willing to get involved. Landowners play a vital role in that it is on their land that the control of invader species takes place. Workers experience first hand what it is to physically clear alien plants and to benefit with income from the jobs created by the project.

Commercial forestry organizations participate because of the need to comply with environmentally sound forestry requirements such as ISO 1400 and the emerging legislation. In the same way the WFWP co-ordinates the activities of invasive alien control and oversees implementation of policies with regard to its activities.

Assessing the views from various categories of stakeholders, as is the case with eMRRP, assists understanding and improvement of objectivity of the research phenomenon. In gathering respondents' views on a given issue as was the case in this study, requires that questioning be as open-ended as possible so that informants can respond spontaneously. Secondly, respondents should be encouraged to voice their inner attitudes, values and beliefs (Hoinville & Jowell, 1977). For this reason care was taken to note the issues respondents chose to talk about outside the questionnaire.

According to Mouton (1994) research is "a collaborative activity by means of which a given phenomenon in reality is studied in an objective manner, with a view to establishing a valid understanding of that phenomenon." In addition, research is conducted so as to answer practical questions, and also to aid making informed decisions (Neuman, 1997; Booth *et al.,* 1995).

The phenomenon in this study is control of invasive alien vegetation by eMRRP, and the study aims to answer practical questions such as sustainability of the process through understanding perceptions of stakeholders.

In line with sustainability it is hoped that such understanding will contribute towards informed decision making on similar ventures in the future. Naturally, it is expected that the study will be faced with conflicting views from stakeholders on certain aspects of the eMRRP as research gathers not only various data but brings together proponents as well as those opposed to the view (Brown *et al.,* 1995). With this in

mind, the questionnaire was designed so as to capture a wide based view of all stakeholders interviewed.

4.4 Selection of research methods

Semi structured and structured interviews were employed on the study. Unstructured interviews also referred to as open-ended questions, allow for probing and for respondents to give their own views concerning the question being asked (Baily, 1987). The closed-ended questions do not allow for probing and present informants with pre-conceived responses about what the researcher thinks is important (Haralambos, 1991; Harvey,1993). Mixing both open-ended and closed-ended questions helps reduce disadvantages in question form as both approaches have advantages and disadvantages. As such the question to ask when carrying out research is not which approach to use, rather it is under which condition and approach is more approapriate (Neuman,1997). For instance, there are times when it would be necessary to interview a group of respondents all in one sitting i.e. focus group interview. Due to the fact that respondents were widely dispersed, not easily available and that it was not clear how much 'focus' there was. Focus group interview method was not used in this study.

Exclusion of focus group interviews may correctly be seen to limit findings of this study. This is because although participants can easily influence one another in focus group interviews, it has the advantage of explanatory extent on sensitive issues (Morgan, 1993). A focus group consists of a carefully selected number of respondents to satisfy targeted characteristics in research in a manner that is logical, comprehensive and able to produce replicable findings (Blum & Foos, 1986). It provides information on a whole wide range of issues that are useful in questionnaire construction. However, this was mitigated by a preliminary visit to the study area and raising unstructured interviews with eMpofana riparian project managers who also introduced the researcher team to the area. Questions on a wide range of issues with regard to control of invasive alien vegetation in eMpofana catchment and the project itself were explored. The purpose of raising such questions at that stage was to get a picture of what actually takes place on the ground and what the project is all about. The information gathered from that visit proved useful in questionnaire preparation.

The questionnaire was the main research tool that formed the basis for semi-structured

interviews. It was administered in person to landowners and eMpofana riparian project employees. In addition, semi- structured in-depth interviews with open-ended questions were conducted on SAPPI, MONDI, KZNNCS and WFWP officials. It will be noted that the interviews with these officials did not exclude the questions contained in the main questionnaire that was applied to other respondents. The only difference was that more of exploratory questions and time were allowed. The rationale for preferring in-depth sessions with the officials was mainly because they were key informants selected to represent views from the involved organisations. Also, the interviews with them were carried out after the interviews with landowners and project employees so there was relatively sufficient time to spend on semi structured in-depth interviews.

Kumar (1989) is of the view that the flow of the interviews should follow similar information patterning just as acquaintances would in a normal conversation. This understanding acted as a guideline when carrying out interviews with respondents particularly on open-ended questions where 'conversation' was let to freely flow. At such times, useful data was gathered (by recording either as the respondent went on or immediately after the interview)

4.5 Preparation of questionnaire

There is no standard size of a questionnaire but every good questionnaire must be unambiguous, clear and minimize potential errors as well as being workable (Hoinville & Jowell, 1977). It must always be borne in mind that completing a questionnaire is an imposition on the respondents and therefore every effort must be made to engage their interest.

When it is important constructing a questionnaire to ascertain that there is an introductory note, questions flow smoothly, and that each variable has one or more questions measuring it (Neuman, 2000). Also it is crucial to keep in mind study objectives, variables to be measured, questions that will facilitate easier interpretation of answers and the view of other interested parties (Schutt, 1996). In addition it is important when constructing the questionnaire to establish the sample because not everyone in the study area is necessarily affected by the phenomenon being studied. For instance this study focused on stakeholders of the eMRRP and not every resident of the area.

Most of the questions were partially open in that there was a set of fixed choices from which to choose and also a final open choice of 'other' that allowed respondents to offer answers that were not catered for by the fixed choices (Neuman, 1997). Further, the questionnaire combined both quantitative and qualitative approaches as the combination is not only of value but it yields great benefits in understanding the object of the study (Neuman, 2000).

The main sections of the questionnaire were divided into the following concepts; Awareness, Process, Biodiversity, Tourism, Water, Job creation, Support and sustainability. The choice of these categories (variables) was derived from the need to enable the various steps in the project cycle to be considered by the interviewees (Refer to Table 4. 1).

In addition, stakeholders' perceptions on awareness of the linkage between UW and WFWP were established.

4.5.1 Awareness of the linkage between Umgeni and national WFW programme

The question on linkage sought to determine whether respondents were aware of any linkage between eMRRP and the WFWP. It was assumed that if the linkage existed and informants were aware of it, it would enable them to see the 'big picture' of how individual and cooperative efforts on control of invasive alien plants in eMpofana catchment fitted into the nationwide campaign. This awareness would help property owners appreciate that the requirements UW may have of them in respect of clearing of invader plant species on their riparian corridors were actually part of national effort which is legally enforceable.

The legality of the control of invasive alien vegetation is contained in the Agricultural Pest Act (Act 36 of 1983), new Water Act (Act 36 of 1998) and Forest Act (Act 122 of 1984). These Acts guard against introduction of invader species and promote effective management and control of those that have been introduced. In addition, the New Environmental Management Act (NEMA) 107, 1998 states that: everyone has the right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

- prevent pollution and ecological degradation;

- promote conservation; and
- secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

On duty of care and remediation of environmental damage Chapter seven 28 (1) requires any person on whose land environmental degradation has occurred to take reasonable measures to remedy the situation. This includes owner of land or premises or one who has the right of use (Government Gazette, 27 November 1998 - Act No. 107, 1998).

This Act (No. 107, 1998) obligates everyone on whose land environmental degradation has occurred to remedy the situation. This applies to land owners, lessees and anyone else who occupies their own land or that of someone else. For instance the Act requires property owners in eMpofana catchment to control invasive alien vegetation on their properties whether the previous owners or neighbours did so or not. Therefore, in asking the question on awareness of linkage between eMpofana project and the National WFW programme, the study sought to determine whether stakeholders are aware of these requirements.

Further, the question sought to establish whether respondents thought the linkage was desirable or not. It was assumed that if respondents rated the linkage as important and it happened to be non-existent, then that might affect their level of involvement in the project activities. Similarly if they felt the linkage was not desirable and UW maintained the linkage, which may affect their perception of the project.

In addition, it will be noted that UW preferred carrying out eMpofana project as a pilot project under its own control and management, rather than giving R 10 million annually in support of WFW projects in its area as requested by DWAF (Umgeni Water, 2000b). Also, as DWAF priority is social upliftment whereas UW's is water, there may have been different opinions on how and where to engage clearing

The categories on the questionnaire also facilitated further formulation of questions without overlooking any aspect of the project. These categories were further divided into specific sections for which questions were structured. The rationale for subdividing was an attempt to define the categories in a way that would assist formulation of questions. For instance subdivisions on biodiversity included

definition, components, state and importance.

Table 4.1 Showing main and specific sections of the Questionnaire

Questionnaire main sections	Specific sections for which questions were constructed
AWARENESS - To establish stakeholders' awareness levels about the project, the medium used and whether awareness creation is regular or irregular	Level of awareness Medium- regular/irregular
PROCESS - To establish the level of understanding of the process leading up to the initiation of the eMpofana project and then that which must follow its completion	Conceptualisation, Project description, Strategic planning, recruitment, Monitoring and evaluation, Contract allocation, Follow up
WATER - To establish perceptions of stakeholders on the impacts of invader alien vegetation on water and how their removal will contribute towards quantity and quality of water in the eMpofana catchment	Quantity Quality Usage Accessibility Riparian rights
BIODIVERSITY - To establish perceptions of stakeholders on the importance of biodiversity conservation in the eMpofana catchment and how removal of invader species facilitates re-colonisation of biological diversity	Definition Biodiversity components (structure, Composition,Function) State Individual perception Importance

JOBS - To establish how the process of control of invasive alien vegetation contributes towards job creation in the area	What jobs How many Who to employ Gender equity
	Skills required/obtained Funding Termination
TOURISM - To establish the extent to which alien invasive vegetation and their removal are considered to impact on tourism	Tourism industry Tourists & Property owner partnership What to see Regulations What benefits Who benefits Sustainability
SUPPORT - To establish the nature an d level of possible support received from stakeholders and other possible sources, if any	Financial Technical Moral
SUSTAINABILITY - To establish the factors necessary for self-sustenance of the project such as property owners' involvement, support and capacity building among employees	Project acceptability Ownership Capacity Skills Funding

4.5.2 Awareness

The questions in this section were to establish the level of awareness of stakeholders on both WFWP and the eMRRP. Although property owners and project employees are involved with the project, (employees are already working in it and property owners have allowed clearing to be done on their properties), it was deemed necessary to understand levels of their awareness. The reason for this was an assumption that the higher the level of awareness the more the likelihood that stakeholders would make lasting informed decisions on support and commitment to the project. However, this assumption takes cognisance of the possibility that a stakeholder may be well aware

of the project but fail to give corresponding support.

Also, the section sought to determine the medium of communication and whether communication was regular or irregular.

The questions on process sought to understand whether stakeholders were involved in the conceptualisation of the project and whether they were knowledgeable about the project's description (goals, objectives and methods). It was assumed that stakeholders could be involved in the project activities only to the extent they understood its description, intention and implication. Also, since one of the aims of the eMpofana project is job creation, it was important to understand how individual employees were recruited, how contractors were selected and how respondents rated the project performance so far.

4.5.3 Water

Since the most important goal of Umgeni Water is water security and supply, it was important to understand the stakeholders' perceptions on significance of clearing invader species on water supply in the eMpofana catchment. The questions in this section centred on river flow, quality, quantity and accessibility of water in the eMpofana catchment. Also the questionnaire sought to understand stakeholders' level of support of the requirement by the National Water Act that water be allocated for the sustenance of the environment. An assumption was made that if stakeholders strongly supported this requirement, they would see the connection between the National Water Act requirement and the clearing of invasive vegetation in order to conserve water in the eMpofana catchment.

4.5.4 Biodiversity

It was important to get to know how stakeholders perceived the project in relation to biodiversity conservation since biodiversity conservation is one of the expected spillover benefits of the eMRRP. In asking the questions on biodiversity it was assumed that if stakeholders rated biodiversity highly and they felt alien plants were threatening it, they would be eager to remove the invader species. Also, there were questions on which invader species were most problematic in the area. The idea was to understand whether the species being cleared matched those that were perceived to be most problematic.

4.5.5 Job creation

The questions in this section sought to determine the number, nature of the jobs created, gender equity and the skills required before or obtained after employment. The motivation for asking these questions was the fact that one of the expected benefits from the eMRRP is provision of jobs to the local people in a bid to uplift their standard of living. Furthermore, it is noteworthy that the KwaZulu-Natal midland has an unemployment rate of 70% (Umgeni Water, 2000b).

4.5.6 Tourism

One of the land uses in the eMpofana catchment is tourism. For this reason, it was important to understand the views of stakeholders on tourism and how cleared riparian zones might contribute to this industry, if at all. In addition, the questionnaire sought to establish what benefits would be expected from tourism, its regulations and sustainability in the area.

4.5.7 Support

In this section the questionnaire sought to establish what support stakeholders were giving or expected to give to the project, and what they perceived to be their short and long-term benefits from the project. It was assumed that the more benefits they received the greater would be their support to the project. Also, the questionnaire asked project supporters to indicate the reasons they did. The purpose for this question was to measure project performance against stakeholders' perceived benefits.

4.5.8 Sustainability

The issue of project's self-sustenance is very important for the eMRRP as UW aims to reduce invader species to 1% in four years and then leave it to property owners to carry on with maintenance (Umgeni Water, 2000). In order to measure the prospects of sustainability of the project through participatory approach from stakeholders, questions on their responsibility to monitor re-growth, rehabilitation, willingness to get involved, and whether they can carry on without support from UW were asked.

4.6 Sampling

A sample is defined as a list or number of units in a population (Casley & Lury, 1987)

and sampling is selection of sections or part of the population in a systematic way so as to aid research (Neuman, 1997). Sampling provides a cost-effective way of carrying out research, as it would cost more money and time to measure whole populations if this were possible. The implication is that methods of sample selection must be accurate and thorough otherwise findings would be compromised. One way of attaining accuracy in sample selection is being sure of the research population and sampling methods to be used depending on information required by the study.

4.6.1 Population

The eMpofana project falls within Midmar catchment which has a total area of 12024 hectares (Umgeni Water, 2000b. The areas to be cleared in the Midmar catchment include dense 683 ha, medium (I 507 ha), natural (724 ha), scrub (5210 ha), sparse (2543 ha), agricultural (712 ha) and wetland (645 ha)(*ibid.).* The eMpofana riparian zone fall within this geographical location and the population therein were sampled for interviews. The total number of respondents who comprised the study population was 164. Out of this number, 80 were property owners, 84 eMpofana riparian rehabilitation project employees and four officials from SAPPI, KZNNCS, WFW and MONDI: one from each.

The main aim of sampling is to generalize and if done well, "a researcher can measure variables with 2,000 cases, generalize to 200 million, and not be off by more than 2 to 4 percent from results that would be obtained if all 200 million were used" (Neuman, 1997). A list of stakeholders, alphabetically ordered was prepared and every fifth name was selected to form a sample for the population. If the fifth person was not available, the one above or below was picked. The choice of fifth person was preferred so as to attain a total of twenty-five respondents, a figure that was randomly assigned but thought to be achievable in the time available, cost effective to physically reach. Interview dates with the property owners so selected were arranged through telephone.

However due to the fact that it was not easy to reach most of the project employees on telephone, a sample of the employees (27 in all) who were conveniently available at the four project sites during interview days was taken. This comprised 30% of the employee population. Selection of these samples was done with the assistance of contractors. Similarly, convenience sampling was applied on WFW, SAPPI,

KZNNCS and MONDI respondents who, although accessible on telephone, only those who were available for interviews were interviewed.

4.7 Literature search

This section was to consult literature, reports and findings that have resulted from many studies on control of invader plant species in South Africa and beyond.

Although no other known study has been carried out on perceptions of stakeholders in eMpofana project, there are similar projects done elsewhere in the country e.g. Turn Table Trust WFW project in Bulwer by Naude (1999) and Hogsback WFW project by Coleman (1999).

The value of literature review is that scientific research is a collective effort of many scholars who share their results with one another in pursuit of knowledge as a community (Neuman, 1997). Similarly, documenting results of such studies is shaped mainly by experiences of other researchers (Booth & Foos, 1995). But this write up must not 'box in' the researcher. He/she must be able to change and adapt should need arise such as when following the original plan would be indicative of the project running aground. From the foregoing it can be noted that reading and documenting findings fulfills research.

It is the view of Brown *et al* (1995) that research is, " all about building on the work of others". Brown further puts it that no research should commence from scratch. His argument is that in every research, someone else must have done a similar thing and perhaps required similar measurements. It is expedient therefore that in research the initial step be to unearth what predecessors have found out.

In this regard, the study was guided by findings of research studies carried out on WFW projects at national, provincial and local levels. It was hoped that literature review would provide understanding on key issues of the programme, its impacts on the socio- economic aspects, strengths and weakness. Also literature on eMRRP was consulted to help understand the activities of the project so far. The understanding so gained aided conceptualisation of the study and then built on from there.

4.8 Observation

Although observation is hardly a technique by itself, the process of recording observations is a formidable one and perhaps underlies all the other techniques (Blum & Foos, 1986). It is one technique open to as many people as can record observations objectively so as to arrive at desired solutions. The data so observed should be recorded immediately to avoid distortion through forgetfulness and to aid memory and clarity in subsequent documentation (Booth, 1995)

Once in the field, it is vital for researchers themselves to become information-gathering instruments by way of observing and listening (Neuman, 1997). Observation reveals relevant details of research phenomenon that questionnaire and or in-depth interviews might never take into account. Also, as Babbie (1992) argues, to collect information about a phenomenon, one must go where the action is and watch. He further contends that observation does not only assist data collection but generation of theory that is crucial in hypothesis formulation. In view of this, every visit to the eMpofana area was a data collection exercise, at least through observation.

The observations made in eMpofana included riparian clearing in progress, some midlands meander hills covered with exotics, pocket forests, stacked wood being burnt or awaiting burning, and body language as respondents stressed certain points, were invaluable data.

The preliminary visit to the study area provided the first opportunity to observe the area and the activities of the eMRRP. As mentioned earlier in this report, the observations made during the preliminary visit were useful in construction of the questionnaire. In addition, Marshall (1995) argues that through such systematic techniques of research, the researcher gains a better understanding of complexities of humans' interactions with their environment.

CONCLUSION

As discussed in this chapter, the study aims to understand perceptions of stake-holders on eMpofana riparian project. The nature of the study and time constraint necessitated the use of both quantitative and qualitative techniques since the two approaches complement each other (Neuman, 1997).

The phenomenon of study is control of invasive alien vegetation by eMRRP project and the main research tool was a questionnaire that formed the basis for semi-structured interviews. The questionnaire carried coded, closed-ended questions as well as exploratory open-ended qualitative questions. It was administered in person to property owners and project employees in a bid to aid making informed decisions on the phenomenon (Neuman, 1997; Booth, 1995).

In designing the questionnaire, the first step was to divide the phenomenon into main sections out of which questions were drawn. These sections were Awareness, Process, Biodiversity, Water, Job, Sustainability, and Tourism. The division of the sections was to enable the various steps in the project cycle to be considered by interviewees. Having designed the questionnaire, the next step was selecting a sample that would represent the population of stakeholders.

The sampling technique used in the study was systematic random sample drawn from a list of stakeholders, which was alphabetically ordered. This list formed the sampling frame (Neuman, 1997) from which every fifth name was selected, whose total made the sample for the study.

The other methods used for data collection were literature search, observation and literature search. Literature search mainly seeks to build the study from the findings of other scholars. Documentation of observations carried out reveals details of the research phenomenon that questionnaire and or in-depth interviews might never take into account (Brown *et al.*, 1995)

As Marshall (1995) further argues, the initial research questions are usually drawn from life experiences and observations. As such, questions were guided by documentation of observations made during preliminary visit to eMpofana catchment.

CHAPTER FIVE

5. RESULTS

5.1 Introduction

After describing methods of data collection used in this study, sampling methods and measurements in Chapter 4, this chapter aims to present the findings. The sections on which questions were based were Awareness, Process, Support, Biodiversity, Sustainability, Water and Job creation. The selection of these issues was mainly to enable the various steps in the project cycle to be considered by the interviewees.

There were fifty-two respondents in all: twenty-five property owners and twenty-seven project employees. Their perceptions are important because in starting the eMpofana, Umgeni Water's (UW) main aim was attainment of higher water flow to the Midmar dam and how the riparian zones can be kept clear of alien vegetation, in a sustainable manner. To achieve this, stakeholders' involvement and commitment to the project from its inception was deemed vital. Their perceptions on the eMRRP determine sustainability; a questionnaire that carried open-ended and close-ended questions was used to assess perceptions.

5.2 Awareness

Questions 2,3 and 6 sought to establish how aware the eMpofana project stakeholders' were of the project and the relationship between eMpofana project and the national WFW Programme (WFWP). The questions aimed to establish how stakeholders gained the awareness before the project started and whether there was any change on awareness after joining the project.

5.2.1 Stakeholders awareness levels of eMpofana Project and WFW

On a scale of 0-5 (where 0 is least awareness and 5 most aware) respondents were asked to indicate their level of awareness of eMpofana riparian rehabilitation project and the WFWP (both national and provincial levels). Their perceptions on both are presented below.

Property owners

Although participation of all possible stakeholders in the eMpofana project is important, property owners play a key role and Table 5.1 presents their awareness levels of the National WFW and eMRRP.

Table 5.1 Level of awareness of property owners on a scale of 0-5

Level (from least to most)	0	1	2	3	4	5	No responses	Total responses
National (WFW)	1	1	1	7	2	4	9	25
Provincial (WFW)	4	0	3	5	5	2	4	25
eMpofana Project	0	0	2	9	8	6		25

Almost half (12 responses) indicated little awareness (0-2) of the national WFWP and almost the same number i.e.13 had little awareness of the provincial WFWP. Four property owners indicated zero awareness level at the provincial level of the programme. Only one property owner indicated no awareness of WFW national level.

All property owners were aware of the eMpofana riparian rehabilitation project (they knew of project's existence) but level of awareness on its description differed from one respondent to the other. With 23 out of 25 property owners indicating awareness levels of 3-5, one can argue that most of them were aware of the eMRRP. Only 2 indicated awareness level of 2 and none for zero awareness.

In comparison property owners seemed more aware of eMRRP than they were of the national WFWP. The high levels of awareness on eMRRP indicate reasonable but probably insufficient awareness for sustainability of the project. In other words, one might be aware of the project but not necessarily committed to its undertakings. However, the results on support for the project will be presented later in this Chapter.

Project employees

By virtue of being physically involved in the clearing of invasive alien vegetation in the eMpofana riparian areas, the employees become stakeholders to the whole process. Also, they are direct beneficiaries of the employment opportunities that the project affords. For some, the eMpofana project could be seen as another employer

that avails needed wages and they might not be aware of the core objectives of the project.

5.2 Table 5.2: Level of awareness of project employees on a scale of 0-5

Level (from least to most)	0	1	2	3	4	5	Total responses
National (WFWP)	26	0	0	0	0	1	27
Provincial (WFWP)	20	3	0	0	0	4	27
EMpofana project	7	3	4	7	2	4	27

Twenty-six out of twenty seven eMpofana project employees indicated no awareness of the WFWP national level and twenty said they were not aware of the WFWP provincial level. These levels indicate poor awareness of the Working for Water Programme among the workers. Since one of the main objectives of WFW is social upliftment, one would expect that these rural poor should be more aware of the programme in its bid to improve their standard of living.

On the other hand seven of the project workers were not aware of the eMpofana project itself. Awareness of the linkage between Umgeni and national WFW programme.

5.2.2 Awareness of linkage between Umgeni and the national WFW Programme

The perceptions of property owners and project employees on the linkage between the project and the national WFWP are shown in the following section.

Property owners

Of the 25 property owners 15 (60%) indicated awareness of linkage between eMpofana project and the national WFWP, 20% said they were not aware of the linkage and 20% responded that they do not know. Asked whether this linkage was desirable, 52% answered yes, 40% said no and 8% indicated that they do not know. In addition, 60% of property owners are aware of UW running the project independent of the national WFWP, 24% said they are not aware and 16% said they do not know.

Table 5.3: Property owners' perceptions on awareness of a linkage eMRRP and the National WFWP and its desirability

Awareness	Responses			
	Yes	No	Do not know	Total
Are you aware of the linkage	15	5	5	25
Is linkage desirable	13	10	2	25
Aware of Umgeni Water running the project independently	15	6	4	25

The reasons given in support of or against the independence are qualitatively shown on the table below. The reasons do not necessarily represent the number of respondents as some gave more than one reason, while others did not respond to the question. Also, as far as was practical, same responses given by different respondents were combined and are reflected once in Table 5.4. The number of respondents per statement in the table is shown in brackets.

From the views shown in the Table 5.4, it becomes apparent that the issues of good management, financial support and objectivity were cited as reasons for the independence. The views given against the independence are, need for devolved power and that the linkage would provide for diversity of opinions, water being a national asset and that one part of the river or dam links into the other and therefore there is need for unity.

Project employees

Employees' contribution and involvement in clearing of the invasive alien vegetation made determining their perceptions on linkage between the project and the national WFWP vital.

Table 5.4: Qualitative analysis of perceptions of property owners on the linkage between eMRRP and the national WFWP. The number in parenthesis indicates number of respondents making this or similar observation.

Reasons supporting the independence	Reasons against the independence
• Supervision by Umgeni Water is better (2) • EMpofana project has very high standards of supervision unlike DWAF (1) • There will be greater efficiency (1) • Local people should have a say on what befalls them and their area (3) • EMpofana project feels it is working in delicate small areas and one needs to treat it carefully. Also the project is specialised to the area (1) • Water is easier to manage at local level independently (3) • It is much easier to deal with a local venture (2) • Independence is better because property owners carry out our activities without national level interfering with our independence (1) • Independence is desirable because local authorities do not agree e.g. Gauteng and KwaZulu-Natal (1) • Umgeni is a business organisation and will ensure cost-effectiveness, sustainability and higher accountability (4) • Water organisation need independence for long term investments (3)	• Unity for the bettterment of the project (4) • It is sensible to link up with the national WFW because one part of the river continues into the next and so is the river-dam connection (2) • Linkage with national WFW is better because the major goal is to provide water to all (1) • Water is a national asset (5) • Devolved power is better: the more the opinions the better. Linkage would provide for more opinions (1) • Only if Umgeni know their work and that they can do the job better independently. Presently, I'm not sure (3) • The big body is better (1)

Table 5.5: Project employees' perceptions on awareness of the linkage between eMRRP and the national WFWP and its desirability

Awareness	Responses			
	Yes	No	Do not know	Total
Are you aware of the linkage	11	7	9	27
Is linkage desirable	1	6	20	27
Aware of Umgeni Water running the project independently	1	15	11	27

Although 26 out of 27 employees (see Table 5.1.5) indicated that they were not aware

of the national WFWP, eleven (41%) indicated that they were aware of the existence of linkage between the project and national WFWP. At the outset this view presents a contradiction because if they are not aware of national WFWP, how can they possibly be aware of the linkage? However, it will be noted that in the first instance the question was not on establishing depth of awareness. Rather the question sought to determine their awareness of its existence, which 41% indicated they did. This shed light on how an employee who is not aware of what the national WFWP is all about can be in a position to give their view on linkage between the two. The rest (59%) were not aware of the linkage.

When asked whether the linkage is desirable, only one employee replied in the affirmative, 26% said not desirable and 75% indicated that they do not know. Further, among the employees who were aware of the WFWP (at least the provincial level), twenty-six per cent indicated that the linkage was not desirable.

However, most project employees were not aware that UW ran eMRRP independently, as only one of them is aware of the independence. The rest responded in the negative indicating either not aware (56%) or simply that they do not know. This implies that although 41% of employees are aware of the linkage between UW and national WFW, they remain unaware of Umgeni running the eMpofana project independently.

5.2.3 Source of awareness

The purpose for seeking to understand source of awareness was to see which one has been more useful, whether there are others that could be explored with a view to strengthening future awareness creation.

Property owners

Out of the 25 respondents interviewed, eighteen (72%) were informed about the eMpofana project by Umgeni Water staff, ten 20% learnt of the project from conservancies' and Farmers Day meetings. One (4%) of employees heard of the project from their contractor and yet another one read from posters.

The visits by UW to individual property owners led to awareness and then to contracts that were signed. From the visits, conservancies through which property owners also

became aware of the project held meetings.

Project employees

As was the case with property owners it was necessary to establish the source through which employees became aware of the project so as establish the role UW has played in creating awareness and how effective this has been. The results revealed that there were 42% of eMRRP employees whose awareness of

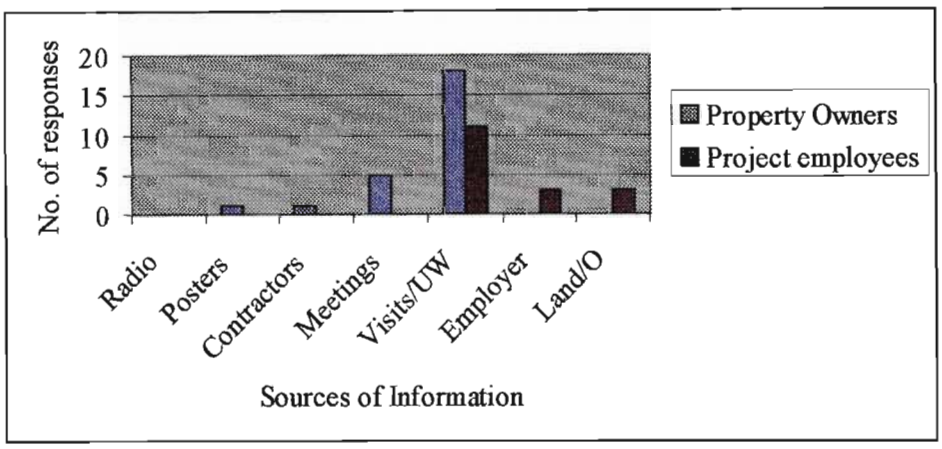


Figure 5.1: Number and distribution of responses to sources of information creating awareness of the eMpofana project

the project is attributable to visits from UW staff. Another 6% indicated that they got to know about it from the employer, landowner (those who specifically own land) and in meetings respectively. A contractor informed one project employee of the project.

Twenty-six percent indicated no knowledge of eMRRP. One implication of these results is that as in the case of property owners, 42% employees became aware of the project through visits by UW staff. Of concern are the seven employees who, despite the fact that they are working for the project, indicated no knowledge of it. The reason they gave for this response was that the property owners on whose farms they worked suggested them into joining eMpofana project without explaining what it entailed. The opportunity to work for the project provided a much-needed extra source of income with which fact the employees seemed content.

As for linkage with the national WFWP, the perceptions of property owners and project employees revealed a general preference for eMpofana project to continue running independently although this is not based on any real depth of knowledge about the WFWP.

5.3 Process and indicators of success

The questions on process were designed to establish stakeholders' perceptions on planning, description and conceptualisation of the project.

Table 5.6: Perceptions of property owners about involvement in the project process

Process	Responses		
	Yes	No	Total
Involved in project planning	3	22	25
Know and understand project description (goal, vision and method)	19	6	25
Involved in project conceptualisation	0	25	25

Property owners

Property owners have the responsibility for control of alien vegetation in the long term. They therefore determine the sustainability of the short-term undertaking of the eMRRP. If they were participants in the planning, the prospects of commitment in the long term are improved.

On the question of whether the property owners were involved in the planning stage of the project, three (12%) claimed to have been involved. The larger majority (88%) however indicated that they were not involved in planning of the project. Surprisingly, only 24% said they knew and understood the project's description (goal, method and vision). None of the property owners interviewed indicated involvement in the project conceptualisation.

Most property owners seem not to have been involved in the planning of the project.

This suggests that the project was presented to landowners once UW had planned it and that, if at all, property owners were involved with planning at the property scale only.

Project employees

As the result in Table 5.3 show, only 3.7% employee indicated having been involved in planning of the project while (96.3%) employees reported that they were not involved in project planning. The employee who answered in the affirmative could have been involved in the planning of the project at the scale of local implementation. There were 37% employees who said they knew and understand the project's description (goal, vision and method) and 63% indicated no awareness of the project description at all. Asked whether they were aware of how the project was conceptualised, 11% answered in the affirmative and 88.9% said they were not.

Table 5.7: Perceptions of project employees on project process

Process	Responses		
	Yes	No	Total
Involved in project planning	1	26	27
Know and understand project description (goal, vision and method)	10	17	27
Involved in project conceptualisation	3	23	27

5.3.1 Indicators of project's success

The questions in this section sought to determine perceptions of stakeholders on what project outcome indicated that the project was successful. For example, would the number of stakeholders involved in the project be seen as an indicator of success or is it the area of alien species cleared improved river flow and or improved aesthetics?

As Table 5.8 shows, the total number of responses exceeded the number of respondents (25 property owners and 27 employees) as some of respondents selected more than one indicator of project success.

Property owners

The invader plant species cleared as an indicator of project success scored the highest (36%). Two of the responses indicated that the number of stakeholders involved in the project was itself indicative of success so far. One property owner was impressed "to see the community at Balgowan get together and call in UW to help clear invader species... itself an indicator of success". There was 10% indicating that control of invader plan species in the riparian areas enhanced recreation. Noticeable improvement on aesthetics as a result of control of invader species as an indicator of project success had 12% of the responses.

Table 5.8: Perceptions of stakeholders on what indicators of project success are

Indicators	Property owners	Project employees
Alien species cleared	18	14
Improved river flow	11	11
Improved recreation	5	0
Natural species recovery	8	3
Improved aesthetics	6	4
Stakeholders involved	2	0
Total	50	32

Indeed the issue of aesthetics and follow up process drew mixed reactions from property owners. One property owner said that, "the project has left river banks bare. What would happen if floods came?" Although six property owners indicated that the clearing of alien vegetation had improved aesthetics one property owner argued that "if anything they have destroyed aesthetics". However, there was an assurance given from the project managers that every effort is being made to speed up follow up on the cleared riparian areas (Wood, 2000, per.comm.).

Project employees

Fifty-two per cent of the employees indicated that the invader species cleared was the best indicator of success and 41% felt improved river flow was. There was no

employee who viewed the number of stakeholders involved as an indicator of project success.

5.3.2 Project success

Having raised questions on indicators of project success, respondents were asked to rate the project success and what they thought were the factors contributing to the success.

It was assumed that the higher the respondents rated the project success the more likely would be their cooperation and commitment.

Likewise, if they rated it as not successful, the most natural thing to do for project managers would be to discover why and then seek to address the discrepancies. This is because sustainability of the eMRRP depends on how well stakeholders accept it and how viable they think it is.

Table 5.9: Perceptions of project success

Rating	Property owners	Project employees
Highly successful	14	23
Successful	8	4
Not successful	0	0
Do not know	3	0
Total	25	27

Property owners

Eighty-eight per cent of property owners rated the project as being successful. 12% did not know and there was no respondent who felt it was unsuccessful. Of the three who said they do not know, two indicated that it was too early to tell and one said only after follow up is done can the rating be done. From the responses, it is clear that most property owners are content with what the project is achieving.

Project employees

Twenty-seven (100%) project employees indicated that the project was successful.

5.2.1 5.3.3 Perceptions on success of project process

The project was implemented on each property in a number of steps. Questions 18 and 19 sought perceptions from stakeholders on the success of the eMRRP. The purpose of this section of the study was to gain insight into the perceptions of property owners and employees in respect of 'on site' operations If these are perceived well, then prospects for long-term cooperation are enhanced. In answer to question 19, respondents came up with planning, execution, management and follow up as the steps that guided their ratings on the performance of the project.

Table 5.10: Perceptions of property owners and employees on success of various steps in project implementation

Factors	Property owners	Project employees
Planning	10	5
Execution	5	7
Management	6	5
Follow up	0	0
Financing	3	7
Do not know	1	3
Total	25	27

Property owners

It was the view 40% of property owners that planning was the most successful step and 20% indicated that execution was. Financing and management had 24% and 6% responses respectively indicating that they were successful. One property owner said he did know and no response was given for follow up.

The responses show that property owners view planning of the project as the most successful of the steps of project implementation. Execution, management, and financing phases were also indicated as successful. However the zero response on follow up could mean no success at all.

Project employees

Unlike the perceptions held by property owners, the project employees viewed execution (30%) and financing (30%) as the project steps that were successful. Management and planning were each selected by 10%, and three employees said they do not know. It can be argued that the reason execution and financing stood out in employees minds was because both touch on their direct involvement in the project: execution because they do the physical clearing, and financing because of the daily wages that they receive and equipment that they use.

Project employees shared the same view with property owners on follow up in that no respondents identified this step as successful.

5.4 Water

The National Water Act (Act No.36 of 1998) makes provision for maintenance of the integrity of the 'resource', which is defined as the river system not just the water in the system. Controlling alien invasive plants in the riparian system is an integral part of maintaining the integrity of the resource. Peoples' perceptions of and support for the principles espoused in the Act will determine their commitment to maintaining the integrity of the resource.

Further, their perceptions on the availability of water before the project was initiated would shed light on whether the efforts towards increase of water security through control of invader species would gain their support. For instance, if most of them said that they had a sufficient water supply before project, then that might suggest that increase of water supply would not be their priority need for the area

Property owners

Forty-eight per cent of property owners indicated that clearing of invasive alien vegetation in the catchment was very significant for water supply and 32% said it was

significant. However, four property owners indicated that clearing of invader species was not significant for water supply and one did not know.

In view of these responses on the significance of clearing invader species for water, it is apparent most property owners 80% perceive clearing as significant. This is encouraging for UW whose main goal for the project is water security and supply. The four respondents who felt that clearing of invader plants was not significant for water supply argued that it was too early to determine the significance.

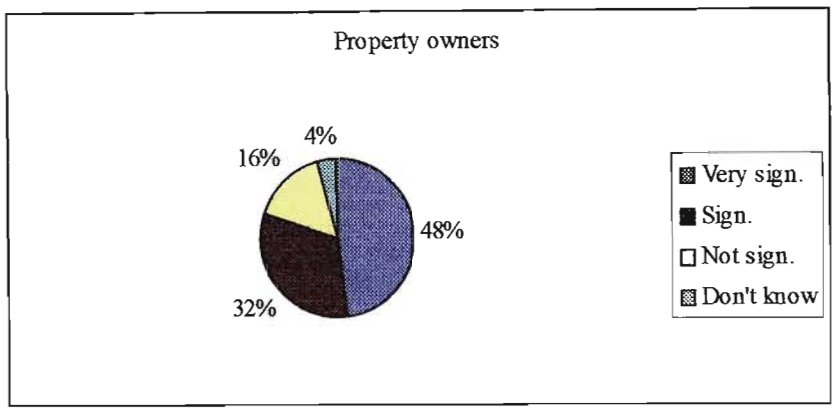


Figure 5.2: Perceptions of property owners on significance of clearing invader species for water supply

Project Employees

Seventy four per cent of employees indicated that clearing of invasive alien vegetation in the eMpofana riparian areas was significant for water supply. However 7% were of the view that the clearing was not significant and 19% said they do not know. As was the view held by most property owners, the responses by the employees show that most of them perceive the clearing of invader species as significant for water supply.

Nineteen per cent of project employees and 4% of property owners said that they do not know of the significance of clearing alien species for water supply. With 16% of property owners and 7% of employees indicating that clearing was not significant for water supply, it is necessary to focus on building understanding.

5.4.1 Perceptions of water quantity before project started

The questions in this section sought to establish the perceptions of stakeholders on how satisfied they were with the amount of water in the river before the project started. Clearly if property owners felt there was a good supply of water they might not be easily persuaded of the perception of UW that it was desirable to remove alien vegetation from the riparian areas in order to improve the supply of water.

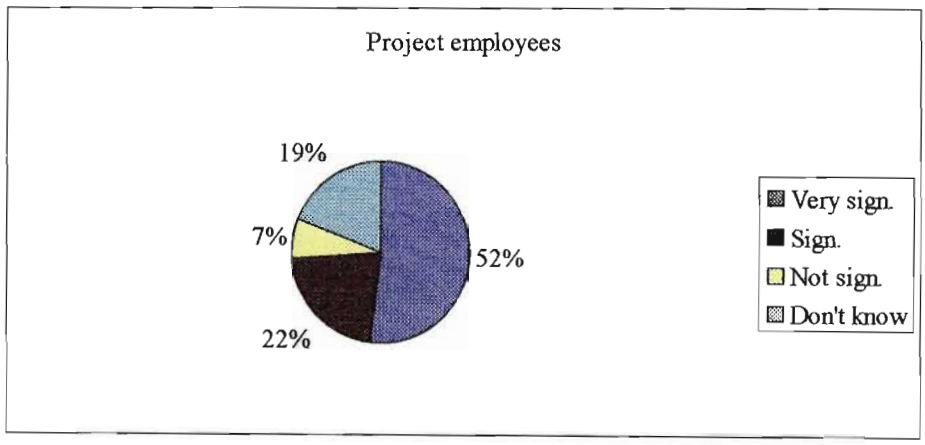


Figure 5.3. Perceptions of project employees on significance of clearing invader species for water supply

Table 5.11 presents the views of stakeholders on the status of water quantity prior to eMRRP

Table 5.11: Perceptions of stakeholders on quantity of water before project started

Water quantity before project started	Property owners	Project employees
Satisfactory	20	4
Unsatisfactory	4	15
Barely enough	1	8
Total	25	27

Property owners

Eighty per cent of property owners were of the view that there was a satisfactory amount of water in the area. Four indicated an unsatisfactory situation and one said the amount of water was barely enough. Since most property owners perceive water quantity as being satisfactory unlike UW, they may not accord water security and supply a high priority.

The property owners who indicated that the amount of water was satisfactory cited the fact they were near the river sources and therefore had enough water from the rivers. Also, where need be "property owners maintained their own bore holes" making them less dependent on river flow.

Project employees

A majority of the project employees 56% perceive the quantity of water in the area as being unsatisfactory and 30% indicated that the amount of water was barely enough. Only four employees said that water in the area was satisfactory.

These views present a sharp contrast from those held by property owners, most of who indicated that the amount of water was satisfactory. One explanation for this difference is that, as discussed earlier, property owners have alternative accessibility to sources of water such as boreholes whereas most employees probably do not have access to potable water and household requirements are met from springs and streams.

5.4.2 Perceptions on support for the National Water Act

The intention of questions in this section was to determine stakeholder support of the National Water Act requirement that water be allocated to sustain the resource (river system). Respondents were asked to indicate their level of support in terms of, very strong, strong, neutral and no support.

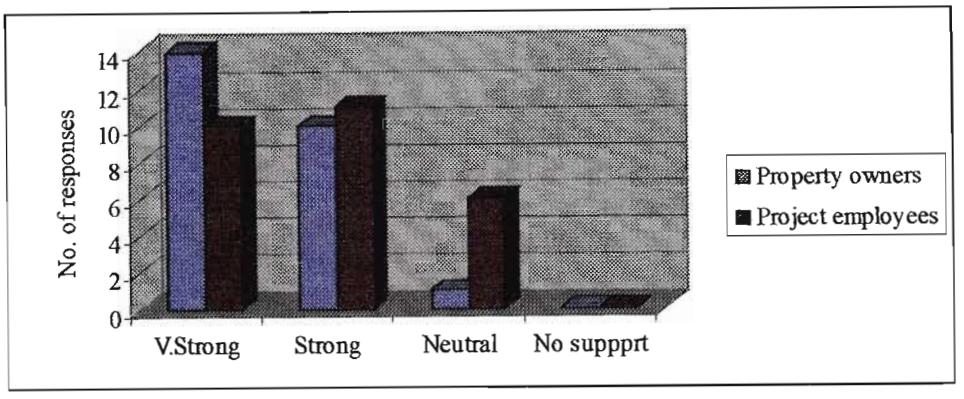


Figure 5.4: Stakeholders support for the National Water Act to sustain water resource

Property owners

All respondents were either supportive or neutral to the Act. Fourteen (56%) property owners indicated very strong support for the National Water Act and ten (40%) showed strong support. Only one respondent indicated neutral.

These responses from property owners indicate support for the Act and its requirement that water be allocated for the maintenance of the environment. Given this strong support, it can be expected that property owners will support the efforts to control invasive alien vegetation being carried out by eMRRP so as to provide the water required for sustenance of the environment.

Project employees

Thirty-seven project employees indicated very strong support for the National Water Act and its requirement that water be allocated for the sustenance of the environment. Eleven indicated strong support and six were neutral. This expression of support may reflect the need marginalised people have for secure access to potable water.

5.6 5.5 Capacity building (Job creation and skills training)

One of the aims of eMRRP is capacity building in an equitable way amongst disadvantaged people and this is achieved through selecting applicants and providing 'on the job' training. Table 5.12 shows the employees' biographical data.

Table 5.12: Biographic data of the eMpofana project employees

Age	Responses	Education level	Responses	Gender	Number
20 & below	1	No education	5	Male	11
21-30	12	Grade 1-7	16	Female	16
31-40	6	Grade 8-12	6		
41-50	5	Technikon	-		
51-60	2	University	-		
60 and above	1				
Total	27	Total	27	Total	27

The Table 5.12 shows that among the project employees interviewed, 40% are men, 59 % are women and 44% of the workers are between 21and 30 years of age. There was one employee below twenty years of age and one above the age of 60years.

As for the level of education, 59% of project employees fall in the Grade 1-7 category and 22% in Grade 8-12 category. Five out of the 27 employees interviewed have no formal education. Although the lack of formal education may not hinder an employee from performing assigned tasks, it is limiting in terms of depth and level of training one can be exposed to.

Table 5.13 Project employees' perceptions of job creation, gender equity, and skills gained

Rating	Job creation	Gender equity on job offer	Skills gained	Responses
Very successful	23	21	New contractor skills	13
Successful	3	5	Conservation guard/staff	12
Not successful	-	1	Team work skills	5
I do not know	1	-	None	1
Other	-	-	Other	1
Total	27	27		32

Table 5.13 shows project employees' rating of the eMpofana project in respect of job creation, gender equity and skills gained from the project.

Of the twenty-seven project employees interviewed 85% were of view that eMpofana riparian project is very successful on job creation, 12% indicated successful and 3 % said they do not know. On equitable distribution of job offers along gender lines, 21 (77%) indicated highly successful, 5 (19%) indicated successful and I said the project has not upheld gender equity on employment. The skills gained indicated 13 (48%) new contractor skills, 12 (44%) conservation guard/staff and 5 (18.5%) for teamwork skills.

Table 5.14: presents perceptions of project employees on job tenure and potential for future employment. It was necessary to establish these factors since one of the main spillovers expected from the project is social upliftment through skills training. Also, since UW is expected to withdraw active involvement in the project after four years, it was important to determine perceptions the potential for future employment. On potential for future employment 30% of the project workers indicated much better and 48% indicated better chances. This means 78% perceived they to have better chances for future employment. However, 3 project employees said there was no change with regard to potential for future employment and 3 said they do not know.

Table 5.14: Perceptions of project employees on job tenure and potential for future employment

Job tenure	Responses	Potential for future employment	Responses
Temporary	4	Much better	8
Permanent	22	Better	13
Other	-	None	3
I do not know	1	I do not know	3
Total	27		27

5.5.1 Perceptions of project employees on employment before and after the project

Most of the project workers 81% view the jobs as permanent (Table 5.14). Four of them viewed their jobs as temporary and one did not know.

There seems to be a misunderstanding with regard to job tenure. This is because Umgeni Water is scheduled to pull out of the project after four years (Umgeni Water, 2000b) and it is doubtful that property owners will retain the current number of project employees. Moreover, most of the project activities are scheduled to end in September 2000 after which it will be the prerogative of property owners to decide who their employees, if any, will be (Umgeni, 2000).

Table 5.15: Perceptions of project employees on job tenure before and after employment on the project

Perceptions	Yes	No	Total
Before	4	23	27
After	5	22	27
Employed elsewhere before	14	13	27

Only 15% of project employees indicated that they were aware of the temporary nature of their jobs with the project before joining. The view has not changed much since employees joined the project, as the majority (81%) remained unaware that their jobs were not permanent

These responses imply that only one employee became aware of the temporary nature of the jobs with the project after employment. The rest were not aware of it before and after joining the project. The implication here is that by the time UW completes its support for the project most of the employees will be expecting to remain on the job and not to be laid off as they view their jobs as permanent.

Asked whether they were employed elsewhere before securing employment with eMpofana project, 51% answered in the affirmative and 49% said they were jobless. With 51 % indicating that they had jobs elsewhere before joining eMRRP, it

suggestive of perceived better terms of service with the project. One of these may have been a false perception of opportunity for permanent employment. It is a credit to the project for providing jobs to 49% of the unemployed.

5.6 Biodiversity conservation

The intention of questions in this section was to determine the perceptions of stakeholders on the importance of biodiversity in the eMpofana catchment. Also included in the section were questions seeking perceptions on whether indigenous species have returned to the cleared areas or not. The assumption was that if stakeholders perceived biodiversity as important, they would naturally want to safeguard it. Similarly, the re-establishment of natural vegetation would signal the re-establishment of environment friendly and aesthetically appealing ecosystems.

Table 5.16 Perceptions of stakeholders on importance of project's goal on and biodiversity conservation importance of biodiversity in eMpofana catchment

Importance of Project's goal of biodiversity conservation		
Rating	Property owners	Project employees
Very important	22	19
Important	3	5
Not important	0	1
Do not know	0	2
Importance of biodiversity in eMpofana catchment		
Very important	21	19
Important	4	4
Not important	0	1
Do not know	0	3

Property owners

Eight-eight per cent of property owners were of the view that the project's goal on biodiversity conservation is very important and 12% indicated that the goal was

important. These responses imply appreciation of the importance of conservation of biodiversity in eMpofana catchment.

The results on perceptions of property owners on importance of biodiversity in the catchment reveal that 84% property owners perceive it as very important and four said it was important. As will be discussed in the following section on tourism, property owners perceived conservation of biodiversity as directly related to the tourism industry and its well being.

Reasons advanced were the intrinsic value of biodiversity to the eMpofana catchment, that indigenous species have the capacity to "withstand our climate better," upholding balance of nature, aesthetics, tourist attraction, cleaning the air and returning nature to 4toriginal state before we messed it up" a property owner contended. Additionally, conservation of biodiversity in the midlands is very important as the area "falls within veld-type 45 which is highly threatened in the country" as argued by on respondent.

Project employees

Seventy per cent of project employees rated the project goal of biodiversity conservation as very important and 19% indicated that it was important. Only 4% of project employee said the goal was not important. On importance of biodiversity conservation in the catchment, 70% of employees indicated that it was very important. 15% of the employees indicated that it was important and 11% said they do not know. Only 4% of employees who held the view that conservation of biological diversity were not important.

5.7 Tourism

The questions in this section sought to establish the perceptions of the stakeholders on the importance of tourism as a land use in the area. One of Umgeni Water's expected spill over benefits from control of invader vegetation in the area is improved quality for tourism. Also, as different sites have different tourist attraction, the questions sought to determine what it is that attracts tourists to the eMpofana catchment. With regard to the Nature Trail designed by UW in the catchment as an education venture and tourist attraction, the questions sought to establish the perceptions of stakeholders on its importance.

Table 5.17: Perceptions of stakeholders on importance of tourism in eMpofana catchment

Rating	Property owners	Project employees
Very important	16	20
Important	8	6
Not important	1	0
Do not know	0	1
Total	25	27

Property owners

Sixty-four per cent of property owners rated tourism in the area as very important, and 32% indicated that tourism in the area was important. Only 4% property owner said that that tourism was not important.

Project employees

As was the case with property owners, most project employees (75%) rated tourism in the area very highly and 22% indicated that the industry was important. Only one of the project employees indicated 'do not know'.

5.7.1 Perceptions of stakeholders on eMpofana Nature Trail

To demonstrate their commitment to tourism as a spill over benefit, UW has designed a Nature Trail to serve as an education and tourist attraction venture in the area. Also the trail was intended to show the importance of biodiversity conservation and of natural vegetation in conservation of quantity and quality of water that comes from the eMpofana catchment. The Nature Trail starts at the bridge below Caversham Cottage and ends at Caversham Mill. It covers a distance 2.8 km on the longer route and exposes walkers to a variety of habitats that are representative of the riparian system.

There are two questions in this section. The first one was meant to establish whether the stakeholders were aware of the eMpofana Nature Trail and the second one sought

their perceptions on importance of the trail to the area. The ratings were categorised in terms of very important, important, not important and I do not know.

Table 5.18: Perceptions of stakeholders on awareness of the nature trail

Property owners			Project employees		
Yes	No	Total	Yes	No	Total
5	20	25	4	23	27

Property owners

Eighty per cent of property owners did not know that the trail existed in the area. Only 20% who indicated awareness of its existence.

Project employees

Most of the project employees (85%) were not aware of the nature trail's existence in the area. Only 15% said they were aware of its existence.

Table 5.19: Stakeholders perceptions on the importance of the Nature Trail

Rating	Property owners	Project employees
Very Important	5	9
Important	10	4
Not important	0	4
I do not know	0	10
Total	25	27

Property owners

The view held by 60% of property owners was that a nature trail in the area would be very important and 33% indicated that the project was important. However, their rating for its importance was not based on awareness of the existence of eMpofana Nature Trail as 80% did not know that the trail existed in the area. In other words their responses were not based specifically on eMpofana Nature Trail, although some gave

their views after learning that it existed. Rather their views were based on perceptions of the importance of a trail in the area.

Project employees

Forty-eight per cent of project employees rated the Nature Trail as important. 37% said they do not know and 15% indicated that the trail was not important for the area. The high figure of 37% who indicated that they do not know is attributable to the fact that 85% of project employees did not know of the existence of the trail.

Over 90% property owners and 48% of project employees rated the importance of a nature trail in eMpofana catchment as important. Except for low awareness levels among the stakeholders, the importance of a nature trail is clear from their responses.

5.7.2 Tourist attractions in eMpofana catchment

On designing the questions in this section it was deemed prudent to seek the perceptions of stakeholders on what would attract tourism to the area. This would facilitate future planning and management of the use of natural resources available in the catchment. Respondents were able to specify more than one attraction.

Table 5.20 perceptions of tourist attractions in eMpofana catchment

Attraction	Property owners	Project employees
Natural vegetation	15	15
Country/rural environment	21	11
Recreation	10	-
Arts and crafts	15	1
Total	61	27

Property owners

Eighty-four per cent indicated that the country/rural environment was an important tourist attraction in the area. Natural vegetation with 60% of property owners and the same percentage followed this on arts and crafts as tourist attractions to the area.

Project employees

The natural vegetation as a tourist attraction in the catchment had the highest number of responses from the project employees i.e.55%. This was followed by country/rural environment with 41%. Arts and crafts had the least 4%. These responses imply that the employees perceive the re-establishment of natural vegetation in the areas cleared and country/rural environment as the two main factors attracting tourists.

5.8 Support

Umgeni Water has assumed responsibility for bringing the invasive alien plants in the riparian areas under control. They estimate this will take four years after which property owners with whom UW have signed agreements will assume the responsibility. These agreements also have support of national legislation. The perceptions property owners have of the project will influence the extent to which they will willingly honour the contracts. The assumption was that if they gave support to the project, it would increase chances of sustainability. It will be noted that apart from water security, sustainability is the key expectation from the UW on the project.

Table 5.21 shows perceptions of stakeholders on support of the project. The perceptions are rated in terms of very strongly, strongly, neutral and not at all.

Table 5.21: Perceptions of stakeholders on support of the EMRRP

Rating	Property owners	Project employees
Very strongly	14	19
Strongly neutral	8	8
Neutral	3	0
Not at	0	0
Total	25	27

Property owners

Eighty-eight of property owners interviewed rated their support for the project as strong and very strong. The remaining 12% were neutral about it.

Project employees

All of the employees interviewed rated their support as strong and very strong.

Table 5.22 Reasons for support (respondents could choose more than one reason for support)

Reasons for support	Property owners	Project employees
Removal of invaders	12	1
Biodiversity	8	1
Job creation	6	22
Awareness creation	4	0
Conservation of water	5	0
Cleaning river banks	7	3
Fodder provision	0	1
Working conditions	0	1
Better wages	0	1
Rehabilitation	2	0
Firewood	0	1
Total	44	31

Property owners

Respondents were allowed to identify more than one reason for their support. 48% property owners support the project because of removal of invasive alien vegetation, 32% for biodiversity conservation, 28% for cleaning of river- bank and 24% job-creation. Only two property owners indicated rehabilitation as reason for supporting the eMpofana project

Project employees

The majority of the project employees (81%) supported the project because of job creation. Other reasons for support from workers were cleaning river- banks, better wages, restoration of natural vegetation, fodder and firewood. Also there was one employee who indicated good working conditions as the reason for supporting the

The property owners and employees differed in the reasons for support. Job creation was the single most important reason advanced by employees; In contrast property owners cited removal of alien, cleaning riverbanks, biodiversity conservation as important, rating job creation much lower.

5.8.1 Perceptions on support received from Umgeni Water

The intention of questions in this section was to establish perceptions of stakeholders on support that the project receives from UW. This support was to be viewed against the four components of the project development namely: planning, execution, follow-up, rehabilitation and communication. The respondents were asked to indicate whether the support received from UW was enough for each component. It will be noted that the question on whether support from UW was enough or not enough was raised with project employees only. The rationale for this was that the employees (labourers and contractors) were the ones doing the physical clearing and also receiving payments and equipment from UW. For this reason it was assumed that they would be in a position to know whether support was enough or not enough. Their responses are shown in the histogram below.

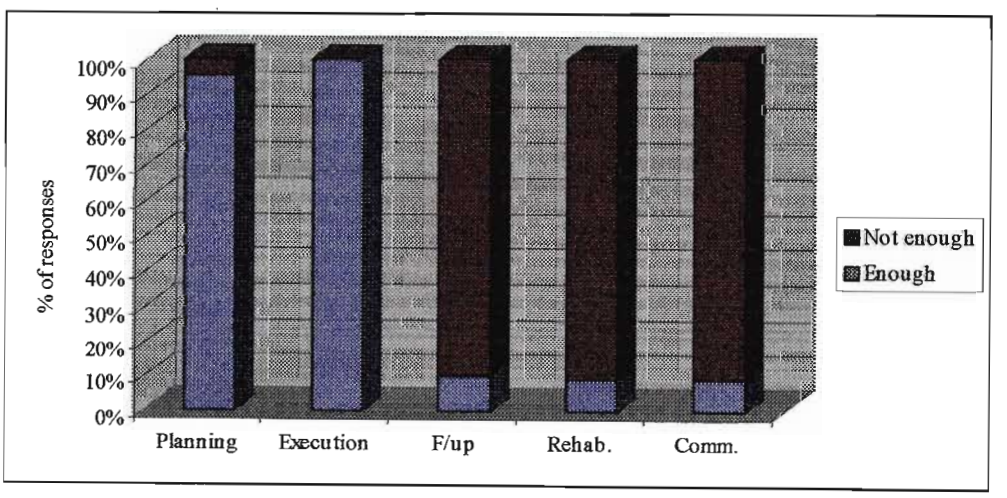


Figure 5.5: Histogram showing enough/not enough support from Umgeni Water as indicated by eMpofana project employees.

Ninety five per Cent of the project employees indicated that support for the planning component was enough and a 100% enough support for execution component of the

project. However there were 10% project employees who indicated that follow up had not received enough support. Also, rehabilitation and communication (each with less than ten per cent) had not received enough support.

The seemingly low indication on follow-up is attributable to the fact that the eMRRP focused on clearing of invasive alien vegetation first with follow up process to come later (Jacobs, pers comm.).

5.9 Sustainability

The intention of questions in this section was to establish stakeholders' perceptions of sustainability of the control of invasive alien plants. It was assumed that the project's sustainability could be measured by how well stakeholders accept and get involved in the project, capacity building, skill creation and funding.

The first question in this section sought stakeholders' perceptions on whether it was possible to continue with control of invasive alien vegetation without support from UW, national or provincial government. The response to this question was to be either yes of no and their perceptions are presented in Table 5.23 below.

Table 5.23: Perceptions of stakeholders on whether further control of alien vegetation after initial clearance is possible without external supports (Umgeni Water, provincial or national government)

Property owners			Project employees		
Yes	No	Total	Yes	No	Total
6	19	25	0	25	25

Property owners

Of the twenty-five property owners interviewed, six (24%) indicated that the process of monitoring and controlling re-growth of invader species could be carried out without external support. Nineteen (76%) felt that the process cannot be done without external support.

Project employees

Only two project employees indicated that it was possible to carry out the process of monitoring and control of invader species without external support. The majority 25 (93%) was of the view that it not possible to execute the process of monitoring and control of invasive alien plants without support from UW, national or provincial government. Given the responses from stakeholders, there is a lack of confidence with regard to self-sustenance of the project as the majority felt they still need external support.

It is important that stakeholders gain confidence for purposes of sustainability of the eMRRP. Apparently some of the property owners were not ready to control invasive vegetation on their land as one owner argued that they were not in a position to control invader species before UW came in unless "force was used." Still another property owner put it that they would not be able to control invasive vegetation, as they have "no time for extras" and that, farmers are "difficult and busy people".

5.9.1 Perceptions of stakeholders on beneficiaries of the eMRRP

The intention of questions in this section was to establish the perceptions of stakeholders on who the beneficiaries of the eMpofana project are. It was assumed that if stakeholders viewed themselves as the beneficiaries of the project, sustainability of the project would be much more feasible to attain, as they would get involved in its undertakings. The beneficiaries provided on the questions are property owners, project employees, tourists and water users.

Table 5.24: Perceptions of stakeholders on beneficiaries of the eMpofana project

Beneficiaries	Property owners	Project employees
Property owners	14	17
Project employees	12	10
Tourists	8	4
Water users	19	17
Total	38	48

Property owners

Respondents were able to identify more than one beneficiary and that is why total responses for Property owners and Project employees are 38 and 48 respectively. Most property owners ie.19 (70%) were of the view that main beneficiaries of the project are water users. Fourteen (56%) indicated that property owners in the catchment are main beneficiaries and 12 (48%) said that the project employees are the beneficiaries. There were 8 (32%) responses from property owners indicating that tourists were beneficiaries from the project.

Project employees

It was the view of project employees that water users and property owners (with 19 responses each) were the beneficiaries of the eMRRP. Also the employees rated themselves (10 responses) as beneficiaries of the project. There were 4% responses indicating that tourists were beneficiaries of the eMRRP.

From the responses of property owners and project employees it is clear that the majority stakeholders viewed property owners and water users as the beneficiaries of the project. Tourists were viewed as beneficiaries of the eMpofana project. This corroborates earlier expression on the importance of tourism.

5.10 Rehabilitation of riparian areas and control methods used

The questions in this section sought to establish the perceptions of stakeholders on rehabilitation of riparian areas and control methods that stakeholders would prefer, and their method of application. The choices of methods given on the questionnaire were biological, chemical, mechanical or combination of two or more of these methods. From the literature review done on methods of control that have been used so far by WFWP, it is apparent that different methods are used in different projects and on different species and sizes of plants.

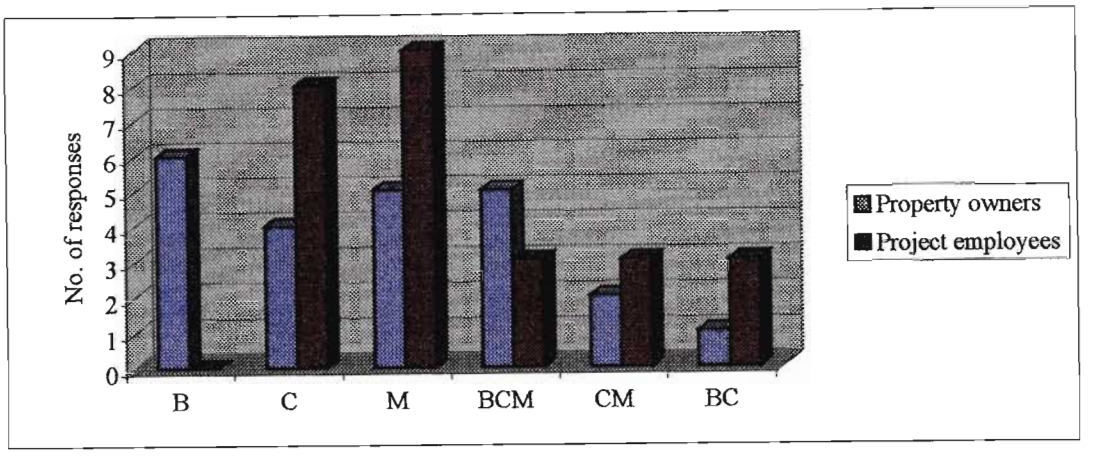


Figure 5.6: Histogram of preference for control methods

LEGEND: BC= Biological & Chemical, CM= Chemical & Mechanical, BCM= Biological & Chemical & Mechanical

Property owners

The question on preferred control methods drew fairly evenly distributed responses from property owners. With six responses biological control had the highest number, followed by mechanical and BCM (5 responses each). The combination of biological and chemical (BC) had one response, which was the lowest response.

Project employees

There was no project employee who selected application of biological control. Mechanical control drew the largest support followed by chemical that had 8% responses whereas CM and BC had the same number of responses i.e. 3%. There is a possibility that the highest number of employees indicated in favour of mechanical and chemical methods because they were familiar with them. Biological control, which is not yet introduced to the study area, may have been unknown to them.

Generally respondents pointed out that each method is to be used with caution as each had its positive and negative effects. The use of chemical for instance was to be limited to herbicide experts for fear of spillage into waterways.

Gardener who also argued that a combination of chemical and mechanical control be applied supported the view on caution on application of herbicide. However, he

cautioned, "Only experts must apply chemicals at least in the initial stages. In addition, fire should be used as means of control" (Gardener, 2000, pers comm.).

The control method used in the WFWP project is instituting gradual death to the plants while they stand to enable a gradual shift from alien vegetation with minimal damage to the environment (Curry, 2000, pers comm.). Curry pointed out that the method of control varies from one plant species to the other. For instance 'frilling' is carried out on Wattle whereas spraying is preferred on control of bug weed and bramble. She felt that the use of chemicals and clear felling of woody plants (as is applied by eMpofana project) is not cost effective and impinges on subsequent land uses.

5.10.1 Rehabilitation of cleared riparian areas

It is the intention of UW to hand over the project to the stakeholders within the next four years (Umgeni, 2000b). For this reasons it was necessary to establish the perceptions of stakeholders on who should monitor and control re-growth and carry out rehabilitation of cleared riparian areas.

Table 5.25: Perceptions of stakeholders on who has responsibility for monitoring and control of re-growth

Agent	Property owner	Project employees
Property owner	16	2
UmgeniWater	7	14
Government	1	1
Government, Umgeni and Property owner	1	10
Total	25	27

5.3 Property owners and project employees

Sixteen (64%) property owners perceive that it is their responsibility to monitor and control re-growth and 7 (28%) perceives it to be the responsibility of UW. Fifty-one (52%) of the eMpofana project employees were of the view that the responsibility to

CONCLUSION

Results, as presented in this chapter have been grouped into eight different topics namely, Awareness, Process and indicators of success, Water, Capacity building, Biodiversity conservation, Tourism, Support, and Sustainability. The topics also formed the main sections of the questionnaire.

Each of the topics was presented under the two main groups of respondents: property owners and project employees. There were fifty-two respondents in all: twenty-five property owners and twenty-seven project employees.

The results are presented in percentages drawn from tables and histograms as appropriate.

Similarities in stakeholders' perceptions

As the responses from both property owners and employees show, most respondents (22 property owners and 19 project employees) were of the view that the project goal of reinstating biological diversity is very important. It is worth noting that both property owners and the employees shared the same view on water users and project employees being the main beneficiaries of the project. Also the project employees shared the same view with property owners on follow up in that they all indicated zero.

Another similarity between property owners and project employees was on impact of clearing invader species on water supply as both categories rated it as very significant; 52% of employees and 44% of property owners. Also the requirement by the National Water Act that water be allocated to sustenance of the environment drew strong support from both property owners (62%) and project employees (77%).

Differences in perceptions held by property owners and project employees

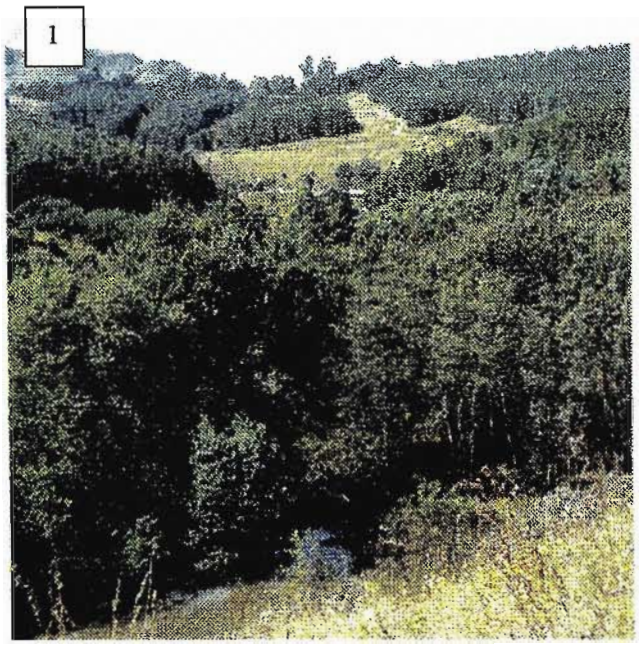
Whereas most property owners felt that project planning was the phase that was successful, the project employees viewed execution 30% and financing 30% as the project phases of development that attained highest success. Another difference in perceptions between the two categories of respondents is that majority of workers, 82% supported the project because of job creation followed by increased river-flow,

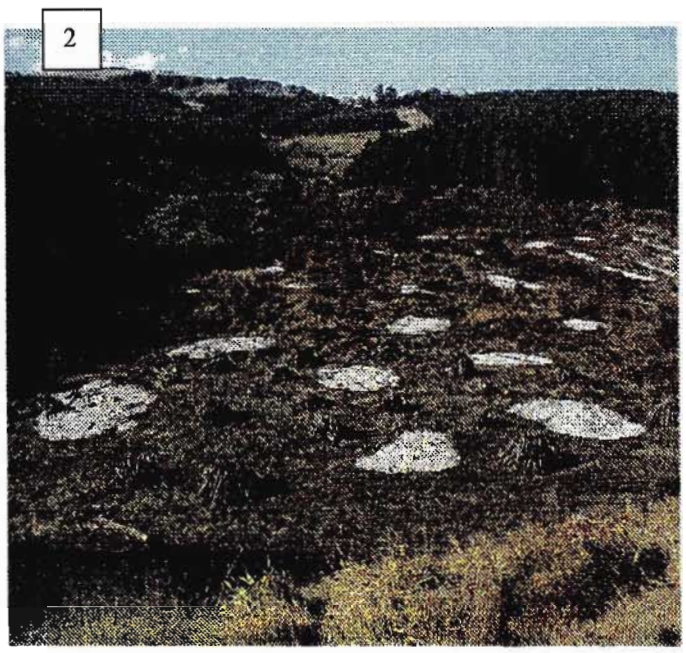
33% whereas property owners rated riddance of invaders species as main reason for support.

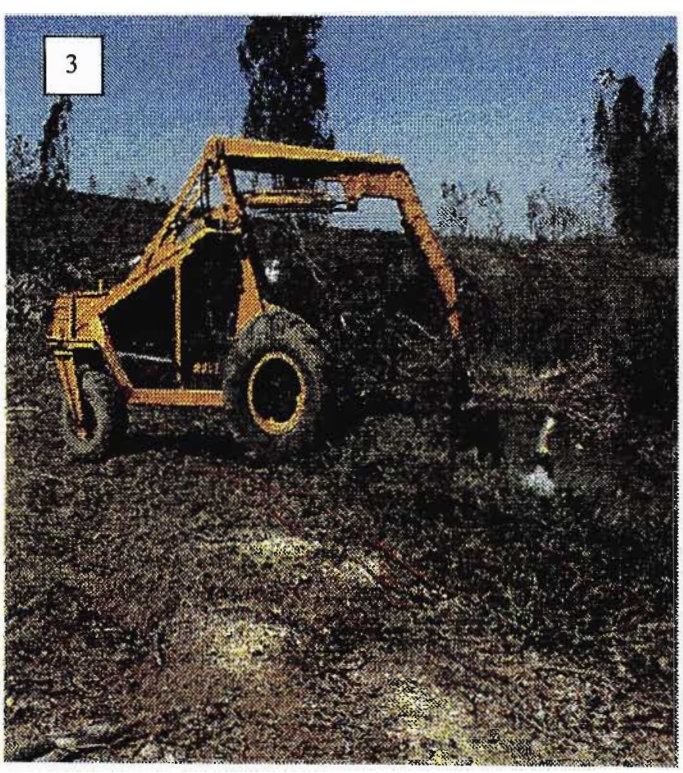
Figure: 5.7 Photographs illustrating various activities in the eMRRP

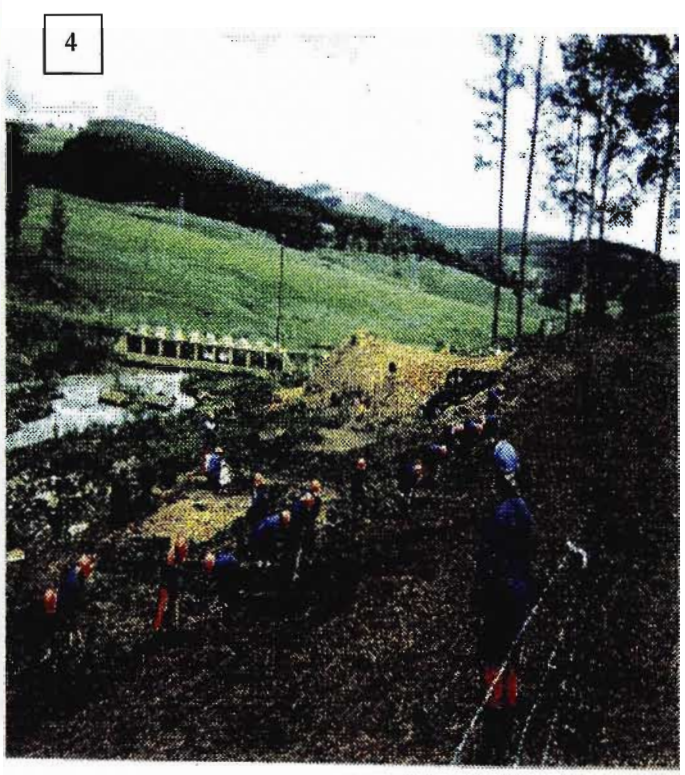
1. Before clearing was done
2. After clearing was done
3. Clearing logjams in progress
4. Rehabilitation in progress

(*Photographs: J Wood*)









CHAPTER SIX

6. DISCUSSION AND CONCLUSIONS

6.1 Introduction

This chapter considers the strengths and weakness of the eMRRP emanating from within its structures, the threats and opportunities of the project coming from external sources, working with the WFWP and the way ahead. In discussing the way ahead the questions that will be uppermost in the mind include whether the stakeholders should work together (catchment agencies, water users, government) or whether the WFWP should begin to oversee all activities regarding control of invader alien species in catchment management.

6.2 Strengths of eMpofana Riparian Rehabilitation Project

Six strengths have bee identified.

6.2.1 Awareness creation

All property owners were aware of the eMpofana riparian rehabilitation project (they knew of project's existence but level of awareness on its description differed from one respondent to the other). Given the resuslts,one can argue that most of them were well aware of the eMRRP.

This level of awareness is seen as strength because if property owners were so much aware of the eMRRP and its undertakings, it would be easier for them to give their support and get involved. This is because it would be difficult for them to get involved or support a project that they know little about. It is also a strength because if they supported the clearing they would be favourably disposed to ongoing control of re-infestation.

6.2.2 Support from stakeholders

With an overwhelming show of support from the stakeholders interviewed, one can argue that the responses are strength of the eMRRP because they not only indicate stakeholders' acceptance of the project but also their readiness to support it. In other words it is much easier for UW to work with them towards sustainability of the

project knowing their support is assured. For instance one property owner said, "they only asked me for a tractor one day. Had they asked for more, I would have given."

6.2.3 Support to the project from Umgeni Water

Ninety five per cent of the project employees indicated that Umgeni Water had provided enough support for the execution component of the project and 95% enough at planning stage of the project. Having provided enough support as indicated by the responses on planning and execution, UW can expect cooperation from stakeholders and anticipate that the job is well done. This is strength because firstly it indicates achievement of goals set by UW to support the project and secondly it demonstrated the capacity that the water authority has to carry out similar undertaking in other catchments. For instance as of August 2000, "the project has already achieved 120% of the expected results" (Wood, 2000, pers comm.).

6.2.4 Potential for future employment

On potential for future employment 8 (30%) of the project workers indicated much better and 13 (48%) indicated better chances. This means a total of 78% indicated better chances on potential for future employment. Only 3% project employees said there was no change with regard to potential for future employment and 3% said they do not know. With the majority (78%) of the employees indicating that they now have better chances of being employed, it is a major strength for the eMRRP. This is because one of the main aims of the project is to offer skills and training so those employees can be in a position to find employment when they leave. In addition if employees feel that they have potential for future employment, they will be more confidence both presently (while working for the project) and in the future when they move on elsewhere.

6.2.5 Success of the eMRRP on job creation

Given that one of the main spillover benefits from the project is to create employment for the local people, a response of 97% shows that the UW has achieved one of its main aims. This is strength, not only because it is a result of professional planning and implementation that eMRRP has had, but because it also curbs the high rate of unemployment in the KwaZulu-Natal midlands rated at 70% (Carter, 1999).

Overall, Twenty-seven (100%) project employees indicated that the project was successful. Considering that eMRRP project seeks co-operation from stakeholders particularly for the purpose of self-sustenance of the project, the high success rating from respondents is a welcome gesture as it indicates possible support and involvement in the project's further undertakings. The next session discusses stakeholders' perceptions on success rate of different steps of the project process.

6.3 Gender equity

On equitable distribution of job offers along gender lines, (21) 77% indicated highly successful, 5 (19%) indicated successful and one said the project has not upheld gender equity on employment.

With 77% of the project employees indicating that gender equity has been achieved, it is strength for the project as that is one of the eMRRP aims. Also gender equity on employment offers a change from neglect of women for job particularly with indications that women-headed households are among the poorest households in KwaZulu-Natal (Carter, 1999).

6.3.1 Weaknesses of the eMpofana Riparian Rehabilitation Project

Five weaknesses have been identified.

6.3.2 Insufficient awareness of the National WFWP and eMRRP

Although property owners and employees indicated awareness of eMRRP, they had little awareness of the WFWP both at national and provincial levels. Given that the WFWP is a national programme with over 200 alien plant control programmes countrywide (van Wilgen *et al.*, 2000) and that the eMRRP is conceptualised within the ambit of national WFWP. This is a weakness because the WFWP produces information, expertise and attracts resources. Failure to engage it positions UW as a competitor when in fact both parties are striving for common goals. Also the WFWP has a wider focus than water and therefore can work in areas where the improvement in water supply has marginal cost advantage. Also, insufficient awareness on the national WFWP leaves the stakeholders with a parochial view of what is otherwise a national campaign against invader species. In this respect their pride in participating and contributing towards the national missions is curtailed.

Another weakness is that lack of awareness permeates other areas of the eMRRP as five project employees and one property owner said that they do not know of the significance of clearing alien species on water. Also with four property owners and two employees indicating that clearing was not significant on water supply, it is important to address the discrepancy.

In addition, with 81% of the project employees thinking their jobs are permanent, there seems to be a misunderstanding with regard to job tenure. This is because Umgeni Water is scheduled to pull out after four years (Umgeni Water, 2000b) and it is doubtful that property owners will retain the current number of project employees. The weakness stems from lack of clear communication on job tenure (Table 5:15).

Perhaps the awareness levels would have increased had UW involved the employees in project with the property owners (O'Grady, 2000). Such forums would be suitable not only to discuss stakeholders' responsibility on eMRRP, but also to expose them to the National WFWP and the possible links with the project.

The fact that eMpofana employees have little awareness on what the project is all about probably compromises the project's main objectives of water security, sustainability of the project and the attendant expectation to have stakeholders' get actively involved. Most of the employees are residents of the area, which effectively makes them stakeholders of the project.

For these reasons, their contribution, together with that of property owners as interest-based persons in the control of the invasive alien plants in eMpofana riparian zones, is vital. Such participation would facilitate endeavours of non-statutory organisations upon which Catchment Management Agencies (CMAS) and Catchment Steering Committees stand in their support for DWAF.

6.3.3 Insufficient stakeholders' involvement in conceptualisation and planning of the project

As project conceptualisation and planning are future oriented, stakeholders must be involved. Their perceptions, attitudes and values influence their behaviour and if they value nature, it will be protected. If it is disliked it will be abused" (Eagles, 1984).

Property owners have the responsibility for control of alien vegetation in the long term. They therefore determine the sustainability of the short-term undertaking of the eMRRP. If they were participants in the planning, the prospects of commitment in the long term are improved.

Most property owners seem not to have been involved in the planning of the project. This suggests that the project must have been presented to landowners once UW had planned it and that, if at all, property owners were involved with planning at the property scale only. However, property owners gave the planning done by UW a high rating even though they themselves were not directly involved in it.

Excluding local people in the planning stage denies the project a wealth of knowledge as " local people have shown far greater ability to map, model, observe, list, count, estimate, compare, rank, score and diagram than most outsiders had supposed" (Chambers, 1996). Although Chambers is referring to the rural poor in their interactions with rural development agents, the idea of involving local people in conceptualisation and implementation of projects is probably applicable to eMpofana project. Such involvement has the possibility of increasing chances of project's sustainability as stakeholders put their skills into effect.

As Smith (1993) further points out, "the most far-reaching change, and the least disturbing, comes when change begins within the group, even though stimulated by outsiders". Perhaps what UW, and indeed any other change agents should do is to facilitate a process of bottom-up planning and implementation. The reverse has the potential to deter sustainability of the project as stakeholders view it as belonging to the development agents- in this case UW. This failure to effectively involve stakeholders in conceptualisation and planning of the eMRRP is a weakness.

6.3.4 Differing project priorities and reason for support from stakeholders

The discussion on support that stakeholders give to the project is based on the assumption that the more the benefits the project is perceived to bring to them the more support they will give to it. For instance the main reason for support from (48%) property owners was removal of invasive alien vegetation. This means that property owners' priority need is different from that of the eMRRP, which is increased water supply and water security.

The 19 property owners who indicated that water users are the main beneficiaries of the eMRRP also pointed out that those users were in Durban and Pietermaritzburg. In presenting this view, the property owners implied that increase in water supply into Midmar dam, also the main target for UW, does not offer them direct benefits. Rather, the metropoles were drawing direct benefits from water for which eMpofana catchment residents were meant to work.

Although this perspective does not seem broad enough, it does present the need to align the project priority requirements with the real needs of the stakeholders as " constructive change cannot occur until we know the needs as the people themselves see them" (Smith, 1993). The results on perceptions of property owners on importance of tourism and biodiversity in the catchment reveal that (84%) property owners perceive it as very important and could be an expression of their real needs. However, employees perceived agriculture as a preferable land use in the riparian zones and this way reflect their real need.

The divergence between UW's priority of water security (note that most property owners indicated that they have satisfactory water at the moment), and property owners indicating that biodiversity conservation and the naturalness of the area was their priority, can be seen as a weakness. However, the view may change if harnessing of the priorities towards common goal is effected (*see recommendations*). As discussed above, development can only be achieved when peoples' reasonable real needs (usually a compromise between developer's perceived needs and the felt needs of the community) are met (Smith, 1993). In meeting stakeholders' real needs, it will be important to take care of those of UW customers in the urban areas as well.

6.3.5 Sustainability

Sustainability has to do with sustainable use, which means utilization of a resource in a manner that will not impede its self-renewal and availability for future generations (Kotze & Breen, 1999). In this regard the eMRRP would be sustainable if in its development and operation it meets the needs of the present without compromising the ability of future generations to meet their own needs (Court, 1990). The need to care for future generations in resource utilization is based on various factors, among them the fact those future generations do not vote and have neither political nor

financial power. In this case they cannot challenge the decisions that are made today regarding control of invasive alien vegetation in the eMpofana riparian areas.

One of the resources in eMpofana catchment that must be used in a. sustainable way for the interests of all citizens is water (The National Water Act No. 36 of 1998). Also, it is imperative that stakeholders are involved and remain supportive to ensure sustainability of the project to uphold the resource. The stakeholders must be ready and willing to shoulder the responsibility themselves, as the most far-reaching development change must come from communities themselves (Smith, 1993). One way to get involved is in monitoring and controlling re-growth of invasive alien vegetation in the eMpofana riparian areas. However, the majority of property owners felt that the process couldn't be done without external support. Similarly, only two project employees indicated that it was possible to carry out the process of monitoring and control of invader species without extenal support.

The indications that property owners are not yet ready to carry on with the eMRRP on their own exposes a great weakness in the project as the expectation of the project, sustainability, is undermined. Partly the insufficient will to carry on with control of invader species on their own is attributable to the fact that they were not involved in conceptualisation and planning of the project. It was conceptualised elsewhere and then brought to them. Also it is unknown. Umgeni Water evidently has not spent enough time and effort dealing with the likely demands, which will be made of farmers and do not appear to have a plan for how these can be met in a sustainable way. As UW has short experience they do not have the information whereas WFWP has several years more experiences of follow up. Since UW does not seem to consult with WFWP, they do not easy access that experience.

6.3.6 Follow up

The property owners shared the same view with project employees on follow up in that they perceived little success on that phase of project development. Perhaps it would have been more enlightening to question understanding of what was required for follow up. Nonetheless it does appear as if people are not well informed of what follow up entails. This indicates a weakness with the project, which if not addressed has the potential to detract from the successes that the eMRRP has so far achieved.

However, as discussed earlier, follow up is to formally scheduled to start once the first round of clearing of invader species in the riparian areas is done

6.4 Opportunities for the eMRRP

The property owners and project employees interviewed (25 and 27 respectively) rated the eMRRP as very successful in a number of key areas of its operations. Such areas include-job creation, riddance of invader species from riparian areas, good planning and execution of the project. The success demonstrates the capacity and willingness that UW has to initiate control of invasive alien vegetation in other catchments in the near future as they have stated in their objectives (Umgeni, 2000b). In addition, the successes indicate the possibility of achieving the goal of removing 99% of invasive alien plants from riparian areas in four years. Since invasive aliens are such a pervasive problem Umgeni Water can develop market opportunities for its newfound expertise

6.4.1 Opportunity to participate in the national campaign on control of invader species

The project has the opportunity to participate in the national campaign on control of invader species and to enjoy the benefits of exchange of expertise with the national WFWP. This would give eMRRP an opportunity to join a national campaign and also allow UW to shift long-term monitoring and control to the national endeavour and not always be their responsibility.

6.4.2 Opportunity to expose stakeholders to pride of contributing to the national campaign on control of invader species

The project has the opportunity to expose its stakeholders to the pride of contributing to the national campaign and to see their contribution in their individual properties as linking to the national picture. In other words the project can be an avenue towards national unity as opposed to localised view on control of invader species.

6.5 Opportunity to provide services to Catchment Management Agencies

There is an opportunity for eMRRP to provide services to the Catchment Management Agencies in respect of clearing invader vegetation in riparian areas.

6.6 Threats against the eMRRP

6.7 Funding

One of external threats that the project faces is dissenting views from politicians who question UW's role in caring for rural communities, the recent review of water tariffs, and their contribution towards national inflation targets (The Natal Witness, Wednesday, July19, 2000). Although it was not UW's role to care for rural communities, the politicians seemed to question the genuiness of the organisation's contributions towards rural communities' welfare. With UW choosing to go it alone in terms of handling eMRRP and not contributing funds towards the National WFWP, it exposes itself to hostility from outside sources.

6.8 Alienation from the national campaign on control of invasive alien vegetation

The choice to carry out eMRRP alone can increasingly be seen to alienate its clientele and project's stakeholders from the national mission and drive to fight against invasive alien vegetation together as a nation. There is a possibility that some sources might view UW's running eMRRP solely as a show of abundant financial resources and others might see creation of divide between 'one people.

6.9 Working with National Working for Water Programme

The eMRRP was initiated in response to the Department of Water Affairs' National Working for Water Campaign (Umgeni, 2000). The need for stakeholders to work together is further strengthened by the fact that water is a national asset and the national government is the public trustee of the resource (National Water Act No. 36 of 1998). Further, the Act lays ground for formation of Catchment Management Agencies (CMAS), which in turn would liaise with stakeholders at local levels such as those in eMpofana catchment.

Given that nine property owners indicated that they have not agreed to assume control and monitoring of invader species on their property, it is vital to review the contract agreements in a bid to ascertain property owners' commitment.

Presently there seem to be success as long as UW is directly supplying funding and technical support when on the other hand stakeholders are not reciprocating

adequately. The situation allows for imbalance, which must be addressed as a way ahead for the project sustainability.

6.10 Way ahead

The eMRRP should join the National WFWP's clarion call for South Africans to embrace and facilitate change in as far as control of invasive alien vegetation and its adverse effects are concerned. The campaign should not remain an exclusive prerogative of WFWP but must extend to incorporate individual efforts. Although the national programme may not be effectively carrying out all its objectives (seemingly preferring bias towards social welfare), nevertheless its focus and what it stands for is biodiversity conservation, water security and jobs creation.

On the other hand UW focuses on water security and not as much on conservation of biodiversity and social welfare. This is done at a time when property owners view conservation of biodiversity as their priority and project employees viewing jobs as their priority. This being the case then, there is need to help the stakeholders see beyond their immediate gain to those of the larger community of South Africans. Although there is marked success made by UW in planning, financial support, job creation, gender equity in the eMRRP, there is need to address sustainability of the project.

CONCLUSION

Whilst the project can be regarded as successful in so far as it has effectively cleared riparian vegetation and operates under a positive disposition for those involved, it has significant weaknesses. It also faces threats, which could negate success achieved so far, and which could cause it to fail to engage the opportunities, which have arisen. Changes are required.

CHAPTER SEVEN

7. RECOMMENDATIONS

7.1 Introduction

The recommendations have been grouped into five main areas: creation of awareness, biodiversity conservation, capacity building and empowerment, and water security.

7.2 Improving awareness and understanding

- Embracing the national working for water campaign
- Stakeholders to be made aware of both the National WFWP and eMRRP on control of invasive alien vegetation and how the two organisations do their work
- Every effort to be made to educate stakeholders on importance of removal of alien invasive vegetation, from the eMpofana riparian areas.
- Stakeholders to be exposed on how the project fits into the national campaign on control of invasive plants and to the pros and cons of teaming up with WFW projects. As WFWP has many years of experience and greater expertise on control of invasive alien plants, it is important that eMRRP taps into this resource

7.3 Biodiversity conservation

- Work with stakeholders in eMpofana catchment to develop procedures to monitor re- establishment of biodiversity in the cleared riparian areas. This is particularly relevant not only because property owners said conservation of biodiversity was very important but also because of the intrinsic value attached.
- Hold workshops to train stakeholders on the use of biodiversity monitoring procedures so they can handle them with minimal external support. Expertise from local universities could be used to train stakeholders.
- Umgeni Water should define its relationship with the national Working for water campaign and establish a joint venture with all appropriate partners

- Cleared areas need to be rehabilitated using indigenous vegetation. Special days and holidays e.g. Hack day, Youth Day, Mothers Day could be used to involve local communities and other interested parties to assist in planting of indigenous plants on cleared riparian areas. Such forums could be use to publicize importance of biodiversity on the environment.

- A consensus should be reached between UW, property owners on whose land rehabilitation is done to monitor re-growth and to avoid activities that would interfere with the rehabilitation process such as agricultural activities on the areas.

7.4 Sustaining interest in rehabilitation

- There is need to stimulate and sustain interest on rehabilitation among stakeholders and in particular, the property owners. This is because rehabilitation is an ongoing process and will require ongoing interest and efforts. Presently, the eMRRP has rehabilitated some of the cleared riparian areas in eMpofana catchment and the rest is to be rehabilitated as need arises since not all, cleared areas require rehabilitation.

7.5 Capacity building and empowerment

- Expose project employees to more hands-on skills, so they can find employment upon leaving the project. In addition it would be appropriate to link up skilled project employees (those who have gained contractor and other skills) with the job market, as it might be easier that way other than letting them do it on their own. The step could be developed to include allowing the employees to buy used equipment from the project such as chain saws, blades, and protective clothing in readiness for future employment.

- Motivate community structures to get involved in decision-making and implementation of project undertakings.

7.6 Water security and supply

- Keep records of stream flow before and after project. Make the observations public regularly.

- Link up with Catchment Management agencies to avoid duplication of efforts on control of invader species and its impacts on water in the eMpofana riparian areas.

- Expose stakeholders (through workshops, seminars, newsletters and radio programmers) to requirements of the National Water Act (No. 36 of 1998), in particular on sustenance of the environment. This should be done in conjunction with DWAF and relevant government department and stakeholders. Also harnessing of the varying stakeholders' priorities to pull in the same direction must be effected so that the diversity becomes a positive strength for the programme.

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APPENDIX 1

QUESTIONNAIRE -eMpofana Riparian Rehabilitation Project (EMRRP)

Dear respondent,

My name is Joseph M Mwaura, a Masters student at the Centre for Environment and Development, University of Natal. This research study is part of requirement for MEnvDev degree and is supported by Umgeni Water and the University.

The questionnaire you are about to complete will assist in understanding perceptions of stakeholders i.e. property owners, eMpofana project employees Umgeni staff, Umgeni clients, government officials and other interested and affected parties. The information you supply will be treated in the strictest confidence and the findings of the study will be made available to you. Please do indicate (underline) whether you want the feedback in form of-, Full report, Executive summary, or Verbal / Interactive report.

Questions are grouped into specific sections as follows: *Process, Biodiversity, Tourism, Jobs, Water, Awareness, Sustainability and Support.* Use the space provided below each question to indicate your response. Also do not hesitate to get in touch with us anytime incase you need clarification Tel. 3941700 Fax 033 2606224

Email mwauraJ@newarts.unp.ac.za

Your name and contact information *(These will enable me to contact you)*

1. Opinions from different categories are being sought. What category are you?

Umgeni staff	
Land owner	
Umgeni client	
Worker (eMpofana project)	
Government official	
Other (specify)…	

II. Awareness of Working for Water Programme (WFW)

2. Are you aware of Working for Water programme (WFW):

Nationally? Yes/ No

Provincially ? Yes/ No

On a scale of 1-5 (*where 1 = least awareness and 5= most aware*) show your level of awareness of National and Provincial WFW programme

National	
Provincial	

3. Are you aware of the eMpofana Riparian rehabilitation project? Yes / No

4. If your answer is Yes, How did you get to hear about it?

Radio	
Handbills	
Television	
In Meetings	
Visit by Umgeni staff	
Other (Specify)	

On a scale of 1-5 (*where 1=least awareness and 5=most aware*) show your level of awareness of eMpofana project

EMpofana project awareness	1		2		3	4		5

5. Do you see linkage Umgeni and the national Working for Water programme? Yes/No

6. Are you aware of the eMpofana project running independently of the national programme Yes/ No

7. In your view, is this independence desirable? Yes / No

Why?

PROCESS

8. To achieve the goal of control of alien vegetation, it would be useful to lay down achievable objectives. What do you understand to be the eMpofana project objectives?

1.	
2.	
3.	
4.	

9. Have you been involved in planning of the project? Yes / No

10. If yes, at what level of planning were you involved?

Designing	
Implementation	
Follow up	

11. Are you aware of the project description? (vision, methods, goal)? Yes / No

12. How would you characterise the description?

Short term	Medium	Long term

13. Are you aware of how the project was figured out (conceptualised)? Yes/No

14. Were you involved in the conceptiualisation of the project? Yes / No

15. The project aims at giving equal opportunities to all people. Would you say this was applied at your recruitment? Yes / No

16. The eMpofana project aims at allocating contracts without discrimination. Would you say this target has been achieved so far? Yes / No

17. List three indicators of success of the eMpofana Riparian Rehabilitation project. The answers should be ranked in the order of importance e.g. *1= Very important, 2= Important, and 3= Not important.*

No. of ha cleared	
No. of people involved	
No. of species cleared	
Amount of money set aside	
Amount of money spent	
Amount of water recovered	
Improved recreation	
Natural species recovery	
Improved aesthetics	
Stakeholders involved	
Others (specify)	

18. How would you rate the success of the eMpofana project?

Highly successful	
Successful	
Not successful	
I do not know	

19. What factors have contributed to the answer you have given (success or failure)?

IV. SUPPORT

20. Do you support the eMpofana Riparian Rehabilitation project ? Yes / No

21. If yes why? Could you list three reasons?

1.
2.
3.

22. How would you rate your support?

Strongly support	
Support	
No support	
Neutral	
Other (specify)	

23. The control of alien vegetation in eMpofana riparian zone requires various kinds of support. In which category would you support for the project fall?

Financial	
Technical	
Labour	
Other	

24. Umgeni Water strives to provide assistance for continuity of the project. How would you categories this assistance?

Financial	
Technical	
Other (specify)	

25. How would you rate support received from Umgeni? Use key words; *Enough* and *Not enough*

Planning	
At follow up	
At rehabilitation	

As a property owner, could you have carried out the clearing of alien plants without support? Yes / No / Not sure

In your view, who are the beneficiaries of the project?

With regard to benefits, what are your perceived short-term benefits?

What do you perceive to be long- term benefits from the project?

26. At certain stages of development, projects might seek multiple sources of funding. Does the eMpofana project receive support from any other source other than Umgeni Water? Yes / No

V. BIODIVERSITY

27. One of the key efforts the eMpofana Riparian Rehabilitation project is to conserve natural life cycle (biological diversity). How would you rate biological diversity in eMpofana?

Very important	
Important	
Not important	
I do not know	

28. Has the general appearance of the riparian system (area along the river) changed since the project started?

29. Would you say that indigenous species have re-appeared since the project started? Yes / No

30. In your view, what role does natural vegetation play in eMpofana riparian zone?

31. Some of the invasive alien plants (exotic) e.g. Eucalyptus are said to be destructive as well as useful. Are alien plants of any benefit to the people in eMpofana catchment? Yes / No

32. If yes what benefits are they?

Building material	
Ornamental	
Firewood	
Charcoal	
Wood chips / pulps	
Fencing	
Poles	
Fodder	
Carving/curious	
Mine props	
Tanning	
Others	

33. Is the cleared wood used? Yes / No

34. Would you say that it is put into good use? Yes / No

35. If it is not put to good use why do you think this to be the case?

36. Invasive alien vegetation (exotic) affects the environment to varying intensities. In your view are exotic plants a threat to natural vegetation in eMpofana catchment?

Strongly agree	
Agree	
Disagree	
Strongly disagree	
I do not know	

37. How would you rate the problem of invasive alien vegetation in eMpofana catchment?

	Before the Project	After the project
Urgent, needs immediate attention		
Not urgent, can stay as is		
I do not know		

38. Problems caused by alien plants differ from one species to the other. What alien invasive species is mot problematic in eMpofana Riparian Rehabilitation project zone?

	Before project	After project
Acacia mearnsii (Black wattle)		
Other species of Acacia		
Eucalypts		
Pines		
Poplar		
Bugweed		
Other		

In line with the species you have marked as problematic what in your view is the source of infestation?

39. Methods of control of alien vegetation differ in terms of effectiveness and cost. What methods should be used to clear alien invasive plants in eMpofana Riparian Rehabilitation project?

Biological	
Chemical	
Mechanical	
Combination of the above	

VI. PROJECT SELF-SUSTENANCE (SUSTAINABILITY)

40.Removal of exotic species leaves some riparian areas (area along the river) bare. Does eMpofana project carry out rehabilitation on cleared land? Yes / No

41. How effective is the rehabilitation process?

Very effective	
Effective	
Not effective	

42. To keep riparian zone under control requires follow up. Whose responsibility is it to monitor land cleared of invasive in eMpofana in case of re-growth?

Land owner	
Umgeni Water	
Government	
Other (Please specify)	

43. In your view, can the process of monitoring and controlling re-growth of alien plants be done without support from Umgeni water, Provincial government or National government? Yes / No

44.If yes, how can this be done?

Manual clearing	
Chemical	
Biological	
Combination of the above	

45.Have you agreed to assume responsibility for keeping the riparian area cleared of alien invasive plants? Yes / No

46. If you were not in a position to control alien plants on your own, What support would you require?

Financial	
Technical	
Other (specify)	

47.As far as effective rehabilitation is concerned, what would you like to see replace alien invasive species in the riparian area with?

Indigenous species	
Exotic species	
A mixture of both exotic and indigenous	

48. In your view, what land uses are appropriate for riparian areas?

Tourism / Recreation	
Agriculture	
Conservation	
Other (please specify)	

49. Has your view on control of exotic plant species changed since the start of the eMpofana Riparian Rehabilitation project? Yes / No

50. What has caused the change?

51. Successful riparian rehabilitation brings various benefits to the environment. What benefits have you gained through the eMpofana project?

Job creation	
Increased water yield	
Increased grazing land	
Improved aesthetics	
None	
Other (specify)	

7.6.1.1 VII. WATER

52. It is the aim the eMpofana project to improve availability of water. How would you rate the water available in the in eMpofana riparian zone before project started?

Satisfactory	
Unsatisfactory	
Barely enough	

53. In your view, has water quantity improved after removal of exotics?

Yes	
No	
I do not know	

53. Is water in the eMpofana riparian zone good enough for intended use (quality)?
Yes / No

54. How bad is water quality in the area?

Very bad	
Bad	
Not bad	
I do not know	

56. The National Water Act allocates water for sustenance of the environment. How would you rate your support for this?

Very strong	
Strong	
Neutral	
No support	

VI. TOURISM

57. One of the benefits of rehabilitated riparian zone is tourist attraction. How important is tourism for the area?

58. In relation to use of rehabilitated riparian areas, please rank the following responses in the order of importance to you : *1= very important, 2= Important and 3= Not important.*

Natural nature of the area	
Natural nature of the riparian system	
Tourism	
Other (specify)	

59. In your view what benefits are drawn from tourism in eMpofana catchment?

60. If there are benefits that come from tourism in the area, how are the benefits apportioned/distributed?

61. Different sites have different tourist attractions. What would be top on you list of possible tourist attraction in the area?

Indigenous vegetation	
Birds	
Animals	
Arts and Crafts	
Other (specify)	

62. In most cases successful tourism depends on adequate awareness creation. How is awareness of tourist attractions in the are maintained?

63. Tourism can be local or internationally based. What is the largest market for tourism in eMpofana catchment?

64. How is the market to be maintained?

65. Are you aware of the existence of eMpofana Nature Trail?

66. How would you rate the nature trail?

Rating	Responses
Very important	
Important	
Not important	
I do not know	

Thank you for taking your time off to answer these questions.

7.6.1.2 JOB CREATION

7.6.1.3 The following questions are to be answered by eMpofana project employees

67. Working for Water programme aspires for equal opportunities. Please indicate your gender; Male / Female

68. The aim of WFW programme to involve people of all ages for effective control of alien plants; what is your age?

<20	
21-30	
31-40	
41-50	
51-60	
60+	

69. One of the objectives of Working for Water programme is skill creation. In this regard, could you indicate your level of education?

No education	
Grade 1-7	
Grade 8-12	
Grade 12+	
Technikon/college	
University degree	

70. One of the main aims of WFW is job creation. How would you rate the eMpofana project?

Very successful	
Successful	

Not successful	
I do not know	

71. If yes, what jobs have been created?

New contractors	
Conservancy staff/Guards	
Tourism	
None	
Other (specify)	

72. How would you categorise the job created?

Temporary	
Permanent	
Other (specify)	

Were you aware of the temporary nature of the employment at the project before joining? Yes / No After joining? Yes / No

73. The study would be better informed if the importance of new jobs created were known. Were you employed elsewhere immediately before eMpofana project started? Yes / No

74. What skills have you gained since the start of the eMpofana Riparian Rehabilitation project?

Conservation guard	

Clearing contractor	
Team work	
Other (specify)	

75. If you have not gained any skills since the project started, what do you attribute this to?

76. Since joining the project, how would you rate your potential for future employment?

Much better	
Better	
No change	
I do not know	

77. To address the issue of unemployment in the eMpofana catchment would you say the project has created sufficient jobs? Yes / No

78. Apart from job creation, the project strives to offer equal opportunities to both men and women. In this regard would you say eMpofana project has been:

Very successful	
Successful	
Not successful	
I do not know	

Thank you very much for taking your time to answer the questions.