SOUTH AFRICA

RIVER SYSTEM RESTORATION FOR A SUSTAINABLE LAND AND WATER MANAGEMENT IN THE BAVIAANSKLOOF MEGA-RESERVE

Preliminary assessment of the opportunities and challenges to the creation of a Payment for Watershed Services Scheme

By
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Presence

"RIVER SYSTEM RESTORATION FOR A SUSTAINABLE LAND AND WATER MANAGEMENT IN THE BAVIAANSKLOOF MEGA-RESERVE
Preliminary assessment of the opportunities and challenges to the creation of a Payment for Watershed Services Scheme"

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TABLE OF CONTENTS

The Baviaanskloof Mega-reserve

The Baviaanskloof –"valley of baboons"- is located between the parallel Baviaanskloof and Kouga mountain ranges in SouthAfrica's Eastern Cape Province. The Baviaanskloof Mega-reserve includes a cluster of formal protected areas and privately owned land, used for livestock grazing and cropping.
The area is one of outstanding natural beauty, with spectacular rock formations, high diversity of plants and vegetation types, and several wild animals species. Because of its rich biodiversity the Baviaanskloof gained World Heritage Site status in 2004, along with seven other reserves in the Cape Floristic Region. The valley offers also several pre-historical and historical sites and artefacts, as for example the famous bushman paintings scattered all over the valley. Furthermore, the area plays a major role as a water catchment, to supplement the growing water needs of downstream users.

In order to realise the full potential of the area in biodiversity conservation, maximum provision of water and improvement of rural livelihoods a number of pressures need to be realised. In this light, the Baviaanskloof Mega-reserve Project has been created with the goal of achieving biodiversity conservation together with local economic development.

(Source: Boshoff, 2005)

1. Background

As a semiarid developing country, South Africa has historically experienced water supply constraints. In recent times, due to a fast-growing population and to increasingly erratic rainfalls, water is becoming more and more the limiting factor to development (Scholes, 2001, in Blignaut et al, 2007). In the past, a system of engineering supply solutions was set up to meet the rising demand for water, but this option is no longer viable since virtually all viable rivers are already being exploited (Blignaut et al, 2007). Therefore, there is an urgent need for alternative solutions, such as sound integrated water catchment measures which can best allocate and manage the existing water resources.

> *"More and more, the complementary factor in short supply (limiting factor) is remaining natural capital, not manmade capital as it used to be. For example, populations of fish, not fishing boats, limit fish catch worldwide. Economic logic says to invest in the limiting factor. That logic has not changed, the identity of the limiting factor has".*
>
> *Daly, in Aronson et al, 2006*

But a sustainable integrated catchment management does not only result in a more efficient exploitation of water resources. In fact, well-functioning watersheds provide a whole range of services which are essential for people's livelihoods and well-being (Le Maitre et al, 2007), as summarized in Figure 1.

Provisioning services *Services focused on providing food and non-food products from water flows*	**Regulating services** *Services related to regulating flows or reducing hazards related to water flows*
• Freshwater supply • Crop and food production • Livestock production • Fish production • Timber and building material supply • Medicines • Hydroelectric supply	• Regulation of hydrological flows (buffer runoff, soil water infiltration, groundwater recharge, maintenance of base flows) • Natural hazards mitigation (e.g. flood prevention, peak flow reduction, landslide reduction) • Soil protection and control of erosion and sedimentation • Control of surface and groundwater quality
Supporting services *Services provided to support habitat and ecosystem functioning*	**Cultural and amenity services** *Services related to recreation and human inspiration*
• Wildlife habitat • Flow regime required to maintain downstream habitats and uses	• Aquatic recreation • Landscape aesthetics • Cultural heritage and identity • Artistic and spiritual inspiration

Table 1- The main watershed services provided by ecosystems (Smith et al., 2006)

As many recognize, "*the links between landscape characteristics, particularly the spatial patterns in geomorphology and land cover, and rivers are a vital and integral part of the functioning of stream flow*" (Ward, 1998; Hancock et al, 2005; in Le Maitre et al, 2007). Especially in rural areas, such as the Western Baviaanskloof, economic activities such as farming and ecotourism are heavily dependent on watershed services (Scholes and Biggs, 2004). At the same time, land-use and land-use changes can have a huge impact on the delivery of ecosystem services, which in turns affects economic activities for various stakeholders both on site and in downstream catchments, in a vicious circle (LeMaitre et al, 2007).

This is precisely the case in the Western Baviaanskloof. Although land owners have recently set-up ecotourism activities, large-scale, commercial agriculture has been the main activity in the valley since the 19th century. The Baviaans catchment is a highly dynamic and fragile system, and the exploitation of land and water resources has resulted in the degradation of the river system. Various land and water problems, such as erosion of stream banks and surrounding slopes, drying up of water sources and disappearance of wetlands, have already become manifest. Furthermore, climate change is expected to worsen the situation, as changes in rainfall patterns have already been measured (Jansen, 2008).

Land and water degradation in the Western Baviaanskloof, however, is not only detrimental for the delivery of watershed services on site, since the area is part of a broader context.
As a water catchment, the Baviaanskloof plays a crucial role for the provision of clean water to downstream users. Both the Baviaans and Kouga catchment supply water to the Kouga dam. This dam, in turn, supplies irrigation water to the Gamtoos valley, where intensive commercial farming is the main economic activity, as well as drinking water to the fast growing city of Port Elizabeth (Jansen, 2008; van der Burg, 2008), as represented in Figure 1. Watershed services provided by the Baviaans catchment have strong implications for water provision to the Kouga dam (van der Burg, 2008), and hence economic implication for downstream users.

Furthermore, the Western Baviaanskloof is part of the Baviaanskloof Mega Reserve, which makes ecosystem conservation and restoration a high priority in the area.

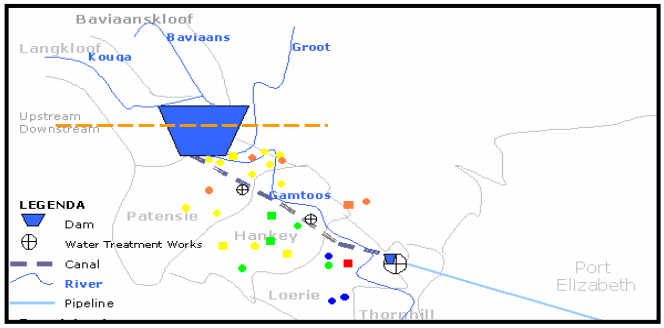


Figure 1- Schematic representation of the Baviaans, Kouga and Gamtoos catchment (from van der Burg, 2008)

*The Baviaanskloof Mega reserve is based on the underlying philosophy of "**keeping people on the land in living landscapes**"*

Farming activities in the valley are potentially in conflicts with the objectives of the Baviaanskloof Mega Reserve Project. For this reason, in 1997 the compulsory acquisition of all privately owned land in the Western sector was proposed (Clark, 1998, in Crane, 2006), but it met the fierce opposition of the local community (Roodt, 2003, in Crane, 2006). As noted by Crane, 2006, "*the future of the reserve as a viable conservation area must take into account human communities and land use on properties adjacent to the Reserve*". This has been finally recognized with the creation of the Baviaanskloof Mega Reserve Project, with its underlying philosophy of "*keeping people on the land in living landscapes*" (BMRP, 2004, in Crane, 2006).

Indeed, although the restoration of the river system will undoubtedly bring benefits for human activities and ecosystems, both on site and in downstream catchment, it conflicts with the current land and water use and, ultimately, with the traditional livelihood strategies in the valley. The shift towards sustainable land and water management practices might possibly involve trade-offs and conversion of cultivated areas into grazing land or conservation areas.
In particular, the Baviaanskloof Mega Reserve Project envisages a shift from stock farming to sustainable wildlife utilization and nature-based tourism, using a local

conservancy as a model (Boshoff, 2005). However, a reduction in the scale of farming activities in favour of uncertain growth in eco-tourism raises concern among the local land owners about who will carry the risk (Crane, 2006). Crane also points out that "*in the context of the Baviaanskloof, just what it will take to persuade farmers to change their land use still seems poorly understood*".

Furthermore, it is often very costly to reverse and restore the watershed services that used to buffer and regulate water flows (Smith et al, 2006), and landowners are unlikely to be able to finance the full cost of rehabilitation: this calls up for a system approach involving the participation of all stakeholders and a proper sharing of costs and benefits (Le Maitre et al, 2007).

In recent years, these challenges to restoration have increasingly been addressed through incentive-based approaches to watershed management. These approaches recognize and estimate the economic value of watershed services, in order to promote investment and compensate private landowners involved in restoration activities for the services they provide (Smith et al, 2006). These mechanisms create positive economic incentives for land managers and natural resource users to behave in ways that improve, or at least maintain, certain ecosystem services (de Groot et al, 2006). Payment for Ecosystem Services, or Payment for Watershed Services, are the most common labels, although different compensation mechanisms have also been used (de Groot et al, 2006).

The first fundamental step in designing a PWS scheme is to define, measure and quantify the environmental services which can be included in the scheme (e.g. Wunder, 2005 and Mayrand & Paquin, 2004), and consequently identify the providers (the potential sellers) and the beneficiaries (the potential buyers) of these services (Smith et al, 2006). Other crucial issues in the design of a PWS scheme are the establishment of an effective and transparent social learning process, enabling well-informed participation by stakeholders in the scheme, and a careful assessment of how useful and acceptable the scheme is to stakeholders (Smith et al, 2006). Furthermore, a well-functioning incentive scheme must be able to properly address needs and priorities of the service providers (Blignaut, pers. comm.).

"Much research has been done on PES so far, but actual trade is not happening that much: why?[…] Some key questions need to be answered: where do farmers and communities feel most vulnerable? What do they need? What are their priorities? To build a successful PES scheme we have to hit the nerve!"

James Blignaut, University of Pretoria

It is against this background that the present study has taken place. The focus is to investigate how farmers can be involved in nature conservation and restoration, and be compensated for certain activities and management measures that are beneficial for themselves as well as for other water users, in terms of improved delivery of watershed services. This report seeks to provide the context for a Payment for Watershed Services scheme in the Western Baviaanskloof linked to the restoration of the Baviaans river system. In particular, landowners' willingness to restore the catchment was investigated, and the issues, opportunities and constraints to restoration –to be addressed by an incentive scheme- were identified. Recommendations for further research will also be provided.

Box 1: Main questions to be answered by this report

1. *What is the socio-economic context of the Western Baviaanskloof?*
2. *What is the state of watershed services in the area?*
3. *What are the costs originating from watershed services degradation?*
4. *What kind of river system restoration measures best suit the local conditions?*
5. *Are local landowners willing to restore their land?*
6. *What are the issues and constraints to be addressed in a Payment for Watershed Services scheme?*

Interviews and questionnaires with local landowners are the main source of information for this report, but experts and other relevant stakeholders were also consulted. Furthermore, all properties in the Western Baviaanskloof were visited under the precious guidance of landowners, with the aim of getting a thorough understanding of farming activities, water management and water-related problems in each farm. To complete the picture, a field trip was organized by the PRESENCE* platform between the 3rd-5th of November in the area: with the overall objective of identifying the best strategies for restoring the valley's river system.

This research is part of the Water for Food and Ecosystem Program (BOX 2), and it builds on the previous land and water assessment of the area carried out by Herco Jansen (Alterra-WUR). It is also part of the PRESENCE network (BOX 3), which facilitated the data collection process and is currently coordinating research on restoration in the Western Baviaanskloof.

BOX 2: Water for Food and Ecosystems ***(Source: Jansen, 2008)***

In 2005 FAO and the Government of the Netherlands organized the International Conference on Water for food and Ecosystems in The Hague, providing a high-level platform for 350 participants around the globe. The objective of this conference was to assist governments in identifying management practices, to present practical lessons learned and to create the necessary enabling environments leading to a sustainable water use at the river-basin level and the harmonization of food production and ecosystem management with a view to implementing already internationally agreed commitments.

As a follow-up of this conference and to implement new concepts for sustainable water management for food and ecosystems, partnerships between countries were established. The project "Water for food and ecosystems in the Western Baviaanskloof" is being executed in the framework of the Water Partnership of the Dutch Ministry of Agriculture, Nature and Food Quality (LNV) and South Africa.

BOX 3: PRESENCE- Participatory Restoration of Ecosystem SErvices and Natural Capital in the Eastern Cape
An overview (*Source: PRESENCE Programme Overview 2008)*

PRESENCE is a multi-stakeholder networking initiative active in forming mutually beneficial and synergistic partnerships for enabling landscape restoration in South Africa. It aims to secure additional investment and collaboration to ensure that its ambitious vision and objectives remain achievable into the foreseeable future. Current national and international partners include: governmental departments; national agencies; universities & research institutes; implementation bodies; NGOs; and private sector and community-based organisations.

Vision: Restoration of Living Landscapes (as defined by the Subtropical Thicket Ecosystem Planning (STEP) programme) 'Mainstreaming' restoration as a viable multi-functional land-use across diverse sectors of society, from socio-economic/socio-ecological and institutional perspectives.

The objective of PRESENCE is to guide, facilitate and enable:

1. *Rigorous transdisciplinary research/programs to address critical knowledge gaps in our current understanding of ecological, cultural, economic and socio-political factors and their integration into implementation, management and planning of optimal restoration strategies;*
2. *Best Management Practices (BMP) for natural resource and ecosystem management to ensure equitable and effective landscape restoration over various geographical and institutional scales;*
3. *Local capacity building through the mainstreaming of restoration processes. This will involve two-way communication and education of (the importance of) the BMP in restoration across governmental, non-governmental and research institutions and the dissemination of knowledge and lessons learned to diverse stakeholder groups with tailored strategies (e.g. through local community-driven 'learning organisations').*

The present project is conducted in partnership with the PRESENCE network, which facilitated the fieldwork and made possible the involvement of local communities.

2. People and livelihoods in the Western Baviaanskloof

The local community of the Western Baviaanskloof is compounded by 16 large Afrikaaner landowners, a farm owned by several coloured shareholders (Sewefontein), a coloured church community (Zaimaanshoek) and the white-owned community farm of Tchnuganoo. In particular, this research focuses on the 11 large landowners (see list in the annexes) who are living and farming in the valley, since they are the main water users as well as the main stakeholders involved in land and water management. The other landowners bought the land for holidays and recreational purposes and live elsewhere in the country (e.g. Johannesburg). At the present stage, farming activities in Sewefontein are still facing constraints and challenges and have not yet reached a large scale, thus were not included in the area since they make limited use of water resources compared to large farmers.

It is important to notice that many people from Sewefontein and Zaaimaanshoek are employed as farm workers, and other coloured families are spread over the whole valley as farm labourers and dwellers. Since watershed restoration might have an influence on the scale of farming activities, it might also have employment implications, which means that the coloured community might be affected. Hence, although large farmers are the main focus of this research, the impact on local coloured communities of restoration will also be mentioned.

Large landowners

Although landowners in Western Baviaanskloof are identified and treated in previous studies as a unique stakeholder group, they form quite a heterogeneous group and this diversity can be quite relevant for the purpose of this research. The extent to which every landowner is involved in farming activities is highly variable, and this has a fundamental influence on the extent of water use and land and water system degradation on the farm, as well as on the plans for the future and the attitude towards restoration.

Nevertheless, for practical reasons it is useful to classify landowners in two main categories.

Some landowners can be considered actual farmers, since they are mostly involved in farming activities. They were typically born and bred in the 'kloof, and their families have been living in the valley for generations. With a few exceptions, they are all between 30 and 40 years old, they have kids about the same age and they form quite a compact group. They are the most relevant group with respect to this research, since they are big water and land users, and the most serious cases of river system degradation were found on their farms. Moreover, although they are all involved in tourism to some extent, they get most of their income from farming, and thus the reduction of farming activities would have a big impact on their livelihood.

Other landowners are mostly involved in tourism accommodation and catering, although some of them carry on some farming, often more for personal pleasure than for real necessity. Most landowners in this group are "newcomers" in the valley and they bought the properties because they love that kind of lifestyle and not really because of farming. Nevertheless, their sources of income are extremely diverse, and tourism is the bulk of income only in two cases, the others base their livelihood on a combination of farming, tourism and other businesses (for example, building contracts). In the latter case, some landowners are still deriving most of their income from farming, although they are planning to gradually

reduce the extent of farming in favour of tourism.

Opportunities and challenges facing local landowners

At present, landowners are faced with diverse challenges, pressures and opportunities which they are obliged to consider when taking decisions on livelihood strategies. Farming activities still represent the main source of income for local residents, although they are becoming less and less profitable, as input costs are fast increasing and sale prices for end products stay more or less the same. On the other hand, tourism is still a new business and hence it has a huge potential which has not been developed yet.

Being agriculture the main economic activity, water is a crucial resource. Unfortunately, water is getting scarcer, and rainfall are becoming increasingly unpredictable (Jansen, 2008). Furthermore, downstream users, such as Nelson Mandela Metropole (NMM), are claiming for additional water, and different options to increase the supply are being studied; a previous study also shows that downstream users, including farmers in the Gamtoos valley and NMM, are willing to pay for additional water (van der Burg, 2008). Since the Baviaanskloof is a strategic catchment for water provision to the Kouga dam, all these issues and claims represent an additional pressure on local inhabitants.

In addition to this, private land is surrounded by the Nature Reserve, and this means that there is a strong interest in conserving and restoring the natural landscape. This is both a pressure and an opportunity for farmers. In fact, on the one hand the Reserve managers are trying to promote more sustainable land and water management and restoration activities on private land; on the other hand, these activities would improve the natural landscape and therefore further enhance the tourism potential in the valley.

The vision for the future

Quite interestingly, almost all landowners share a common vision for the future of the Western Baviaanskloof. This vision includes farming activities on a smaller scale, but more intensive, in favour of a growth in the tourism business, which in turns implies that portions of land will be taken out of production to be part of the natural system. A substantial increase in the number of tourists is expected, although many local inhabitants agree that tourism should keep its current "*niche*" character, since mass tourism would disrupt the wild and peaceful atmosphere of the valley.

With few exceptions, however, landowners got engaged in the tourism business a few years ago, as a way to create additional income, and hence in many cases farming is still providing the necessary capital to run tourism accommodation, since most landowners got into tourism in the past few years. As pointed out by a farmer, "*you can't jump into tourism and make a profit out of it during the first years. There must be a period of overlap of farming and tourism, because farming feeds tourism at the beginning –in fact, tourism takes some time to pick up and become profitable*", and this is quite a common feeling in the valley.

It has to be pointed out, however, that a reduction of farming activities in favour of tourism would not be socially costless. Farming, in fact, is more labour-intensive than tourism, and an expansion of the latter business might imply less job opportunities for the coloured communities, whose members are currently massively employed as farm labourers.

> *"The change* [from farming to tourism] *can't happen overnight!"*
>
> A landowner

3. Agriculture as the largest land and water user of the Western Baviaanskloof

As mentioned before, at the present stage agriculture is still the largest economic activity in the area. Most of the agricultural land is used for livestock grazing, and it also includes a portion of irrigated pastures. A smaller area is used for crops, with alfalfa as the most common crop –used both for fodder storage during winter months and for direct grazing. Other crops such as maize (in summer) and wheat (in winter) are also grown, together with onion seeds, beans, carrots and pumpkins (these results are in line with Jansen's report).
Crops are grown on the large and fertile floodplains, while grazing lands (the "veld") can be found both on the floodplains and on the surrounding hills. Altogether, 35% of the Baviaanskloof area is used for agriculture (Jansen, 2008).

Livestock keeping uses most of the land devoted to agriculture, and Angora goats, sheep, ostriches and, to a lesser extent, game farming represent the main source of income (de la Flor, 2008; Jansen, 2008). Grazing, and specifically overgrazing in the past, is the major driver for the extensive degradation of the original subtropical thicket vegetation on the north-facing slopes. The degradation of the natural vegetation interests the whole valley, although its extent is highly variable, since some landowners have taken measures to reverse the process in the past decades with visible improvements. On the other hand, in some locations degradation is so intense that the soil is bare on a large percentage of the total area: this makes it impossible for the vegetation to recover naturally (Turpie et al., 2003), since the top soil is lost, but it also means that those area are lost to livestock grazing. Yet, it would be a mistake to blame the present farmers for allowing overgrazing: in most cases, in fact, the degradation is the result of overgrazing in the past, generally during the 1930's and 40's, and the subtropical thicket regenerate very slowly.

Although livestock grazing is by far the largest land use in the area, water consumption by livestock represent only a small portion of the total water used in the area, estimated to be around 24,116 m3/year (de la Flor, 2008). Irrigation, both for crops and grazing land, is by far the largest responsible for water consumption in the area –domestic use is almost irrelevant, being around 1,642 m3/year (de la Flor, 2008). According to this study, licences for irrigation water cover a total area of approximately 395 ha, although this is likely to be an underestimation, since a few landowners did not answer this question –in Jansen, 2008, an estimate of 300-500 irrigated hectares is reported, according to DWAF data. In terms of water consumption, total water use for irrigation in the Western Baviaanskloof is estimated to be between 1.75 millions m3 and 2 millions m3 (Jansen, 2008, and DWAF, 2004, in Jansen, 2008).

The most common water management measures are furrows and pipelines to channel water from sources and fountains to the irrigation dams; most of "lifestyle farmers" do not have any other water management measure.
All kind of irrigation systems, such as flood irrigation, sprinklers and pivots can be found in the valley. The type of irrigation system is directly related to water consumption: flood irrigation is undoubtedly the less efficient method, followed by sprinklers and pivots, which is the most efficient one.

Water supply comes from different type of sources, namely howls and pits (holes in the ground close to the river bed, hence

exploiting the underground water table) and natural springs, often located in the lateral 'kloofs. Every farm has its own water source, and servitudes on other properties are quite common. It also happens that water sources are shared among different landowners. The assignment of water sources to every property was established long ago, through informal or written agreements, and only recently landowners had to apply for a license, in order to comply to the National Water Act (1998). Although the process of licensing is still on-going, it is expected that the licensed water rights will be in line with the previous arrangements.

Besides irrigation infrastructures, in more intensively cultivated farms measures to protect crops from floods are also very common. These measures are usually in the form of weirs built on the banks of the main river and tributaries, in order to control the water flow during heavy rains and to prevent overflow on the surrounding areas.

On the Baviaans river, control measures are typically weirs to channel the river bed, to prevent overflow but also to confine the river on a limited area and protect crops and veld. In fact, due to the geomorphology of the area, the Baviaans river does not flow in the same river bed over the years, but it tends to meander and change its course following major flood events, as clearly stated during the field trip. Quite obviously, this creates problems for landowners who farm close to the river bed.

Moreover, protection measures were also taken on the tributary streams, such as the water bodies coming from the lateral 'kloofs. In 1981 a major and destructive flood occurred, causing extensive damages and losses. After that flood, farmers were given subsidies to protect low lying lands, and they did that by digging channels from the kloofs to the river, with the assistance of DWAF which showed them the best locations for weirs. These measures appear to be successful against floods, but they also brought major changes to the river system, as the next section will show.

4. The state of watershed services provided by the Baviaans catchment

The Baviaans catchment provides most of the existing watershed services. Although the Total Economic Value of ecosystems includes also some "non tangible" values such as for example the existence value, this research focus only on those services which have a direct or indirect use value, since economic activities are mostly dependent on these services (see also van der Burg, 2008). Moreover, particular attention will be paid to those services which are being lost or degraded, since those ones will be the focus of river system restoration. Table 2 gives an overview of the services provided both on site and downstream, and it summarizes the interactions between economic activities and watershed services. All watershed services, as listed in Table 1, are included in Table 2, to give the sense of the large extent to which the Baviaans catchment provides these services. In the following sections, however, the focus will be on those services which are provided by the catchment and which are affected by human activities, as highlighted in the table below.

Service	Direct use value on site	Indirect use value on site	Direct use value down-stream	Indirect use value Down-stream	Affected by current L&W mgt on site	Affected by changes in rainfall	Costs on site	Costs down-stream
Provisioning services								
Freshwater supply	x		x		x	X	x	X
Crop & food production	x		x		X (indir)	X	x	X
Livestock production	x				x	X	x	
Fish production								
Timber & material supply								
Medicines								
Hydroelectric supply								
Regulating services								
Buffer runoff		x			x	X	x	
Soil water infiltration		x			x		X	
Groundwater recharge		x			x	X	X	
Maintenance of base flow		x		x	x	X	x	X
Drought mitigation		x		x	x	X	x	x
Flood mitigation		x		x	x		x	X
Peak flow reduction		x		x	x		x	
Erosion prevention		x		x	x		x	X
Sedimentation control		x		x	x		x	X
Control of water quality	x			X				
Cultural and amenity services								
Aquatic recreation								
Landscape aesthetic		x			x		X	
Cultural heritage		X						
Artistic and spiritual inspiration		X						

Table 2- Watershed services provided by the Baviaans catchment both on site and downstream

Provisioning services

Provisioning services, such as fresh water provision, crop, food and livestock production, have a direct use value both on site and downstream, and it is thanks to these services that the most important economic activities can take place.

In particular this study tried, among other things, to estimate in a qualitative way the dependence of local landowners on water supply, by presenting them with two different hypothetical scenarios involving a 10% and 30% supply reduction. A 10% reduction would impact farming activities for all respondents but one, involving a reduction in number of farm workers in 4 cases; yet, the large majority of respondents would still be able to maintain the current livelihood and would still be able to face the problem by substituting the lost farming activities with other activities. In contrast, a 30% reduction of water supply would represent a much bigger constraint. In all cases, the reduction would impact farming activities, although the consequences for employment on the farm would stay the same as in the previous scenario. Moreover, the reduction would affect livelihoods for the

majority of landowners, and in some cases landowners would not be able to substitute the lost activities with others, probably because they would not have the necessary capital to invest elsewhere. These results show that, to some extent, landowners have the capacity to buffer a reduction of water supply, but if this reduction is too large their livelihood strategy would be disrupted. Therefore, it can be inferred that at this stage, being agriculture the main source of income in the valley, the valley's economy is highly dependent on water availability.

Provisioning services, besides having a vital importance on site, are also enjoyed by water users in the Gamtoos valley, since the Baviaans river supplies water to the Kouga dam. This implies that water use in the Western Baviaanskloof has direct consequences on water availability downstream. It is claimed, in fact, that upstream farmers are currently using too much water through inefficient irrigation systems, affecting water supply to the Reserve and to the Kouga dam. Indeed, inefficient irrigation systems, such as flood irrigation, are still in use in some properties, although many farmers have already shifted, or are planning to shift, to more efficient infrastructures such as sprinklers or pivots, since a more efficient water use is more profitable for their activities as well.
At the same time, the Baviaans river supplies on average only 20% of the total water in the Kouga dam, with the Kouga river contributing for about 77% (Jansen, 2008). In addition, water consumption in the valley is relatively small, when compared to water use for irrigation in the neighbouring Langkloof, estimated in the order of 25-30 millions m3 per year (Jansen, 2008). Nevertheless, water availability is expected to become such a big limiting factor to development in South Africa that every catchment will play a crucial role and will need to be restored, and a more efficient water use will be undoubtedly beneficial for downstream users.

"Water in South Africa is going to be such a big problem that every river system will need to be restored. So, even if the Baviaans is only a secondary tributary to the Kouga dam, its restoration is very important for the reserve and the Kouga dam itself".
Japie Bucke, SANBI (Working for Wetlands)

Regulating services

Although regulating services do not have a direct economic value, the regulation and buffering of water flows are crucial for the life and the economic activities of human beings, and a loss of these services brings about threats for human well-being (e.g. increased strength of extreme events such as floods) and additional costs associated with economic activities and infrastructures (e.g. losses of crops during floods).

The Western Baviaanskloof is characterized by low annual precipitations, in the order of 300 mm on average, of which 2/3 fall in summer and only 1/3 falls in winter. Due to climate change, the erraticness of precipitations seems to be increasing, with an increase in summer rainfall (and extreme rainfall events) and a decrease of winter precipitations (Jansen, 2008). In addition, dry periods, with very little precipitations, are quite common in the valley, and according to local farmers a drought occurs periodically, followed by a major flood. In normal years, the Baviaans river is dry for several months, namely during winter, and water flows only during the rainy season. Major flood events play a crucial role for the system, since many local inhabitants report that after these events the river flows for a longer period of time, sometimes even for a couple of years.

These characteristics make the Baviaans catchment a highly dynamic system, and for

this reason the regulating services provided by the watershed play an essential role. The degradation of the vegetation on the hill slopes, the disappearance of wetlands, the interventions on the river bed and tributaries streams have disrupted the functioning of the system, with a broad range of consequences.

First of all, the water retention capacity of the catchment has experienced a substantial reduction. During rainfall events, the absence of good vegetation cover on the hill slopes causes a high run off, associated with exacerbated soil erosion and soil capping. Instead of infiltrating in the soil, water runs directly into the water bodies, which in turn are getting deeper and deeper as a combined effect of higher run off and human interventions such as channels. The disappearance of wetlands on the main channels, together with the man-made regulations of the river system, contributes to the progressive incision of the water bodies. The effects of these complex interactions can be summarized as follows:

- Groundwater recharge is substantially reduced;
- Due to the incision of the main channel and tributary streams, and to the reduced recharge, the water table in the valley is getting lower and lower;
- Already scarce rainfall water, especially during heavy showers, flows rapidly out of the valley and it is not retained by the system, and hence it is lost to humans and ecosystems;
- The base flow of the Baviaans river is heavily affected, since water is no longer retained during the rainy season to be slowly released during dry periods;
- The disruption of the natural base flow affects the drought mitigation capacity of the system;
- Fast-flowing water is causing serious erosion problems;
- The channelization of the water bodies prevent water from flowing over the flood plain, and thus from depositing precious silt on the veld;
- The strength of extreme events such as heavy showers and floods has increased.

The loss of regulating services has obvious consequences also downstream, in terms of reduced water supply to the Kouga dam. The disruption of the natural base flow causes a reduced water supply during dry periods, while during the rainy season excess water reaches the dam, resulting in spillage and thus in water losses for agriculture in the Gamtoos valley. The average annual spillage from the dam is far from being a secondary problem, since it is estimated to be around 90-100 millions m3 (Jansen, 2008) -but of course, this is a combination of the inflows from both the Baviaans and the Kouga river.

In addition, erosion in the Baviaans catchment implies an increased siltation in the Kouga dam, which in turns affects the dam's storage capacity and increases the spillage during rainy periods.

Cultural and amenity services

Since the Baviaanskloof Mega Reserve a whole is a World Heritage Site, cultural and amenity services represent a crucial resource. Moreover, these services have a high indirect use value for the rising eco-tourism business in the area.

Disappearance of wetlands, degradation of the original vegetation cover and erosion has an impact on landscape aesthetic, and this might represent a constraint for eco-tourism development in the area.

5. The costs of watershed services degradation

So far, watershed services provided by the Baviaans catchment have been explored, as well as the impact and processes driven by human activities in the area. Under a socio-economic perspective, however, it is crucial to notice that the loss or disruption of these services implies issues and costs for human well-being and economic activities, both on site and downstream: these costs were estimated in a qualitative way in the Western Baviaanskloof, while the costs for the Gamtoos valley are estimated quantitatively by van der Burg, 2008. For this reason, particular attention will be given to the costs on site, while only a brief overview will be given about the costs downstream (based on the mentioned study and on expert interviews as well).

Loss of water retention capacity

The lack of retention capacity is seen as the major problem in the catchment by many landowners, since during heavy rainfall events only a small portion of the water is kept in the valley, while the rest just flowing fast to the Kouga dam.

Nevertheless, almost all landowners pointed out that rainfall quantity is just one side of the coin, because the type of rainfall also plays a major role. In fact, they do not really benefit from heavy showers, because a lot of water comes down at the same time and as fast as it comes it also leaves the river system. What they call "soft" rain –meaning low-intensity rain stretched over a longer time span- is what they actually need, since the soil is then able to absorb and retain most of the water. In this case, the compromised retention capacity of the catchment plays a crucial role, since healthy systems would be able to buffer and retain water during heavy showers, contributing to the water table and benefiting natural vegetation and water availability on the farms. The current situation implies a loss of precious water which might be avoided through an improved catchment management.

The implications of a lower water table and loss of silt deposition

The construction of channels to control water flow in tributary streams has resulted, as it was seen before, in a lower water table and in the loss of silt deposit. It was possible to asses the consequences for farming activities by observing the differences between two tributaries streams next to each other: in one of them the channel was removed, and the natural water way rehabilitated; in the second case the channel was in place.

The first tributary was restored in 1991, after the pressure of the downstream farmer. The latter, in fact, has servitude for water on that 'kloof, and he asked for the rehabilitation of the water way after his fountains dried up. As reported by the landowner, after the restoration a flood occurred, and three days later his fountains had water again: this is a striking proof that the protection measure was heavily affecting the system.

> *"The construction of channels on tributary streams was the biggest mistake ever made in the valley":*
>
> A landowner

Furthermore, it was observed that the natural vegetation is much greener and healthier downstream of the restored 'kloof than elsewhere. Indeed, the farmer reported that in this area the grazing capacity has increased after restoration. Although a proper valuation of the increase was not carried out, since it was out of the scope of this research, it seems evident that the current dropping of the water table and loss of silt, as a result of the many channels built all over the catchment, is affecting the fertility of the land and it is causing a reduction in the grazing capacity on the flood plain. According to

other landowners, who has a similar measure on his property, "*the construction of these channels was the biggest mistake ever made in the valley*".

The consequences of droughts

The present field research was conducted at the end of a very dry period: although the majority of landowners still had enough water, some of them were experiencing reductions in the discharge of their sources, reduced water storage, and reductions in their farming activities, and most of them agreed on the need for some good rain in the near future.

In particular, landowners reported reductions of water storage (dams) varying from 20 to 60%, and reductions in water discharge from sources ranging from 0 to 75%. Nevertheless, most respondents are still able to carry on with their usual farming activities. Where a decrease of farming activities did occur, farmers reduced the irrigated area or sold part of their animal –in one extreme case, 1700 ostriches out of 2000 were sold.

As it was to be expected, all landowners who are mostly engaged in tourism did not have problems with water availability, they reported to have more than enough. The drought affected mainly some of the "actual" farmers. Some other farmers reported no problem with water availability at the moment, but they would have to reduce the irrigated area if rains did not come in October. On the other hand, some farmers have the perception not to be affected at all: water availability was not a problem for them; they could get more if they wanted, but they did not because the costs of pumping the water (costs of electricity) were too high and it would not be profitable for them. It can be argued, however, that high pumping costs represent indeed a problem linked to a lower water table and thus to reduced water availability.

The effects of past drought were also investigated, in order to understand possible long-term consequences. It appears that long-term consequences are highly dependent on the duration of the drought, and on the quality of rainfalls at the end, but in general it is possible to replant the crops after the rain comes back. At the same time, as one landowner pointed out "*the only long term consequences are in the bank*"; another farmer said that it took him more than one year to resume his activities after the rain came back, and in addition it took him at least 5 years to re-build the animal stock and the financial resources, while also the natural grazing land takes years to recover.

It is not clear, however, whether the degradation of the river system, and the consequent reduction of drought mitigation capacity, has actually resulted in increased drought strength. Almost all landowners talked about cycles in local rainfalls, and it is normal to have a drought every 10-15 years – "*a dry spell*"- followed by a major flood event. None of them noticed an increase in the effects of the current drought compared to other dry periods in the past –although the effects of the system degradation are likely to become evident on the log term. This also means that, being a common phenomenon in the valley, farmers are used to face the problems and have developed coping mechanisms against droughts, such as for example irrigating only the most profitable crops at the expenses of others. According to a farmer, "*a drought is not the end of the world*".

Flood damages

Although floods were expected to be a major problem in the valley, according to landowners this is not a big issue. In fact, if it is true that these events bring some damages,

on the other hand they occur only every 10-15 years and the economic damages are never so relevant. Among damages, the most important one is the loss of crops, since some farmers experienced soil losses where crops were washed away, but the interested area was always in the range of a couple of hectares. Floods also cause damages to fences and, to a lesser extents, farm roads, while livestock losses, when occurring, are never serious. When crops are washed away that portion of land is lost for the whole season, and replacing the soil is expensive, but in general floods have no long-term consequences and it takes from 1 to 6 months to repair the damages. However, the financial effects of a flood can represent a problem: according to a landowner, *"you do not feel the consequences right away, you feel the financial effects in 1 year. Fixing the damages is not in the normal budget, so you try to spread the expense over time"*.

It is interesting to notice that some landowners pointed out that protection measures are very beneficial for their activities, even though they recognize the detrimental effect on the river system and they do no consider floods a big issue in the valley.

The cost of watershed services losses for downstream users

Due to his strategic location, the Baviaanskloof fulfils a critical role as a water catchment, and therefore the loss of watershed services translates into costs for downstream users.

The closest "neighbour" of the Western Baviaanskloof is the so called "core-Reserve", the protected area located between the cultivated land and the Kouga dam. For the Reserve, the degradation of the Western section of the Baviaans section means a reduced water supply for wild animals and natural vegetation especially during dry periods, since the river base flow is currently irregular over the year.
But it is downstream of the Kouga dam that the loss of watershed services causes the highest economic losses, which are all related to a non-optimal water supply to the dam. An irregular base flow means, first of all, that water supply is scarce during the dry season –winter- and too abundant during the rainy season, when water overflows the dam and it is lost to irrigation and human consumption. This might also happen during extreme rainfalls events, since the water is not retained in the upper catchment but reaches the dam all at once. Besides, erosion of soil and water ways in the Baviaans watershed translates in an increase in siltation in the Kouga dam, which has a double negative effect on water availability downstream. First of all, it represents an additional cost when the water is used for human consumption. The water which is not used for agriculture ends in the Loerie dam downstream, which supplies drinking water to the city of Port Elizabeth, and increased sediment means higher purification costs. Secondly, silt accumulation in the dam reduces the storage capacity, which in turns contributes to spillage during rainy periods. Moreover, the presence of silt in irrigation water puts an additional pressure on irrigation infrastructure, creating problems associated with clogging and additional cleaning-up costs (van der Burg, 2008).

6. River System Restoration

During the first consultations with farmers, experts and other relevant stakeholders, the need for catchment restoration emerged abruptly, together with the willingness of researchers, implementers and farmers, especially the local champion, (Piet Kruger) to get involved in the process. Many ideas and opinions were going around about it: therefore, the River System Restoration Field Trip was organized in order to get together experts, interested organizations and landowners and "make the point" on the needs and priorities for the rehabilitation in the valley (BOX 4). The field trip started up collaboration between the participating organizations which gave birth to BICR (Baviaanskloof Integrated Catchment Restoration) Implementation Project (BOX 5), which will be operating starting from 2009. The present report wishes, among other things, to provide background information to The BICR.

The following sections draw from the outcomes of the Field Trip, as well as from other expert
interviews where necessary. Furthermore, the landowners' willingness to restore will be investigated.

BOX 4: River System Restoration Field Trip in the Western Baviaanskloof

A field trip was organized by the PRESENCE platform during 3rd-5th November in the World Heritage-Listed Baviaanskloof, South Africa. Representatives from numerous PRESENCE* partners participated in the field trip: CSIR, SANBI, R3G, Wageningen University, LNV (Dutch Government), Rhodes University, Gamtoos Irrigation Board, Eastern Cape Parks, EarthCollective, independent consultants as well as local private landowners.*

The event engaged experts and landowners in participatory mapping and planning exercises for integrated water catchment restoration. The overall objective was to identify strategies for restoring areas which may lead to improved water security and functioning of the catchment's ecosystem. The field trip was seen as a critical part of the process in adopting the ecosystem approach for catchment-side restoration. In fact, while on the one hand restoration measures must be planned and designed for every specific location, on the other restoration has to be coordinated and managed for the catchment as a whole. The Baviaans river system is highly complex, and every component (river, tributary streams, vegetation) influences the functioning of the system and acts in synergy with the others.

Priority areas were identified during transect walks, restoration measures proposed and a research-implementation agenda was drafted to further stimulate cooperation between collaborating organizations. Moreover, researchers, implementers and land owners were given the chance to share opinions and ideas about approaches to restore the Baviaans catchment..

BOX 5: BICR Implementation Project- Activities planned for 2009

1. ***Rhodes University Field Trip*** *(Coordinated by Prof. Fred Ellery, Environmental Sciences Department)*

The main objective will be on collecting data for the assessment of the condition, impacts and baseline for supporting the definition of measures for restoring the catchment. This assessment will provide a basis for a cost-benefit analysis aimed at pointing out the most appropriate short-term measures, which will be conducted by DLG/LEI under the Working for Food and Ecosystems Programme.

2. ***On-going student research proposal*** *(Rhodes University- Coordinated by Prof. Fred Ellery)*

These research projects will be aimed at getting a thorough insight in the most suitable restoration measures in the catchment.

3. ***Future student research projects*** *(Wageningen University)*

These research projects will carry out spatial and biophysical assessments in the Baviaans catchment.

4. ***Development of a SANPAD project proposal for The BICR between interested individual and organizations***
5. ***Project assistant intern*** *(Funded by WWF)*
6. ***LNV/DLG funding*** *(Enabled by Josefien Oude Munnik, DLG)*

This funding is intended on initiating implementation in the area, developing the onsite learning village and developing monitoring project. More details and a transparent report on the funding allocation will be provided to the ***In Care*** *team as soon as the project initiates.*

7. ***Working for Wetland Project Plan*** *(Coordinated by Japie Buckle, SANBI, and supported by Pete Illgner, private consultant)*

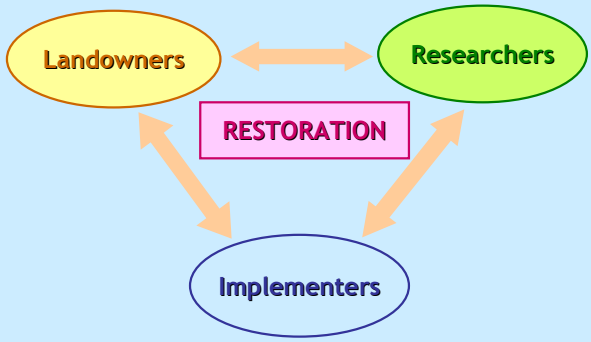
The Working for Wetlands initiative will be engaged with the `implementation planning, Environmental Impact Report and monitoring plan. This report is a long term process (around 3 months year) which will enable the ***In Care*** *to provide important information to plan implementation.*

Restoration measures: where and how?

The Baviaans catchment is a highly complex and dynamic system, where all components (main river, tributaries, vegetation, geomorphology, rainfall patterns) influence the functioning of the system and act in synergy with each other.

Therefore, every single intervention must take into account the effects that it might have on the system as a whole. While every measure must be carefully designed according to the needs of the specific location, it is crucial to plan and coordinate the rehabilitation effort across the whole catchment. Moreover, after identifying the necessary interventions and selecting the locations, the time scale of restoration and the priorities for intervention must be set carefully. Another important, more practical aspect must be considered: in fact, different interventions require different implementation time lengths and budgets, and this ultimately influences the time scale and priorities for restoration.

BOX 6: Restoration as an interactive process



This is why The BICR Implementation Program involves different organizations as well as local communities, in order for restoration objectives to be achieved through the collaboration of different stakeholders, such as researchers –to give technical and scientific advice-, implementers –to give practical advises and to execute the measures- but also local landowners and communities, since they can provide essential local knowledge and can allow restoration on their land (BOX 6).

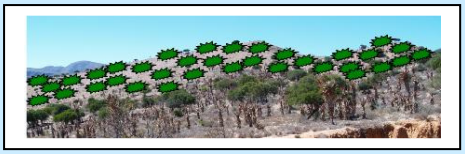
In the Baviaans catchment, the required measures were identified and priorities were established, as presented in BOX 7 following the projected chronological order.

BOX 7: Proposed restoration measures in the Baviaans catchment

***Step 1:* Rehabilitation of tributaries streams and related floodplains**

The rehabilitation of tributaries stream is seen as the first priorities in the area. It involves the closure of the channels –built after 1981- deviating the water directly into the main river, and the re-opening of the natural water ways, hence allowing water to flow over the floodplain again, feeding the now dried-up land and depositing silt. This kind of intervention is simple and inexpensive, but it is likely to yield excellent results and to release a lot of pressure from the system, since it would slow down the water flow to a great extent.

***Step 2:* Rehabilitation of the natural vegetation on hill slopes**



The loss of vegetation cover over large areas of the catchment puts a lot of pressure on the river system because of the high runoff and poor infiltration rate. Replanting pilot projects –part of the Subtropcal Thicket Restoration Programme (STRP)- in small areas have tried to restore the subtropical thicket cover in the past, by planting spekboom, a pioneer specie. Due to the extent of the degraded area, however, replanting might not represent a viable option, since it is expensive and time-consuming –although very effective. For this reason, an alternative method, known as brush-cutting, was suggested by Japie Buckle. Basically, it consists of laying down *Acacia karroo* branches on the bare soil. *Acacia karroo* is also a pioneer specie very common in the area, and more precisely it is the first specie to colonize areas poor in vegetation. This natural process is simulated by laying down the branches, since they temporarily cover the soil, slowing down the water and keeping moisture into the soil, and ultimately it allows the re-colonization by natural vegetation. This technique has the advantages of being quick, inexpensive and effective, and hence it appears very well-suited for the area. This intervention and the rehabilitation of the tributary streams might be implemented at the same time; in any case the restoration of the hill slopes is a high priority and it should not be done after step 3, since it also releases a high degree of pressures from the river system.

***Step 3:* Rehabilitation of the main channel**

As a last step, human interventions on the main channel and their negative effects must be addressed and reversed. First of all, weirs channelling the river to control the water flow and protect the crops must be removed, allowing water to flow freely on the floodplain. At the same time, this alone is not enough to reverse the serious erosion affecting the river bed: to address this problem, small retention structures must also be built where necessary. These structures slow down water and allow sediment deposition, thus stopping and reversing incision. Moreover, during the field visits some sites where wetlands were in the past were discovered: wetlands must also be restored since they play a fundamental role in the regulation of water flow. The rehabilitation of the main channel is undoubtedly very expensive and time-consuming, as it was pointed out by Pierre Joubert (Gamtoos Irrigation Board) who is currently implementing wetland restoration in the Kromme catchment. However, this is not the only reason why restoration of the main river must be the last step. In fact, interventions on the main channel are extremely vulnerable to flood events, since they might be easily washed away, and the previous interventions (Steps 1 and 2) would be highly beneficial in slowing down the water and releasing pressure from the system, thus reducing the risk of these measures being washed away.

In order to fully understand the benefits brought by the measures presented in the previous section, it is useful to identify the watershed services which would be restored through the contribution of each intervention, as presented in Table 3.

Service to be improved	1. Restoration of tributaries and related flood plains	2. Restoration of degraded slopes	3. Restoration of the main channel
Provisioning services			
Freshwater supply	x		X
Crop & food production	x		
Livestock production		X	
Regulating services			
Buffer runoff	x	X	
Soil water infiltration	x	X	
Groundwater recharge	x	x	X
Maintenance of base flow	x	x	X
Drought mitigation	x		X
Flood mitigation	x	x	X
Peak flow reduction	x	x	X
Erosion prevention	x	x	X
Sedimentation control	x	x	
Cultural and amenity services			
Landscape aesthetic	x	x	x

Table3- Contribution of the projected measures to the restoration of watershed services

The costs and benefits of restoration from the landowners' perspective

In order to devise an incentive scheme for landowners, the costs they would bore and the benefits they would enjoy must be carefully identified and valued. Since the purpose of this study is to provide the context for a PWS scheme and to undertake a preliminary assessment of the situation, such costs and benefits have not been quantified and valued, but at the same time the information collected allows for a general overview, as presented in BOX 8.

It is believed that the challenge to a successful payment scheme is to determine the balance of costs and benefits case by case, or better farm by farm, and see if and how incentives can play a role. The assessment should be done at the very local scale, because every farm is different and therefore the balance between costs and benefits might be very different. In fact, it is likely that in some cases the benefits of restoration outweigh the costs, and thus there would be no need for incentives. In other farms, rehabilitation measures might have adverse effects on crops or grazing land –for example, the restoration of the river bed might cause the loss of productive land on the floodplain- and in this case the losses should be compensated. The guiding principle to this way of thinking is that landowners' income should not be affected by restoration.

BOX 8- The costs and benefits of restoration

Benefits
Increase of grazing capacity on hills and floodplains
Increased water availability, especially in dry periods
Reduced flood damages
Possibly, reduced pumping costs
Possibly, land tax reductions
Added value for tourism, in terms of improved landscape
Added value for eco-tourism initiatives

Costs
Possible loss of crop areas on floodplains
Possible loss of grazing areas on floodplains
Restoration costs

7. The willingness to restore

As mentioned before, the involvement and consensus of local communities in the restoration process is essential for the success of The BICR Implementation Programme and for a successful establishment of a Payment for Watershed Services scheme. Therefore, a thorough understanding of landowners' willingness to restore and of the trade-offs involved is the necessary background needed to identify the most suitable ways to promote and market restoration, as well as to identify the issues which must be addressed by an incentive scheme.

The relationship between conservationists and local landowners in the past: a brief overview

Due to its exceptional natural beauty and its World Heritage Site status, the Western Baviaanskloof has been object of several research and conservation projects in the past.

The compulsory acquisition of all privately owned land proposed by the Project Management Unit (PMU) in the late 90's (as presented in Crane, 2006), although it proved to be unfeasible, raised a lot of concerns between local landowners, to the point that at present times farmers are still mistrusting the current Reserve management, the Eastern Cape Parks Board (Noirtin, 2008, and pers. comm.). This is a striking example of miscommunication between local communities and conservationists, which causes wariness towards outsiders proposing new projects and threats the success of restoration efforts (Noirtin, 2008).

In general, as found out by Noirtin, 2008, landowners are willing to collaborate with any institution or organization, at the condition that their voice can be heard and that their opinions and points of view are taken into consideration. Indeed, in the past the communication between researchers –and restoration programmes- and local communities was inexistent or unclear (Noirtin, 2008, and pers. comm.). Furthermore, conservation programmes made a lot of promises in the past which were not kept, since only a few restoration efforts were actually undertaken (Noirtin, 2008, and pers. comm.).

A river system restoration programme must definitely deal with the mistakes done in the past, learning from them and listening to the local communities involved in the project.

Landowners' perceptions and willingness towards catchment restoration

Before trying to evaluate the attitude toward restoration, it is useful to assess what land and water problems are perceived by landowners at the single farm level. Indeed, every farm is a different case, and different land and water problems can manifest in different farms; furthermore, the existence of a problem does not necessary mean that this is considered an issue by the interested landowner. Respondents were confronted with various land and water problems found in the valley, and they were asked to indicate whether each of them represented a problem on their property. The results are presented in Table 4.

Potential Problem	Perception
1. High runoff and loss of water during good rains	Considered as a problem by the majority of landowners
2. Erosion on tributary streams	
3. Erosion on the river bed	
4. Floods	Considered as a problem by half of landowners (and therefore with the same "rating")
4. Water scarcity during summer	
4. Decrease of water supply over the years	
4. Decrease of groundwater availability	
5. Changes in rainfall	Considered as a problem by a minority of landowners
6. Water scarcity all year round	
7. Water scarcity during winter	

Table 4- Land and water problems as perceived by local landowners

These results are pretty much in line with what emerged during interviews, discussions and informal talks with landowners. Problems such as high runoff –with consequent loss of water during good rains- and erosion on the water bodies are found everywhere in the valley, and are considered as major problems by landowners.

The recognition of land and water problems is the first step towards the willingness to restore the land, and indeed all landowners but one are willing to restore the tributary streams and the main river bed. Quite interestingly, only one respondent wants to restore if he is given incentives, while the others are willing to restore at no conditions, and some of them are already taking rehabilitation measures on their land. Landowners were also presented with a list of possible effects of restoration measures, including both positive and negative effects at the same time, such as for example less erosion and loss of crops. None of the respondents indicated negative effects of restoration, while all positive impacts, as listed below, were selected by a large majority:

- Less erosion
- Increase of groundwater availability over the year
- Less runoff and more water kept in the 'kloof
- More silt would deposit on the veld
- Improvement of landscape and hence benefit for tourism in the valley.

These results imply that the functioning of the catchment, as well as the watershed services provided by it, are well understood by farmers, as well as the consequences of watershed degradation and the need for restoration.

"I changed my mind in the last 10 years, erosion is done by farmers for lack of knowledge, which leads to overgrazing"
A landowner

From this rapid assessment, it appears that river system restoration is quite welcome in the valley. Landowners showed a high awareness of the needs and reasons for restoration, as well as the beneficial effects that the measures would have for the catchment and for their own farming activities too. It also appears that the awareness and the general interest towards the natural environment and its restoration has improved over the years, as proved by the enthusiastic participation of some landowners to the field trip; moreover, a landowner affirmed that *"He changed his mind*

in the last 10 years, erosion is done by farmers for lack of knowledge, which leads to overgrazing" .

The picture emerging from this rapid survey is pretty encouraging, and it can be explained by various factors. First of all, it was previously shown that the economy of the valley turns around agriculture, and therefore it heavily depends on water supply and watershed services at large. In fact, many regulatory services have an influence not only on water availability, but they also allow the sound functioning of the system sustaining agriculture, tourism and human life in general. Therefore, the high level of interest, care and concern towards the health of the system and its restoration shown by farmers is not surprising.

However, this explanation alone does not give the complete picture, since it would put landowners' awareness and willingness to restore under a mere utilitarian perspective, and it would overlook other important altruistic motivations. During interviews and informal chats, in fact, it turned out that landowners are not willing to restore only out of economic interest, but also because of a deep rooted love for the valley they are living in and for the land they are farming. All landowners stated, in one way or the other that they could not live anywhere else. In addition, for all of them farming is not just a way like another of earning an income, but it is their passion and they will never quit it completely. For example, one landowner said clearly that, although tourism is his main activity and farming last year was an economic loss, it is still is favourite activity and he will keep on doing it.

"You just have to keep in mind that you don't actually own the land, you're just passing by slowly through it"
A landowner

While trying to understand the motivations behind the willingness to restore, one has to consider it also on a chronological perspective. An external observer, who started to work on the Water for Food and Ecosystems program in the Western Baviaanskloof four years ago, reported that a big mind shift has happened since then; especially the "actual" farmers have switched from a total denial of land and water problems and need for restoration to a very open attitude and a high participation in activities such as the field trip or other meetings. This change was confirmed by other observers as well. This has been possible because external researchers and implementation agents have also changed their attitude towards farmers. According to the author, most of the responsibility goes to the PRESENCE network and to its participatory approach: for the first time, research has been conducted listening to local landowners and communities, bringing experts to the 'kloof and facilitating communication between them. For example, many landowners expressed their full appreciation and support for the Field Trip, saying that it was the first time that they were involved in such an initiative, and their first chance to talk and share opinions and ideas with researchers and implementers. Indeed, during interviews and informal chats, farmers repeatedly stressed the fact that they want to be involved and consulted in the restoration process.

In addition, landowners are willing to collaborate and dedicate time to researchers, as they proved by being extremely available and helpful during the interviews, but after all the research projects conducted in the area they would like to see practical results such as implementation efforts. As a landowner stated clearly during an interview, *"Nothing happened in the past, only a lot of research and talking but no benefits came back. A stone put in a little stream against erosion would already be a sign for people here!"*
Finally the situation is changing and restoration measures will be implemented, and this is really fuelling landowners' interest and enthusiasm towards restoration.

8. Conclusions & Recommendations

From the outcomes of this research it appears clearly that the loss of watershed services provided by the Western Baviaanskloof, as well as the economic costs involved, are widely recognized by all stakeholders and experts consulted during the study. On the other hand, the current degradation processes can still be reversed if actions are taken in the near future, and the rehabilitation of the catchment would undoubtedly bring high economic benefits for several land and water users on site and downstream, as well as huge environmental benefits.

The present situation is optimal for the The BICR Implementation Programme, in which various research institutes and implementing agencies committed to engage in restoration, because it will fit perfectly with the current Baviaanskloof context. The creation of the Baviaanskloof Mega-reserve, and its status of World Heritage Site, calls for sound nature conservation and rehabilitation practices seeking to preserve the unique beauty of the valley. This represents a great opportunity for tourism development in the valley, and hence an incentive for private landowners to engage in sustainable land and water management on their land. Landowners understand the huge potential of tourism and are planning to expand this business at the expense of farming, and are extremely positive towards the rehabilitation of the river system. On the downstream side, there is a high need for additional water supply and a sounder watershed management upstream. Therefore, the conditions are extremely favourable and represent a unique opportunity for the implementation of rehabilitation measures that must not be missed.

Restoration is also an opportunity for job creation in the valley, especially in light of the future expansion of the tourism sector, which is likely to employ less people than the current farming activities. According to the plans, the labour force needed for rehabilitation interventions will be drawn from the local communities and, if labour-intensive techniques are used, the project will be able to create many new jobs and give an additional contribution to the economy of the Western Baviaanskloof.

On the other hand, rehabilitation measures might imply trade-offs and, ultimately, costs for landowners, and this is a challenge to restoration that can be successfully overcome through the realization of a Payment for Watershed Services scheme. The balance between costs and benefits at the farm level must be carefully evaluated in order to understand if and where incentives are needed. Moreover, the scheme must be designed according to the local socio-economic patterns, needs and priorities: this also mean that financial incentives may not be the most viable options, and those incentives such as service provision (e.g. waste management service, free technical consulting, tourism marketing) may best suit the needs of local landowners.

Besides the costs of restoration, risk perception is another aspect that is still poorly understood and needs further investigation. In fact, farmers recognize the adverse effects that control measures on water bodies have on the functioning of the system, but at the same time some of them state clearly that these measures are very beneficial in protecting their land against floods. On the other hand, floods are not considered to be one of the major problems in the valley, due to their sporadic occurrence and to the limited extent of damages. Thus landowners' risk perception appears to be in contrast with the actual risks and costs involved in current management as compared to risks and costs involved in

restoration. These two sides of the coin must be quantified and compared, because a successful incentive scheme must be designed in order to address the risk.

A crucial aspect of the current favourable situation towards river system restoration is the good communication established between local landowners, researchers and implementing agents, and especially the involvement of local farmers. This interactive relationship has made the setting-up of the The BICR implementation agenda possible, and it must be carefully cultivated along the whole implementation effort to guarantee its success. In particular, it must be kept in mind that landowners are an integrant part of the restoration process, and their role goes well beyond giving the permission to work on their land: they know the area better than anyone else, and thus they are a valuable source of knowledge and information.
There is still a group of stakeholders, however, which has not be properly included in the process, namely the local coloured communities. Besides their future involvement as labourers in the implementation action, they could also provide important local and traditional knowledge and should also be consulted and, if applicable, included in the Payment for Watershed Services scheme.

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