SOCIAL OPTIMALITY IN LAND USE: A COMPARATIVE STUDY OF CONSERVATION AND AGRICULTURE IN THE SUNDAYS RIVER VALLEY, EASTERN CAPE, SOUTH AFRICA

MCom Dissertation,
Economics
University of Cape Town

Submitted by:
Susan Snyman
SNYSUS002
October 2009

ABSTRACT

This dissertation explores the direct and indirect costs of expanding the land area set aside for conservation in the Sundays River Valley of the Eastern Cape. While many parks have been located in zones of low commercial value, either deliberately, to cut opportunity cost of conservation, or through historic accident, the Greater Addo Elephant National Park (GAENP) is looking to expand in an area with high agricultural potential. It is also an area with high levels of unemployment, extensive land degradation, and unique biological diversity. These factors make achieving a socially optimal use of land particularly pertinent. Data was collected from the Greater Addo Elephant National Park (GAENP), citrus farms and restoration projects in the area. The thesis tests the hypothesis that a combination of carbon farming (restoration) and eco-tourism provides an ecologically superior land use option, and estimates its opportunity costs in terms of the income, employment and multiplier effects of agriculture foregone.

TABLE OF CONTENTS

Acknowledgements

Thank you to my family and friends for their constant support and encouragement, particularly my Mom, Nicola and Chris.

This dissertation would not have been possible without the financial support given to me by the Environment for Development (EfD) initiative (www.efdinitiative.org) through the Environmental Policy Research Unit (EPRU) at the University of Cape Town. Thanks to Tony Leiman, Edwin Muchapondwa and Thomas Sterner for facilitating this funding and for their constant encouragement and support.

Thanks to all at SANParks (especially Lucius Moolman and John Adendorff), the Sundays River Citrus Corporation (SRCC) and Mike Powell from the Subtropical Thicket Restoration Project for sharing all the required data, as well as comments, and valuable information with me.

Very special thanks to Tony Leiman, my supervisor, for his tireless enthusiasm, guidance and motivational support throughout this dissertation, despite us being on different continents for a large part of the process.

List of acronyms

AD – Avoided Deforestation
AENP – Addo Elephant National Park
CBD – Convention on Biological Diversity
CCD – Convention to Combat Desertification
CDM – Clean Development Mechanism
CER – Certified Emission Reduction
EIA – Environmental Impact Assessment
EU ETS – European Union Emissions Trading Scheme
GAENP – Greater Addo Elephant National Park
GEF – Global Environment Facility
GGP – Gross Geographic Product
GHG – Greenhouse Gas
JI – Joint Implementation
MPA – Marine Protected Area
NB – Net Benefit
NEMA – National Environmental Management Act
NR – Net Revenue
OC – Opportunity Cost
PGR – Private Game Reserve
SANParks – South African National Parks
SDF – Spatial Development Framework
SEA – Strategic Environmental Assessment
SOM - Soil Organic Matter
SRCC – Sundays River Citrus Company
SRV – Sundays River Valley
STEP – Subtropical Thicket Ecosystem Planning Project
STRP – Subtropical Thicket Restoration Project
TEV – Total Economic Value
TGI – Total Gross Income
UNFCCC United Nations Framework Convention on Climate Change
WTCC World Travel and Tourism Council

List of Figures

List of Graphs

List of Tables

1. GENERAL OVERVIEW OF THE STUDY

1.1 Introduction

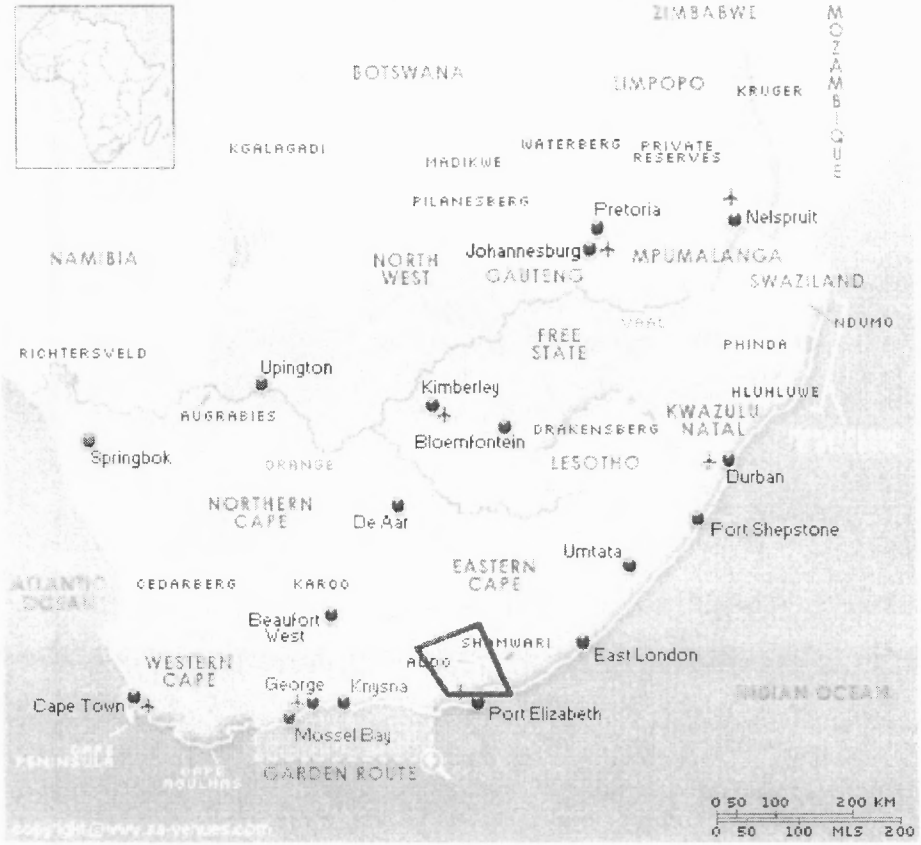
This thesis will address a present problem: the expansion of the Greater Addo Elephant National Park (GAENP) in the Eastern Cape province of South Africa. The problem is clear: where many parks have been deliberately located in zones of low commercial value either because this kept the opportunity cost of conservation down, or because these were areas left unexploited through historic accident, the GAENP is an area with high agricultural potential. Tourism is however a growing sector with high income elasticity, while agriculture's potential for growth may be limited. This thesis does not pretend to make a categorical statement as to the present and future opportunity costs of conservation, but it does try to offer insights.

The combination of socio-economic and environmental issues makes the topic of land use, particularly in South Africa, a complicated, interesting and important one. Natural resources provide numerous opportunities for economic empowerment through sustained agriculture, ecotourism, and indigenous plant use, as well as through hunting and game farming, which are both very important economic activities in the Eastern Cape (Pierce, 2003:3). Sustainable use of natural resources is essential to ensure their survival and continued provision of services now and for future generations.

The problems of declining biodiversity, im mediate human needs and declining ecosystem resilience apply to South Africa in general. They are particularly relevant to the Eastern Cape Province with its low per capita income, large areas of degraded land, slow economic growth, high rates of population growth and widespread unemployment. Figure 1 shows the location of the study area in relation to the other provinces in South Africa.

Any land use, including pure preservation, presents trade-offs between environmental impacts and economic development (www.environment.gov.za). There are a number of different factors that have played a role in the development of South African land use patterns. The most important of these are rainfall distribution, mineral deposits, harbours and other transport routes (www.environment.gov.za).

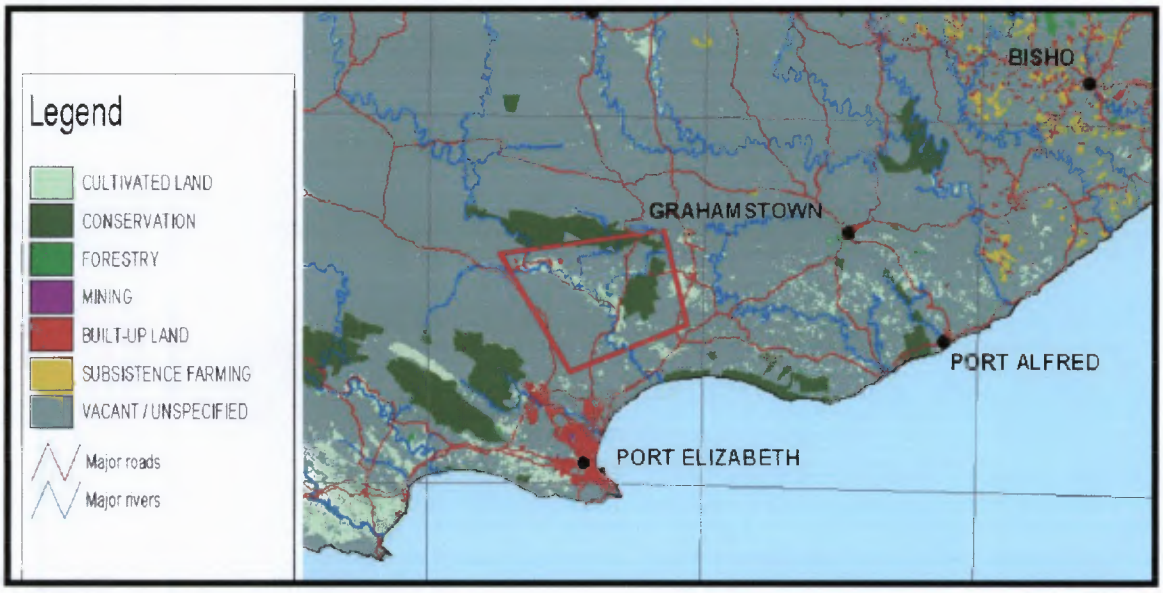
Figure 1: Map of South Africa showing location of the study area



Source: http://www.sa-venues.com/maps/south-africa-provinces.htm

The Sundays River Valley (SRV) in the Eastern Cape (the area of study) has been extensively developed. The former floodplains are fertile and provide both land for cultivation and water for irrigation. This development can be seen clearly in Figure 2 below. The red box outlines the Sundays River Valley (SRV): the extent of cultivation close to the river's banks can be clearly seen. The conservation areas illustrated in dark green are largely parts of the Greater Addo Elephant National Park (GAENP).

Figure 2: Land use in a section of the Eastern Cape, with the Sundays River Valley demarcated



Source: adapted from www.environment.gov.za

These pressures lessen with distance from the rivers in the valley. In consequence, despite this heavy cultivation, the SRV still contains roughly 815 000 hectares of the indigenous vegetation (Xeric Succulent Thicket). 25% of the thicket is intact, 27% is moderately degraded and 48% is severely degraded (Turpie, 2003). At a provincial level there are large areas of such degraded thicket in the former homelands (Transkei and Ciskei) and much of the intact thicket is still outside of formally conserved areas. From a conservation perspective this is an important point to note, further degradation could impose economic and financial costs: steep slopes, friable soils and uneven rainfall mean that degradation brings the possibility of irreversible declines in productivity.

A local study has made the link clearly: degradation results in stronger water runoff and increased rates of erosion. Natural resources are lost, ecosystems do not function well and ecosystem services are diminished or completely destroyed (Pierce, 2003). This imposes economic costs, decreasing farm productivity, diminishing potential for ecotourism, imposing restoration costs, raising sediment loads in rivers and reducing opportunities for carbon storage (Pierce, 2003:6.2).

1.2 Rationale of the Study

The thicket biome is confined to South Africa and it is stated to have some of the highest levels of endemism globally (Vidaeus, 2002:8). Biodiversity of global significance is only one aspect though; it also provides the resource base for a wide range of economic activities, including mohair, ecotourism, hunting and horticulture which employ a large number of people (Sims-Castley, 2002).

Conservation of this biome is thus of both economic and ecological importance. Despite this recognition, the Spatial Development Framework (SDF) compiled by the Sundays River Municipality (2005) intimates that the Sundays River Valley is the most affected area in the Municipality with respect to vegetation impact due to intensive agricultural farming. Most of this agricultural farming is in the form of citrus but there are also lucerne, vegetable and stock farms in the area. This issue is not just one of competing land uses. Stock and game farmers use thicket as a resource but can benefit from a measure of degradation as this opens up the vegetation for browsing and grazing, reduces the tick load, and increases visibility. Clearly there are certain trade-offs between the economic and ecological objectives of landowners.

In any land-use study that involves opportunity costs an issue is spatial heterogeneity. This 'patchiness of nature' needs to be taken into account, particularly in the areas of biodiversity conservation, parks management and the protection of genetic diversity (Sterner, 2003). Conservation value and agricultural potential are not always parallel. For each alternative use there may be certain land that is better suited. For example certain land may be inferior for agriculture, for example, slope may be too steep, rocky soil, poor drainage, inaccessibility, etc. (Sterner, 2003), but it may offer a large amount of biological diversity or be valuable from a tourism perspective.

Poverty has added to the range of economic and ecological issues involved in conservation. The Eastern Cape provincial Gross Geographic Product (GGP) per capita is substantially less than the national average (Eastern Cape Business Information Service, 2001 in Eastern Cape State of the Environment Report (2004)). It is the poorest province in terms of average monthly expenditure (Statistics South Africa, 2000, in the Eastern Cape State of the Environment Report (2004)), with nearly 57% of households and 64% of individuals in the Eastern Cape living in poverty (GAENP Strategic Environmental Assessment, 2001). On the environmental side large areas of the Eastern Cape are severely degraded with overgrazing by domestic livestock, in communal areas and on private farms and overstocking of game on private reserves is cited as the main reason for this (Pierce, 2003). In the Sundays River Valley (SRV) degradation has been caused mostly by wheat and goat farming.

A further dimension was added to the conservationists' problems by the introduction of 'exotic' or extra-limital species of game in the Eastern Cape. These compete with local species and have, to a certain extent, added to the process of degradation. While these exotic species may be attractive in terms of eco-tourism and trophy hunting (Cousins et al, 2008) they can result in a tradeoff between ecological integrity and eco-tourism (discussed further in Chapter 3).

The trade-off between game and citrus is also important. Although much research has been done in comparing game farming with conventional stock farming (Smith & Wilson, 2002; Langholz & Kerley, 2006), there have been few comparisons between it and citrus farming. This is relevant because although most of the expansion of the GAENP to-date has involved wheat, dairy and goat farms, further expansion may involve the large area of citrus surrounding an extensive section of the Park in the west. It is also of importance because of the economic and financial contribution of the citrus industry to the local economy of the Sundays River Valley and the regional economy of the Eastern Cape.

One's first instinct in addressing such an issue is to look to the existing linkages between various sectors and the broader economy. The basic tools for this are Input/Output (I/O) tables and Social Accounting Matrices (SAMs) and these certainly do exist. However, a deeper study of the I/O, supply and use, and SAM tables available showed that these could offer little in the case of changing land use in a section of the Eastern Cape. A more narrowly focused approach was found to be necessary. This would need on-site investigation and interviews with participants in the various sectors involved, and some indication of the broader

economic impacts they would have would then be found by direct observation. This was the route that was followed in this thesis.

The issue of expanding the GAENP is a real policy issue and one that faces real economic constraints. Merely expanding the park is not the issue: this is an extremely heterogenous area and this heterogeneity is the root of much of its biodiversity and also many of the threats to that biodiversity (for example, where habitat loss is associated with specific soil and climate combinations that especially suit dairy or citrus).

The rationale of the study was to look at the economics of the choices involved in the allocation of land to conservation or other purposes such as agriculture. Opportunity cost is clearly a key issue, but ideally this should be seen in its broadest sense: it is not just about profit foregone. It is about the impact of the choice on the economy as a whole.

1.3 Problem Statement

A full assessment of all the alternative land uses in the SRV is beyond the scope of this thesis. The two alternatives that will be looked at are: conservation, in the form of the Greater Addo Elephant National Park (GAENP) and citrus farming. The possibility of thicket restoration for carbon credits is assessed in isolation as the incremental value it offers would appear as a windfall when farmland is restored to conservation. Conservation and citrus farming are currently the most common

land uses in the SRV. Both are expanding yearly, and therefore, competing for land.

Land restoration has been included as it is something very new in the area and is gaining popularity. Thicket restoration can be combined with the other two uses and need not be treated as a unique land use. As evidence of this, the GAENP has included a thicket restoration project on one of its sections in Darlington (pers comm. J. Adendorff, Conservation Manager, SANParks, 2008). Restoration of thicket and the associated carbon capture is certainly an added benefit of conservation as a land use and should therefore be treated as such.

The problem statement that arises is: what is the socially optimal conservation outcome and from there, what is the socially optimal mix of land use in the Sundays River Valley (SRV)? This dissertation looks at the opportunity costs of changing the land mix, where opportunity cost is taken in a broad economic and social sense that encompasses things like jobs, income, foreign exchange, economic linkages and the global carbon benefits.

1.4 Data Collection

Primary data was collected from the GAENP, the Sundays River Citrus Company (SRCC), private citrus farms, SRV municipality, Subtropical Thicket Restoration project and from community members employed in businesses in and around the Park. The aim was to value the land under each use and to assess the socio-

economic and environmental impact of each use. Analysis of the data included calculation of establishment, operating and employment costs per hectare, as well as income and employment benefits. Secondary data was collected from Park reports, financial statements and secondary sources drawn from the extensive literature on land use, biodiversity and conservation[1]

1.5 Assumptions and Limitations of the Study

This study was written specifically as a Masters dissertation. This meant an administrative time constraint. This was particularly felt in the work on the consumption diaries. It restricted both the number of subjects in the case study and the time frame for the diary-keeping. It should be stressed that the consumption diary exercise was not intended as a statistical survey but as a base of information, grounded in theory and personal observation and interaction with the subjects, which can be expanded in the future.

Space and time constraints also restricted the range of land uses investigated. The range of climatic conditions in the SRV makes numerous land uses possible. This dissertation treats only two main uses, with a third use included as an option on its own and also as a further benefit of one of the other discussed uses. It was beyond the scope of the paper to analyze all the possible land use options. The SRV has relatively specific characteristics with respect to climate, soils,

1. The author worked in the study area in a Private lodge for two and a half years and then as a researcher within the Park and surrounds for a year and a half. This yielded primary knowledge of conservation, the communities and tourism in the area and provided a useful foundation for the research and the interviews, giving a qualitative background to the analysis of the quantitative data and information

topography, etc. resulting in the arguments, results and discussion that emerge in this dissertation being tailored to such areas. A number of the arguments relating to agriculture and conservation can however be generally applied in other situations, as can the arguments relating to land restoration and the possibility of earning a passive income.

1.6 Literature Review

The literature relating to the topics under discussion is spread through this dissertation rather than being relegated to a separate literature review section. Use was made of both published and unpublished sources. Unpublished sources included GAENP reports, accounting reports from citrus farmers, and other reports such as the Strategic Environmental Assessments (SEAs). There is considerable literature on the issue of land use, biodiversity, conservation and more recently on carbon trading. It is hoped that this study will add value to it by bringing together three issues that have hitherto been discussed separately.

1.7 Structure of the Dissertation

Chapter 1 is a general overview of the study. Chapter 2 looks at the background of the area of study – the Sundays River Valley in the Eastern Cape. It includes biodiversity and its implications for land use, the impact of degradation and a brief description of the Subtropical Thicket Ecosystem Planning (STEP) project. Chapter 3 describes conservation as a land use, with particular reference to the

Greater Addo Elephant National Park, its expansion, operating costs and employment effects. The next chapter (Chapter 4) looks at land restoration and the associated carbon capture as a unique land use as well as being an added benefit of conservation as a land use. Restoration projects are not carried out solely to gain carbon credits. The benefits of restoring the land extend to greater tourism potential and more productive grazing areas for stock and game. Chapter 5 looks at citrus farming as a land use and its economic, financial and environmental implications. After thorough analysis of each of the land uses Chapter 6 summarizes the results and looks at the comparison between the alternatives discussed from an economic, environmental and social perspective. Chapter 7 offers a discussion of some of the literature and its application to the land use question in the Sundays River Valley. Chapter 8 concludes the study and offers suggestions for future research in the Sundays River Valley and on the topic of socially optimal land use.

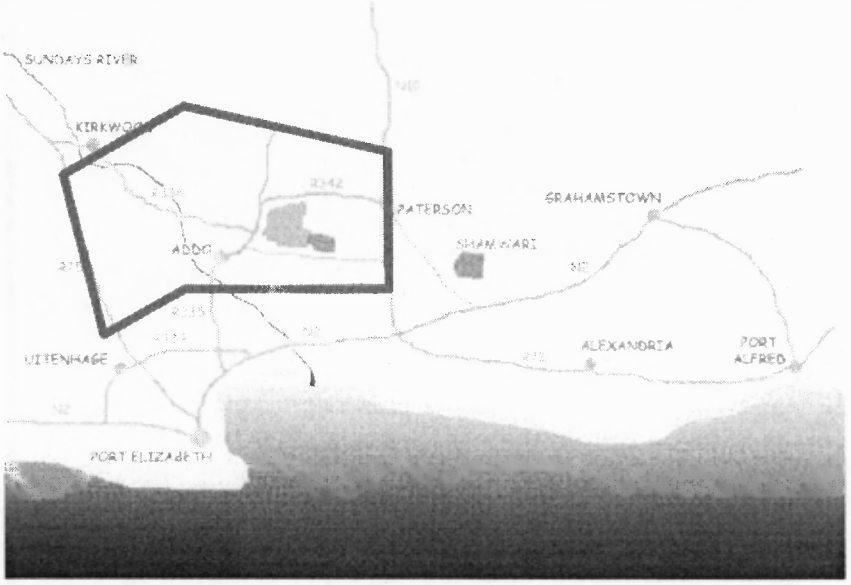
2. BACKGROUND

2.1 The Area of Study

2.1.1 The Sundays River Valley (SRV) in the Eastern Cape, South Africa

The paper will focus on the Sundays River Valley (SRV) an area in the Cacadu District of the Eastern Cape. The Sundays River Valley stretches from the town of Addo in the south to Kirkwood in the north (see Figure 3). The valley's elevation averages 85 metres above sea-level and has an average annual rainfall of 395mm. It falls into a climatic transition zone and receives rain all year round, with peaks in autumn and spring. The average maximum temperature is 29.6°C, while the average minimum is 5.7°C, with cold, frosty mornings occurring during the winter months from May to August and temperatures sometimes reaching 40°C in the summer months from September to April.

Figure 3: Map showing the Sundays River Valley (SRV)



Source: www.sundaysrivervalley.com

The Sundays River Valley produces large quantities of Navel and Valencia oranges, lemons and loose skinned citrus fruit. Sheep, cattle and game are also farmed. A large part of the Greater Addo Elephant National Park (GAENP) is also situated in the SRV.

2.1.2 Socio-Economic Overview of the SRV

The Valley is not heavily populated. Table 1 gives a breakdown of the population of the Sundays River Valley. Data from the 2001 Census is used as more recent statistics are patchy at best.

Table 1: Population figures for the Sundays River Valley from the 2001 Census

African/ Black		Coloured		Indian/ Asian		White		Total
Male	Female	Male	Female	Male	Female	Male	Female	
14 440	15 705	3 590	3 894	5	3	1 075	1 151	**39 863**

Source: www.statssa.gov.za/census01/html/default.asp

As can be seen from Table 1 African women constitute a large percentage of the population in the Sundays River Valley (39.3%). This is of interest in the discussion of alternative land uses as it was found that farming in the Eastern Cape (Farm Worker Survey in the SEA, 2001, Volume 1) employed a larger percentage of African males leaving the females unemployed or employed on a casual basis. Connor & Zimmerman (2008) found that businesses around the AENP employ a total of 557 people, 52.4% males and 47.6% females. The tourism industry employs a large number of women, thereby assisting a previously otherwise disadvantaged group and training them for future employment (Connor &

Zimmerman, 2008). Citrus farming (as opposed to goat and dairy farming, which were focused on in the 2001 Farm Worker Survey) also employs a large number of women, albeit as seasonal pickers and packers, and contributes to local equity in terms of gender employment.

The average population growth in the SRV area is estimated at roughly 2.3% per year, which will result in a population of about 63 220 by 2010 (SRV Spatial Development Framework, 2005). With a household size of approximately 5.1 people, this would mean an additional 2512 households (SRV Spatial Development Framework, 2005). With increasing pressure on land, it becomes very important to ensure that land use combines economic benefits and environmental sustainability. In a country such as South Africa, with its history of marked inequality, poverty and unemployment, it is also important to weigh-up the alternative land uses in terms of employment and job creation. As can be seen from Table 2, the average unemployment rate in the Sundays River Valley is 20.11%.

Table 2: Official employment status for the Sundays River Municipality, Census 2001

	African/Black		Coloured		Indian/Asian		White		
	Male	Female	Male	Female	Male	Female	Male	Female	Total
Employed	4335	2924	1015	596	3	0	553	349	**9775**
Unemployed	1836	2555	410	470	0	0	20	16	**5307**
Not economically active	3298	5166	798	1496	3	3	158	389	**11311**
Totals	9469	10645	2223	2562	6	3	731	754	**26393**
% Unemployed	19.39%	24.00%	18.44%	18.35%	0.00%	0.00%	2.74%	2.12%	**20.11%**

Source: www.statssa.gov.za/census01/html/default.asp

The major economic activities of the area are summarised in Table 3.

Table 3: Summary of the major economic activities of the area

	No. Employed	% of Total
Agriculture; hunting; forestry and fishing	4663	47.72%
Mining and quarrying	14	0.14%
Manufacturing	478	4.89%
Electricity; gas and water supply	49	0.50%
Construction	206	2.11%
Wholesale and retail trade; repairs, hotels and restaurants	721	7.38%
Transport, storage and communication	150	1.54%
Financial intermediation; insurance; real estate and business services	225	2.3%
Community; social and personal services	1031	10.55%
Private households	908	9.29%
Undetermined	1325	13.56%
Total	**9770**	

Universe: All employed persons aged 15 to 65 years.
Source: Census, 2001, www.statssa.gov.za

Agriculture and hunting are the biggest single sources of employment (47.7%). Note that there is neither commercial forestry nor fishing in the SRV. The economically active population in the SRV increased by approximately 17% from 1990 to 2000. Informal employment increased by approximately 320 % over the ten years 1994-2004. This reflects the national trend, over that time period, towards self and informal employment. Although the informal employment, over the same period, increased from 694 to 2057, formal employment decreased by 1527 job opportunities. (SRV, Spatial Development Framework, 2005).

Table 4: Monthly income for all persons in Sundays River Valley, Census 2001

	African/Black		Coloured		Indian/Asian		White		Total
	Male	Female	Male	Female	Male	Female	Male	Female	
No income	8389	10153	2084	2670	6	0	364	572	**24238**
R 1 - R 400	1366	1756	253	285	3	0	20	30	3713
R 401 - R 800	3359	3077	849	765	0	0	65	145	8260
R 801 - R 1600	992	465	252	109	0	0	68	93	1979
R 1601 - R 3200	185	121	101	38	0	0	131	125	701
R 3201 - R 6400	90	78	36	17	0	3	209	111	544
R 6401 - R 12800	50	40	14	4	0	0	143	45	296
R 12801 - R 25600	0	3	0	0	0	0	33	10	46
R 25601 - R 51200	5	3	3	0	0	0	17	12	40
R 51201 - R 102400	3	0	0	0	0	0	16	0	19
R 102401 - R 204800	3	10	0	0	0	0	7	0	20
R 204801 or more	0	0	0	0	0	0	3	4	7
Total	**14442**	**15706**	**3592**	**3888**	**9**	**3**	**1076**	**1147**	**39863**

Source: www.statssa.gov.za/census01/html/default.asp

Table 4 shows the large percentage (60.8%) of the population in the Sundays River Valley that ostensibly earns no income. Although informal employment plays a growing role it is important that land use options in the SRV encourage employment that is long-term and sustainable. Incomes are clearly skewed: only 23.8% of the population in the SRV earn a salary of more than R1600 a month, resulting in a low average wage rate and a small proportion of people earning above it. In a province that is as poor as the Eastern Cape, it is important to consider land use options that could increase this average wage rate. Due to the low percentage of income-earners, there tends to be a high number of dependents, which is risky, should anything happen to the income-earner. The Consumption Diary case study in Appendix 5 and described briefly in Chapter 3 gives evidence

of this high level of dependency. The next section describes the environment of the SRV, illustrating current land use patterns, soils and rainfall.

2.1.3 The Environment of the SRV

The source of the Sundays River lies in the Compassberg Mountains (the highest mountains in the former Cape Province) near Nieu-Bethesda. The river flows south-southeast past Graaff-Reinet. It then cuts through the Zuurberg Mountains, passes Kirkwood and Addo and then empties into the Indian Ocean at Algoa Bay near the city of Port Elizabeth. The agricultural heart of the valley is based on the Fish River-Sundays River Canal Scheme, a canal and tunnel system which supplies water from the Orange River to the Great Fish River Valley and to the Sundays River Valley, supplementing the existing water supply of the Eastern Cape. Since 1992 the water from the Sundays River Valley has also supplied Port Elizabeth. It was this water scheme and the building of Lake Mentz (now Darlington Dam) that allowed for the expansion of the citrus industry in the SRV.

The climate, varying soil composition, and biological diversity of the Sundays River Valley make a number of land uses viable. Some of these uses are economically viable, others environmentally sustainable and some both. When discussing the expansion of the formal conservation area in the Addo Park, an issue of primary concern is that much farmland in the Eastern Cape has already been converted from conventional livestock and crop cultivation to game farming or conservation (Smith & Wilson, 2002). These conversions clearly involved opportunity costs, however, most were prompted by economic issues rather than rising environmental

awareness. Farmers noted reduced forage availability and an increase in variability in forage production made their stock farming less profitable and sustainable (Lechmere-Oertel, 2003). Increasing input costs in the farming sector also made it less profitable and further encouraged the shift to game farming. These factors, combined with declines in government subsidies to the agricultural sector (Vidaeus, 2002) and changing market conditions resulted in many farmers converting from traditional grazing practices which impact negatively on the environment to more biodiversity compatible uses, including hunting and ecotourism (Vidaeus, 2002). The expansion of the Greater Addo Elephant National Park was therefore accompanied by the establishment of a large number of private game reserves in the areas surrounding the Park. An important question that arises, and will be discussed later in the dissertation, is whether or not it matters if the conserved areas are privately- or state-owned and operated?

As already mentioned, the area is remarkable for its heterogeneity of climate and soils. It is a truism that conversion takes place first on land with the lowest opportunity costs but that these costs are likely to rise as the extent of conversion increases. This study will attempt to assess the broader economic merits of local conversions to date and of further conversions at the current margin. An attempt will also be made to determine the socially optimal conservation outcome.

The diagrams below show the land use patterns, average annual rainfall and the soil type for the Eastern Cape, with the Sundays River Valley outlined by the black border.

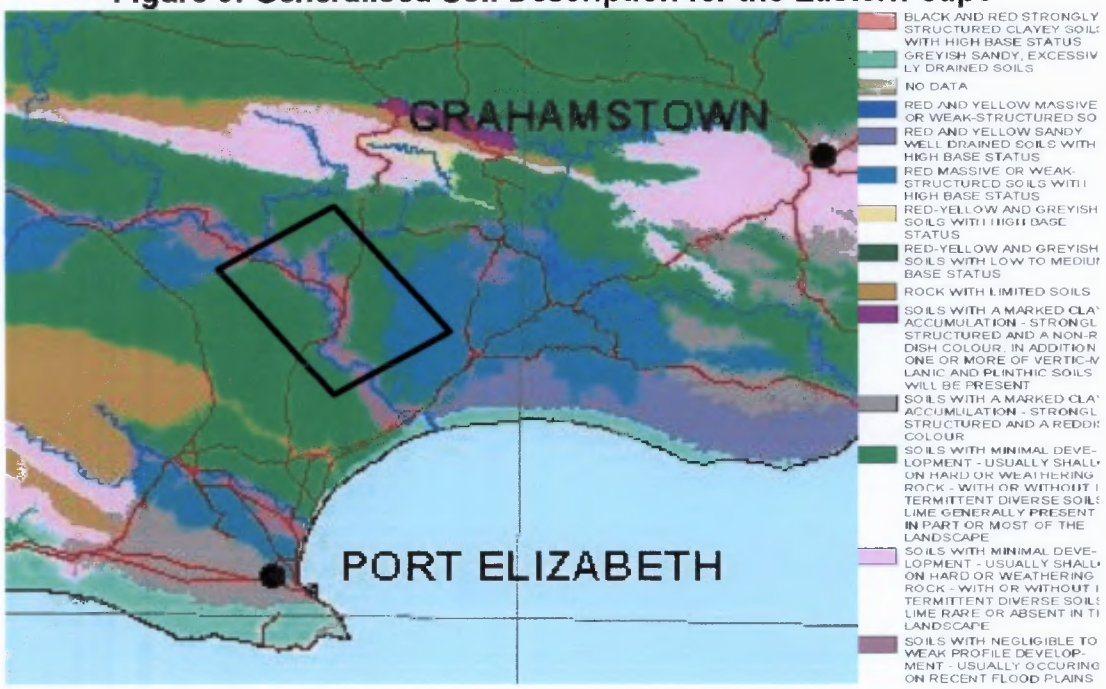
Figure 4: Land use patterns in the Eastern Cape

Source: www.environment.gov.za

Figure 5: Mean Annual Precipitation for the Eastern Cape

Source: www.environment.gov.za

Figure 6: Generalised Soil Description for the Eastern Cape



Source: www.environment.gov.za

In Figure 4 it can be seen that the predominant land uses in the study area are cultivated lands and conservation, with citrus farming forming the bulk of the cultivated lands. The bulk of the study area receives somewhere between 379 and 574mm of rainfall per annum (See Figure 5). Soils in the SRV are typically shallow and along the Sundays River itself the soils are typical of old floodplains, with a negligible to weak development profile. The following section describes the STEP project which sets out guidelines for landowners and government decision-makers with respect to land uses involving areas of Subtropical Thicket and is therefore relevant to the SRV and the land uses discussed in this dissertation.

2.2 The Subtropical Thicket Ecosystem Planning (STEP) Project

The National Environmental Management Act 107 of 1998 (NEMA) specified sustainable development as a goal for South Africa (Pierce, 2003). Such development requires the integration of social, economic and environmental factors into planning, implementation and decision-making (Pierce, 2003). This is a feature of the STEP project: a process whose goal is to integrate the natural environment into land use decisions at the municipal level and move towards sustainable development (Pierce, 2003) in the Eastern Cape Province.

The project's aim was to assess the biodiversity of the south-eastern Cape region, with a special emphasis on the unique, indigenous vegetation type known as thicket, and to integrate this information into spatial planning and land use management (Pierce, 2003). The project also measured how much of the thicket has been destroyed or damaged by human activities and tried to determine the degree by which the biodiversity in the different areas was endangered (Spatial Development Framework, 2005).

Subtropical Thicket is renowned for its diversity and high levels of endemism. In the STEP project area there are 1588 plant species that are uniquely associated with the subtropical thicket, 322 (20%) of which are endemic (Pierce, 2003).

Subtropical thicket is typically associated with nutrient-rich soils (Pierce, 2003). This makes its soils attractive for agriculture. The nutrient-rich soil is a consequence of organic material rather than minerals, so the removal of the thicket

for agriculture results in nutrient loss and subsequently less naturally productive soils. Encouraging farmers to maintain areas of natural vegetation will not only assist in preserving biological diversity, but it could also play a role in increasing the productivity of the soil. This is especially true of steeply sloping areas where the natural vegetation slows water runoff and reduces erosion.

The STEP project has provided a detailed summary of the vegetation of the area and has provided recommendations for the future use/non-use of the land. Projects such as STEP provide guidelines for municipalities and local governments seeking to make more informed land use decisions. However, these are based predominantly on ecological considerations. Since sustainability has a socio-economic dimension it would be useful to have similar socio-economic guidelines that would detail the externalities of various land use options and their associated use and non-use benefits (to be discussed in the following section, 2.3).

2.3 Valuing the Environment

Total economic value (TEV) has three basic components: direct use values, indirect use values and non-use values. These are extensively documented in basic texts on environmental economics, but this chapter follows the approach taken in an earlier study (Sims-Castley, 2002). In the case of the thicket biome the direct use values would include benefits that enter directly into the economy, either by direct consumption (e.g. as natural browse for stock), or by non-consumptive use of its services for recreation, tourism and research. Indirect use values would

include the ecological functions of the thicket biome which indirectly support economic activity and human welfare. Non-use values (or passive values) include, option-, inherent- (or existence) and bequest values. Option value refers to people's willingness to pay to keep the option of having the thicket available for future use. Inherent value is associated with knowing that the biome exists even if one has no intention of ever using it. Bequest value relates to the possibility of future generations making use of the biome (Sims-Castley, 2002). All these values are important when assessing land use options, though they are often difficult to measure. According to Geach (1997), the biodiversity of the GAENP has a major role to play in its total economic value (TEV). As a source of genetic material it has existence and option value, as well as contributing to the direct use value of the area for recreation, scientific research, and education (Geach, 1997).

Chapter 3 includes more information on the economics of conservation and the economic value of a National Park.

2.4 Biodiversity, Degradation and Desertification

Biodiversity loss, land degradation and desertification often occur together. The SRV includes areas of low and highly variable rainfall, fragile soils, steep slopes and extensive land conversion, which puts it under threat on all three counts. A general overview of biodiversity and the threats facing it, as well as issues of land degradation, the associated impacts and the impacts of desertification follow in this section.

The main threats to biodiversity in South Africa have been identified as:

- Rates of land transformation (urban development, cultivation, plantation, mining, dams and roads)
- Alien plant invasion
- Environmental pollution
- Climate change, and
- Land degradation

(www.sanbi.org/frames/researchfram.htm)

All of these threats are evident in the Eastern Cape and therefore need to be addressed and taken into consideration in future land use decisions.

Biodiversity certainly makes an economic contribution to human societies, as it provides or enhances ecosystem productivity, insurance, knowledge and ecosystem services (Heal, 2004). The economic and environmental consequences of land degradation are not confined to the countries where it occurs. The associated impacts, which include: loss of biodiversity, reduced atmospheric and subterranean carbon sequestration, and the pollution of international waters all significantly affect environmental and food security throughout the world (Global Environment Facility, 2003). Management of these resources is therefore of global, as well as local, importance.

South Africa is party to the Convention on Biological Diversity and the Convention to Combat Desertification. The Convention to Combat Desertification (CCD) was entered into force in 1996 with 179 countries participating. It is a legally binding

framework which aims to tackle land degradation, promote sustainable development in fragile ecosystems and to mitigate the effects of drought, particularly in Africa (Global Environment Facility, 2003). Land degradation in the Eastern Cape and the inability of large areas of subtropical thicket to restore itself naturally may lead to desertification (Kerley et al, 1995) and a consequent loss of biodiversity as well as economic potential. Land use which degrades the thicket should therefore be avoided to ensure economic and environmental sustainability of the area and to comply with the CCD. Degradation and transformation of the thicket has resulted from a number of processes including: excessive browsing by domestic livestock, land clearing for cultivation, harvesting of medicinal plants and wood-fuel, alien plant invasion, mining and urbanization (Palmer et al, 2006).

It has been found that plant systems with more biodiversity are on average more productive than those with less (Heal, 2004:106). Well-functioning systems are likely to be more productive from the point of view that they are efficient in their functioning whereas 'stressed' systems will not function as productively. An important point in today's world of climate change is the fact that diversity has been found to help natural ecosystems to adapt to conditions that vary over time or space (Heal, 2002).

Biodiversity also plays a role as the raw material in plant breeding and in this way it contributes greatly to the productivity of agricultural systems (Heal, 2002). Natural variation in plants and animals helps to generate new and higher-yielding plant and animal varieties (Heal, 2002), which is also of importance in agricultural systems, particularly cultivated crops such as citrus. This is not as relevant to the SRV as

there are no local varieties of major agricultural crops whose genetic material is likely to be preserved in the SRV.

Biodiversity offers an important defence against disaster in the form of new diseases, and it also acts as a source of knowledge, whereby one can learn from natural organisms how to make chemicals that may have valuable properties (Heal, 2002). Heal (2002) is referring to the principle of conservation in general and, once again, this does not necessarily apply to the SRV, unless one looks at the option and quasi-option values of the plants for pharmacological purposes. This does not necessarily necessitate a large area to be conserved, as one could study the plants in a relatively small area. With respect to this argument there are diminishing marginal benefits as the area conserved expands. The resulting economic problem is to determine the benefits and to ascertain the optimal scale of conservation. And although there are numerous plants in the subtropical thicket biome that have medicinal and other uses, they can be cultivated in small botanical reserves, or nurseries and do not provide a sufficient argument for expanding areas under conservation. The marginal economic benefit of conservation is declining, while the marginal opportunity cost rises. In a pristine system, the most productive land will usually be the first lost to agriculture. This was seen in the SRV, where the more fertile soils along the Sundays River were cultivated with wheat, and later citrus. The financial value of a given hectarage of land is not the sole determinant of its value. There are secondary issues like contiguity, soil types, edge effects, etc. that will be discussed later in the dissertation.

Biodiversity also has indirect use value in the form of ecological stability and ecosystem functions (Geach, 1997).

The importance of biodiversity from an economic perspective, as well as an environmental one, has only recently been taken into consideration in the assessment of land uses. The economic benefits of biodiversity are often difficult to quantify and are unlikely to accrue fully to landowners, but that does not mean that they should not be included in assessments. Assessments that only take into account the financial aspects are likely to leave out externalities. Privately optimal and socially optimal land uses may be very different when differing land-uses have varying ecological impacts.

Discussing biodiversity in general terms Walker (1999) mentions its 'multiple use' suggesting that this can lead to overall improvements in a regional economy, a higher standard of living for inhabitants and improved natural resource base. In his paper Walker (1999:206) describes 'multiple use' as involving the simultaneous use of resources on the same site, sequential use of resources on the same site, and different uses on different sites. Connor & Zimmerman's study (2008) implies that such improvement in the regional economy and in the resource base can be tied to the expansion of the Greater Addo Elephant National Park (GAENP). There has certainly been an improvement in the living standards of those households which have gained employment through the park, or park-related businesses.

It is widely assumed that ecotourism provides a mechanism for the maintenance of biodiversity however local experience suggests that it may have environmentally perverse outcomes. Kerley et al (2003:13) found that tourists focus on a few

charismatic species. They also noted that a large proportion (60%) of self-guided tourists indicated that **clearing** of indigenous thicket vegetation in order to improve game-viewing opportunities would **increase** their enjoyment of the AENP (Kerley et al, 2003:16). 'Diversity' in itself seems to have limited value to visitors. Environmental education can make a difference to the public's appreciation of biodiversity; a point strongly made for the Addo Park by Geach (1997). Geach (1997) surmised that educating the public to appreciate the little things (biodiversity per se) can reduce dependence on mega-fauna, such as elephants, lions, etc. to provide utility. Without it, ecotourism may offer a weaker incentive for land and thicket restoration than naïve proponents suspect.

According to surveys carried out in 2004 and 2005 by Boshoff et al (2007:191) more than 90% of visitors to the AENP visited the park 'to see the animals' and 78% of respondents considered 'peace and quiet' to be an important reason to visit the park. These figures suggest that a certain amount of degradation would allow visitors to see more animals and from that point of view it is not necessarily a 'public bad'. The survey also showed that 23% of respondents visited South Africa's national parks 'frequently', which suggests that the national parks are a popular venue for visitors (Boshoff et al, 2007:192) and have the potential, if managed correctly, to generate an income and make an economic contribution to society.

As Kerley's work (2003) anticipated, some forms of species diversity are proving more important than others. Almost all of Boshoff's (2007) respondents said that the reintroduction of predators (lions and spotted hyaenas) was good for the

tourists who visit (Boshoff et al, 2007). It is likely that the introduction of lions into the AENP played a significant role in the increase in tourist numbers, though it is difficult to ascertain the exact role, due to the fact there were a number of other changes taking place within the park during the same period, e.g. road upgrades, and expansion of facilities. The re-introduction of predators offers a double benefit, adding diversity and balance to the system, and simultaneously increasing the social utility and commercial value of the ecosystem. These results indicate that a large amount of the value of the Park is related to the fauna, particularly the mega-fauna. It would appear therefore that the Park and its associated values would be markedly different if it was being conserved for purely conservation and/or preservation reasons. The next two subsections describe the externalities, impacts and opportunity costs of various land uses.

2.5 Impacts and Externalities associated with the various land uses

When looking at different land uses it is important to examine all the externalities[2] associated with each. Such externalities and impacts may be positive or negative.

Table 5 shows that the three options being assessed all have a number of positive externalities or impacts associated with them and each also has some negative externalities and impacts, with citrus farming showing the most negative externalities largely due to its impacts on the environment. As shall be shown later

[2] An external effect, or externality, is said to occur when the consumption or production decisions of one agent have an impact on the profit or utility of another agent, in an unintended way, and when no payment/compensation is made by the generator of the impact to the affected party (Perman et al, 2003).

in the chapters on each land use there are also varying employment and income benefits as well as opportunity costs associated with each use.

Table 5: Impacts and externalities of land uses addressed in this paper

Externalities	Conservation	Citrus Farming	Restoration
Positive	• Biodiversity	• Income	• Carbon Sequestration
	• Income	• Export Earnings	• Employment
	• Carbon Sequestration	• Employment	• Income?
	• Employment	• Carbon Sequestration	• Biodiversity
	• Multiplier effect	• Multiplier effect	• Climate change mitigation
	• Aesthetic value		
	• Existence value		
Negative	• Reduced food production	• Pollution – fertilizers, pesticides	• Reduced food production
	• Carbon emissions - transport	• Ecosystem changes	• Long-term employment effects
		• Reduce biodiversity	
		• Soil Erosion	
		• Carbon emissions - transport	

2.6 Opportunity Costs of Various Land Uses

Opportunity costs are easily overlooked in a cost-benefit analysis. Their importance in terms of foregone income and employment should not be excluded as it can have a significant impact on the economic sustainability of the chosen land use. The opportunity cost of expanding the National Park is the set of net benefits sacrificed by converting the land involved from the 'best' available agricultural use. The opportunity cost of agriculture is similarly the net benefit that

may have been generated had the land been converted to National Park. The benefits of such conservation are not easily measured, particularly those non-use benefits that accrue to the environment. In the case of the SRV the term 'converted' to conservation is used rather than 'retained for' conservation, as much of the area added to the National Park was previously agricultural farmland. This poses a number of problems in determining the opportunity costs of expanding the Park, as there are costs involved in returning the land to conservation e.g. rehabilitation of the land, removal of internal fences, installation of game fencing, etc. (Pers. comm. J. Adendorff, Conservation Manager, GAENP, June 2008).

As the Park expands it is likely that the marginal opportunity costs of increasing species represented will rise. It is the lack of flexibility, or interchangeability, on the part of resources that is the cause of increasing opportunity costs (McConnell & Brue, 2005). The park expansion is not only about increasing the number of species represented. It is about sustainability issues i.e. ensuring that the species that are in the park have a better chance of survival and that ecological processes are conserved. For agricultural land, the opportunity costs depend on the local and international agricultural economy as well as the productivity with which land is used (Chomitz et al, 2005). More technically there are problems relating to non-convexity issues. Externalities, economies of scale in conservation and the non-homogeneity of land are all also issues in this regard.

At present a number of other issues that were unimportant in the past, need to be taken into consideration. One of these is the impact of the various land use options on the climate in terms of emissions (pollution), carbon sequestration,

deforestation, etc. Other issues include changes in soil quality (due to nutrient leaching), changes in water quality and water flows (Foley et al, 2005). Water is a particularly pertinent issue for the SRV, which has a relatively low, sporadic and unpredictable annual rainfall (see Figure 5 pg. 20). It is important to ensure that any chosen land uses utilize the water resources efficiently. An issue in the analysis is the costs incurred in building the Sundays River Irrigation Scheme to supply the agriculture, particularly citrus. This is technically a sunk cost and therefore outside of any opportunity cost calculation, however it has changed the effective price of water in the area and thus changed the set of feasible agricultural options. However, with the development of the Couga harbour and industrial area it seems likely that urban/industrial water demand in the region will grow. As citrus farming requires more water than game farming or eco-tourism, it could be impacted by this.

Discussing an opportunity cost for an area of land presumes some knowledge of its 'best available alternative use': something that may be difficult to attain in reality. Rational landowners would select that set of uses that maximize the present discounted value of their stream of expected net benefits from the land (Lubowski et al, 2006). The outcome of such calculations are not only sensitive to the discount rate used, they may also be fundamentally unstable: expectations of future land use profits are based on current and historic values of relevant variables (Lubowski et al, 2006), variables made volatile by climatic and market fluctuations.

Changes in markets, environmental or economic policy, the political situation, human preferences and culture all have the potential to significantly change the incentives for various land uses (Naidoo & Adamowicz, 2006). This in turn introduces a large amount of uncertainty in the decision-making process, and with this, risk. Certain land uses that appear the most economically viable at one point in time, may not remain so in the future. In the face of such fundamental uncertainty, any discussion of opportunity costs has to accept some reliance on past patterns rather than simply trying to predict future trends.

Another problem in assessing opportunity costs is the effect of land use externalities in adjacent areas. This is particularly true where conservation and agriculture abut (Schelhas (1991) in Geach (1997)). It is well-known that farmers suffer losses from wildlife that leaves the parks. Less well known is that parks also suffer from '*edge-related effects*' (Schelhas (1991) in Geach (1997)). Such cross-boundary influences include, amongst other things, invasive plant species (particularly prevalent in the Eastern Cape), and agrochemical runoff which may affect soil quality or certain plants/animals (Schelhas (1991), in Geach (1997)). This is particularly prevalent in the SRV where citrus farming entails widespread use of fertilizers and crop sprays, which may negatively impact on the vegetation, soil, air and water quality of the Addo Park. As described later in the chapter on citrus farming, the use of methidathion and confidor by farmers in the SRV results in water runoff being affected by the chemicals. EUROPGAP restrictions for exports have limited the number of fertilizers and pesticides that can be used, which has had the effect of reducing the negative impact on the environment. The level of all chemicals is measured on a regular basis to ensure that standards are

being met. The drip irrigation method that is presently favoured also limits the amount of runoff.

With this socio-economic and environmental background, the dissertation proceeds with a discussion of two land use options in more detail. A chapter is also included on land restoration for carbon t rading which is essentially an extra benefit of conservation rather than an alternative land use, but can be employed as a land use on its own as well. The first land use to be discussed is that of conservation, with particular reference to the Greater Addo Elephant National Park (GAENP) and its ongoing expansion.

3. CONSERVATION AS A LAND USE

"Ultimately conservation is about people. If you don't have sustainable development around these (wildlife) parks, then people will have no interest in them, and the parks will not survive" - Nelson Mandela

3.1 Benefits from Conservation and Tourism

The statement above clearly identifies one of the most important problems facing conservation as a land use. Mere preservation is not enough. In an ideal system the land under conservation would both pay for itself and offer tangible benefits for the people living around it. Clearly this ideal is rarely attained in conservation areas seen as 'unattractive'. There are a number of parks (such as those in the central 'Karoo' area of South Africa) that do not cover costs and offer very little to the surrounding communities, but from an ecological point of view are some of the most diverse areas in the country. The public's willingness to pay for these areas appears close to zero. Their conservation is consequently a public good. This leaves such parks with the problem that there is little incentive for the surrounding communities to help conserve the land, and the possibility of conflict over the land's use may arise.

Cutter et al (1991) in Suh & Harrison (2005:10) suggested that natural resources could be classified along a spectrum from exploitation to conservation to preservation. They defined exploitation as '*the complete and maximum use of a resource for individual or social gain in the short term*' and conservation as '*the*

wise utilization of a resource so that use is tempered by protection to enhance the resource's continued availability', whereas preservation is defined as '*the non-use of a resource by which it is fully protected and left unimpaired for future generations'*. The distinction is important: preservation and conservation present different management objectives. In South Africa, though some of the areas of a national park may be preserved, it is more likely that the park will be managed according to conservation objectives. The larger the area under consideration however, the more likely that there is a combination of conservation and preservation.

The benefits from conservation and tourism are numerous and were mentioned briefly in section 2.3. Norton-Griffiths (1996) divides them into three broad categories: local, domestic and global. Local benefits are those directly derived from tourism revenues. Domestic benefits are all other benefits that accrue from biodiversity conservation in the area e.g. erosion control, the potential consumer surplus of tourism, existence values, etc. Global benefits represent the benefits to the rest of the world that are generated by biodiversity conservation, including values of carbon sequestration and existence and option values (Norton-Griffiths, 1996). Norton-Griffiths (1996) also warned of a tendency for the developed world to free-ride on the conservation efforts of less developed countries. He felt that the developed world should make a greater contribution to the conservation of large areas in these countries. His study on the opportunity costs of Kenyan conservation clearly showed that they were paying a very large amount to conserve biodiversity, with very little in tangible benefits to themselves (Norton-Griffiths, 1996).

Recognizing these arguments, if conserved areas are to remain intact then the local benefits have to somehow be increased. This can be done by, for example, increases in revenues from tourism, donations from the global community who are benefiting from the existence of the conserved areas, etc. Fortunately the Addo area is less at risk than many others in SA. The majority of the Park's costs are already met by revenues received from international visitors. Expanding the Park to include more dryland areas might induce longer stays by existing tourists and would allow the expansion of facilities to cater for them. This might therefore be a more efficient means of funding such conservation than trying to shift the tourists to the less popular parks in the Karoo. The inflow of NGO and Global Environment Facility (GEF) funds into the area reflects that the 'public good' nature of the biodiversity in the SRV is recognized at an international level.

South African National Parks (SANParks) has over the years moved towards a new concept of conservation (Cock & Fig, 2002:134 in Connor & Zimmerman, 2008) that is based on inclusivity and linking conservation to human needs, this is line with the recent focus on 'sustainable development'. Cock & Fig (2002:235) in Connor & Zimmerman (2008) state that: "*the key to a new concept of conservation is that it attempts to link the protection of biodiversity to human benefits*" – including access to resources within parks, tourism, employment and income generation. It is a truism all over the world, and particularly in Africa with its' high levels of poverty, that parks need to benefit the people living around them and that they need to find a way of paying for themselves or at least offering a viable, preferably better, alternative to other possible land uses. Even in South Africa, which has a well structured National Park system, there are very few parks that fund

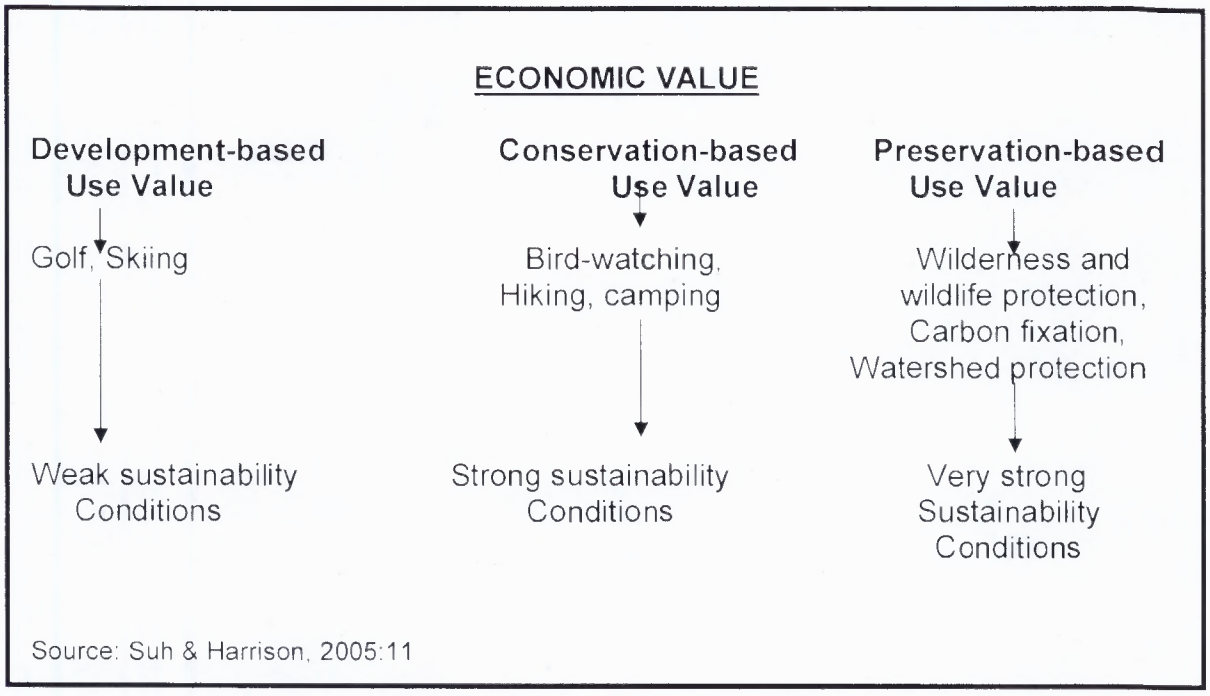
themselves and a large amount of money has to be invested in order to maintain the land under conservation. Conserving areas for the 'global good' is unlikely to win the support of surrounding communities.

With this in mind SANParks uses popular parks to 'cross-subsidise' the conservation of areas that are of importance from a biodiversity point of view, but have lesser eco-tourism possibilities. The Greater Addo Elephant National Park is one of the parks to play this role in the portfolio of South African National Parks. Its growth and increase in revenues over the years has allowed it to support other parks that are not doing as well in financial terms, but are important for conservation and biodiversity objectives (pers. comm. L. Moolman, Regional Manager, Frontier Cluster, SANParks, 2007).

3.2 The Economic Value of a National Park and Tourism

The standard definition of the economic value of a national park mentioned earlier emphasised use and non-use values, and within those two categories cited, the direct use value, indirect use value, option value, bequest value and the existence value. Suh & Harrison (2005), however, argue for a further distinction between a development-based use value, a conservation-based use value and a preservation-based use value.

Figure 7: Alternative Classifications of the Economic Value of a National Park



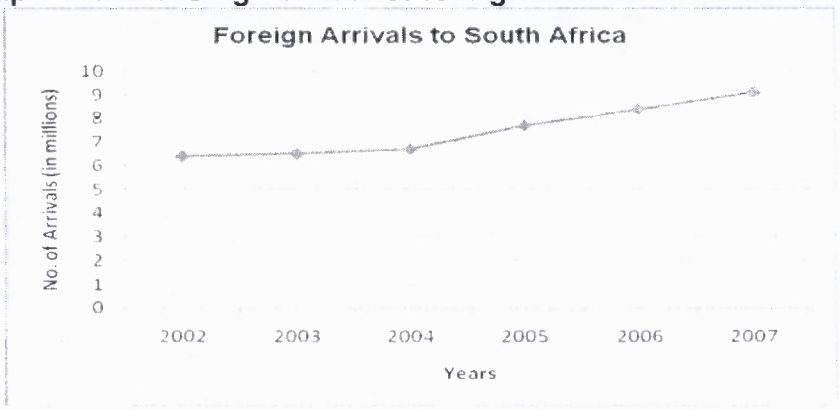
Source: Suh & Harrison, 2005:11

Preservation refers to the long-term economic value. Conservation and current intensive use relate to the medium-term and short-term economic value, respectively (Suh & Harrison, 2005:11). Different values also have different sustainability views about the extent to which weak or strong conditions should be imposed to achieve the sustainable use of resources in natural ecosystems (Suh & Harrison, 2005:11). The closer one moves to the preservation objective, the stronger the conditions for sustainability become. The 'value' of the Addo Park would include a combination of the conservation-based use value as well as the preservation-based use value. Due to its National park status it is unlikely to ever include any development-based use value.

Tourism has great potential for contributing to economic growth and social development (Geach, 1997). Visitors to South Africa, in line with international

trends, are putting greater emphasis on nature-based experiences (Geach, 1997). South Africa has long been a destination to visit for its wildlife and nature-based tourism experiences. Tourism makes a contribution to GDP and plays an important role in employment creation. According to the World Travel and Tourism Council (WTCC) travel and tourism contributes 8.7% to GDP, as well as comprising 7.8% of total employment (WTCC website, 2009). Over and above these direct impacts, there are also a number of indirect impacts in the employment sector, as well as capital investment, resulting from travel and tourism. For this reason, eco-tourism activities should be promoted and included in national parks, rather than keeping the areas merely for preservation. Activities include, amongst others: game drives, walks, hikes. Expansion of national parks, and conserved areas, improvement of facilities and activities in existing natural areas and greater involvement of surrounding communities in order to reduce poverty and unemployment are all ways in which eco-tourism can play a positive role in growth and development.

Graph 1: Increasing number of foreign arrivals to South Africa



Source: South African Tourism, 2008

Graph 1 shows that visits to South Africa by international travelers reached a record 9.1 million in 2007. The majority of these are, however, still low income visitors from the rest of Africa. The 8.3% observed increase far exceeds the global growth rate of 6.1% (www.southafrica.net/satourism/research).

World statistics have demonstrated t he importance of tourism as a worldwide growth pole (Hamilton et al, 2007). Africa only receives about 4.5% of the world tourist market but its 8.1% expansion rate with South Africa leading, is among the fastest in the world (Hamilton et al, 2007). With the upcoming 2010 Soccer World Cup there is expected to be an even further increase in tourism and its income-earning potential in South Africa. At a local level Geach's (1997) study showed that the recreational use of the GAENP generated considerable consumer surplus. It would appear therefore that there is still scope for further growth and development in the area of eco-tourism and the expansion of accommodation facilities in and around the Park.

Strategically, however, one has to consider the risks carefully before encouraging the State to focus further funds and efforts on expanding its conservation and ecotourism efforts. The tourism market is vulnerable to a large number of socio-economic and political variables. The exchange rate plays a large role with a weakened rand encouraging more foreigners to visit. The political situation in South Africa, as well as in neighbouring countries such as Zimbabwe, also influences people's perceptions and travel plans. Increasing fuel prices and the impact of air travel on climate change will result in the cost of air travel rising, which will also impact on the tourism market. It will be interesting to see how the recent

collapse of the world economy (September 2008) impacts on tourism in South Africa, as well as on export markets, including citrus. The recent cholera outbreak in Zimbabwe (January 2009) has also caused much concern amongst foreign visitors traveling to Southern Africa and if it is not contained could lead to a decline in tourist numbers. The swine flu pandemic (April 2009) also puts a halt on travel and impacts on the tourism industry. One has to bear all of this in mind when considering the expansion of national parks and nature reserves and its impact on the regional economies and specifically on poverty reduction and income generation.

Sharing the benefits of conservation with local communities is only one aspect of the problem. The expansion of a national park can also create externalities for surrounding private landowners. One of these is the movement across park boundaries by wild animals which may increase landowners' costs of production (Norton-Griffiths, 1996). This was certainly the case when the Addo Elephant National Park was initially formed and there was competition between the elephants and neighbouring citrus farmers. This is not a problem in Addo anymore but the existence of national parks and game reserves alongside communities still causes a large amount of conflict in other areas in Africa (e.g. the human-elephant conflict in Botswana (pers. comm. A. Songhurst, Human-Animal Conflict researcher, Botswana, 2 008)). The development of policies to mitigate these negative externalities is vital for the continued existence and conservation of natural areas and their acceptance by local communities.

3.2 Brief History of the Greater Addo Elephant National Park (GAENP)

The Addo Elephant National Park (AENP) was formed in 1931 to protect a remnant population of 11 elephants. The elephant population had been decimated in the early 1900s as the growth in citrus farming in the Sundays River Valley (SRV) resulted in conflict between farmers and elephants (Meiring, 1959). The conflict arose as there is no surface water in the Addo bush so elephants were forced to look for water on surrounding farms (Geach, 1997).

In subsequent years growing awareness of the importance of the biological diversity found in the SRV led to expansion of the Park and an extension of its role to biodiversity conservation and social upliftment.

The Park is unique in that it includes 5 of South Africa's 7 biomes (World Bank Report, 2004) th ough it is dominated by Subtropical Thicket[3]. This biome is threatened but also possesses great phylogenetic biodiversity (see e.g. Forest, F. et al. Preserving the evolutionary potential floras in biodiversity hotspots. *Nature, February 2007,* 445:757-760). It also has value as a means of carbon sequestration (Mills & Cowling, 2004 in *Rate of carbon sequestration at two Thicket restoration sites in the Eastern Cape, South Africa* and Mills et al, 2003 in *Farming for carbon credits: implications for land use decisions in South African rangelands).*

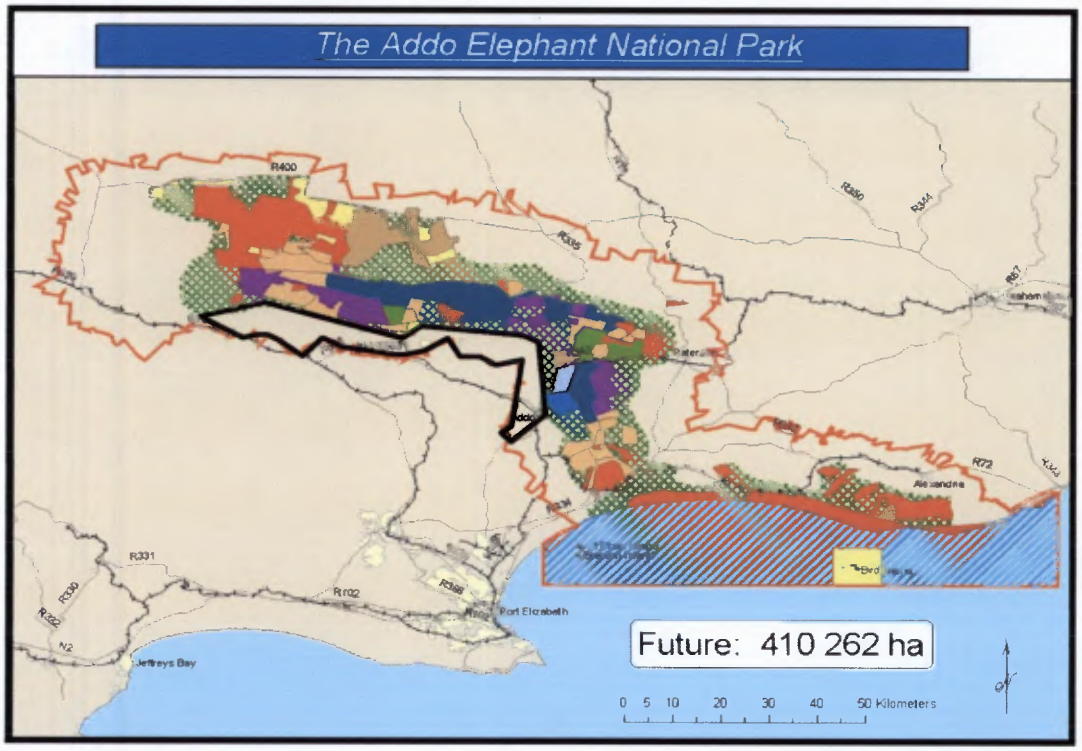
When the Addo Elephant National Park was created it was 1585 hectares in size (SANParks presentation to the Minister, 2008). It was soon realized that in order to

[3] Subtropical Thicket is a vegetation type characterized by a dense canopy of woody trees and succulent shrubs (www.ru.c.za)

maintain the growing elephant population there would have to be an increase in the size of the park. The expansion process was also driven by the desire to conserve representative examples of the varied landscapes and their associated biodiversity patterns and processes, while at the same time promoting sustainable development and eco-tourism in the region (Sundays River Municipality, 2005:38). Initially there were small additions to the park size and then in 1984 the 34 000 hectare Zuurberg Mountain Park was added (Kerley et al, 1995). In the late 1990s the idea of a Greater Addo Elephant National Park was formulated. The argument was that since the Park's unique position gives it a broad range of biomes, with its inclusion of a Marine Protected Area (MPA) it could make a major contribution to South Africa's commitment to the international conventions on Biodiversity and Combating Desertification (Coastal and Environmental Services, 2001).

Table 6 shows the increase in the size of the GAENP over the years, with the colours matching with Figure 8 below. The black outline indicates current and/or possible future citrus areas. With the orange outline indicating the proposed expansion area of the GAENP. At the end of the expansion process the resultant park will be the third largest national park in South Africa, after the Kruger National Park and the Kgalagadi Transfrontier National Park. Because of the inclusion of a 120 000 ha marine reserve and the inclusion of 5 different biomes the GAENP will be one of the most diverse national parks in the world and the only park to offer the 'Big 7' (Elephant, Buffalo, Black Rhino, Lion, Leopard, Great White Shark and the Southern Right Whale) (SANParks, 2008).

Figure 8: Proposed incremental increases in size of the GAENP



Source: GAENP Report to the Minister, 2008

Table 6: Change in the size of the GAENP from 1931 onwards with matching colour coding in Figure 8 above

YEAR	SIZE OF THE GAENP
1931-1953	1 585 ha
1980	3 732 ha
1985	29 241 ha
1990	46 598 ha
1995	53 020 ha
2000	82 613 ha
2004	137 485 ha
2006	170 569 ha
Future	410 262 ha (incl. 120 000 ha marine reserve)

Source: GAENP, 2008

Prior to the recent round of expansions, the Park implemented an 18-month long conservation programme, starting in September 2001, funded by the Global Environment Facility (GEF) through the World Bank. Strategic Environmental Assessment Reports (SEA) were drafted to investigate the biological, social and economic importance of the proposed expanded park (Coastal and Environmental Services, 2001). These SEAs indicated that the GAENP could be both ecologically and economically sustainable. Discussion of some of the results from these SEAs has been included later in the chapter in order to compare the predictions with what has actually taken place since the expansion process began.

Figure 9: Map of the GAENP showing the different sections

Source: GAENP, 2008

As can be seen from Figure 9 the Park is divided into various sections each different and containing a variety of biomes and features. There is still the issue of roads, railways, homes, farms, etc. that separate some of the sections, and this will have to be addressed in the future if the park is to be opened up as one whole unit. The current sections are Main section (the original section of the park that contained the elephant camp and is currently 14 000 hectares in size (2008)), Nyathi (which encompasses the area around the Coerney River and some of the Zuurberg mountain range), the Zuurberg section, Kabouga, Darlington (which contains the Darlington dam – previously Lake Mentz), Kuzuko (which is a contractual area, and includes nama-karoo vegetation), Woody Cape (along the coast and incorporating the highest coastal sand dunes in the southern hemisphere, as well as the coastal forest area) and the Colchester section. It was felt important to assess whether or not this fragmentation of the park affects the conservation objectives and also whether it is detrimental to the eco-tourism goals and the long-term sustainability of the GAENP. This will be discussed further in Chapter 7.

According to the Strategic Environmental Assessment (SEA) Report on the expansion of the AENP (Coastal and Environmental Services, 2002:16) '*SANParks will not actively pursue the purchase of land in the dairy, chicory and beef producing areas of Alexandria and Nannaga. However this area is of high conservation significance and therefore alternative management options will be explored in consultation with landowners*', for example, conservancies and contractual national park. Some land has been purchased in the Alexandria area, however, due to the profitable dairy industry in that area some of the prices were

far above the average paid in extending the park. It is important to assess whether the area being bought is, from a conservation perspective, worth the amount being paid and worth the opportunity cost. The dairy industry in the Alexandria area is profitable and the foregone income can be substantial. The jobs that are created through the industry can also play a very important role in reducing unemployment and alleviating poverty in the area. Some areas are perhaps better left to dairy farming and the money can be more effectively spent in conserving larger areas or areas with greater diversity somewhere else.

The argument that arises here is whether or not it is better to conserve smaller areas with a large amount of diversity, or to conserve larger areas with perhaps less diversity? The ideal would obviously be to conserve large areas with a large amount of diversity, but this is rarely possible or feasible.

The extent to which land should be conserved or restored is also moot. It is not obvious that it should be restored to, or kept in, pristine condition. Much of the current park was previously used to farm livestock and wheat. This historical use of the land resulted in the thicket vegetation being severely degraded creating open plains. This degradation is not a complete 'public bad' as the open areas and thinned bush can provide better game viewing opportunities. They are thus a source of utility and add value from the perspective of visitors to the park (Boshoff et al, 2007). The original-state thicket was impenetrable, heavy bush which would have provided very little and unrewarding game-viewing opportunities. Moreover the bush was probably kept fragmented by heavy game. Elephants open up this bush, creating paths for other animals such as buffalo and kudu and space for

grass growth. It appears that in tourism, as in stock farming, there is an 'optimal degree of degradation'.

SANParks' allocations of funds for land purchase is determined by each Park's aims and missions. Outside funding is also used to buy land. Contractual arrangements with private land owners also form part of the land 'purchase' procedure. Private land owners 'donate' their land to the Park in return for being included in the National Park. Such 'donations' are generally called 'contractual parks' where there is some contractual agreement between SANParks and the private landowner, whereby land is included within the National Park according to some agreed upon conditions (e.g. extra traversing area for the private landowner, game reintroductions by SANParks, etc.) 18 000 hectares has been bought by contract into the Park so far (end of 2008). This process is very important for the expansion of the GAENP as to buy all the land outright would cost billions of Rands and would not be financially viable. This could also be an indication that farming is no longer the preferred land use of the farmers in the area. With respect to direct sales, the Park works on the willing seller willing buyer policy, and will only use expropriation as a last resort (pers. comm. SANParks, J. Adendorff, Conservation Manager, GAENP, 2008). Currently, as appropriate farms wi thin the GAENP 'footprint' become available, and as funds allow, they are purchased and added to the Park. The 'footprint' of the GAENP is SANParks' ideal outline of the park with respect to its biodiversity, eco-tourism and conservation functions.

3.4 Results of the SEA Farm Worker Survey (Coastal and Environmental Services, 2001)

Employment in conservation and tourism is often cited as justification for land conversion. It has, however, to be seen against a background of jobs that the land would otherwise generate. Such an indication was provided by the 2001 Strategic Environmental Assessment into the proposed Park expansion and has been included here as a means of comparison.

This study was done on farms that were potentially to be included in the GAENP and showed that on the 16 farms surveyed the **average number of workers per hectare** amounts to **one worker for every 272.5ha**. Dairy farms supported, on average, one worker for every 46.4ha while the larger, mixed farms supported one worker for every 365 ha. The study also showed that 83% of the workers surveyed were semi-literate or illiterate, having only attended primary school, with 13% having attended secondary school.

30% of farmers indicated that 30% or more of wages were made in kind e.g. rations, housing, etc. The **average highest wage for male workers** was **R578 per month (2001)**. The average wage figure for females was incomplete but was found to be between R141 and R407 per month[4]. These results showed that the average farm worker was poorly educated and received a relatively low wage. The surveys also showed that the majority of workers on the farms were male leaving few employment opportunities for females. It is important to note here that there is

[4] Expressed in 2007 Rands these wages are an average highest wage of **R774.85 per month** for the males and a range of **R189.02 and R545.61 per month** for the females

now a minimum wage in place for South African farmworkers: something that was not present at the time of the 2001 survey.

The report also stated that the AENP and other ecotourism operations employ twice the amount of labour at four times the salary of comparable pastoral operations (Coastal and Environmental Services, 2001). Was this assumption largely sanguine or has it proved to be accurate? This question will be looked at later in the chapter when the current employment per hectare for the park is calculated.

3.5 Proposed Costs and Employment-related Issues from the SEA (2001) for the GAENP

The following data also comes from the various SEAs that were written prior to the expansion of the AENP in order to determine its socio-economic, conservation and development potential.

Table 7: Estimation of costs of expansion

Area	Ha	Cost R/Ha	Land Cost R millions	Fencing Distance	Fencing Cost*	Total Cost R millions
Karoo	120 000	400	48	135km	R13.5m	61.5
Forest	30 000	1000-1200	30-36	40km	R4m	34-40
Mountain	60 000	800-1000	48-60	75km	R7.5m	55.5-67.5
Bushveld	45 000	1000-2000	45-90	65km	R6.5m	51.5-96.5
Total	**255 000**		**171-234**	**315km**	**R31.5m**	**R202.5-R265.5**

Source: Le Quese & Calverley, 1998

*The fencing cost figure is based on the estimate of R100 000 per kilometre for the construction of an Armstrong fence[5]. As will be seen later in the section on establishment costs there are different options available for fencing depending on what game is to be kept in the fenced areas, i.e. predators, or mega-herbivores, such as rhinoceros or elephants. Now that the Park has been established for a period of time and the larger animals have become accustomed to the fences there is not as much need for an Armstrong fence, which has resulted in a lowering of the fencing costs.

Table 7 shows that the total proposed costs would amount to between R202.5 and R265.5 million (in 1998 Rands)[6] to extend the park to a size of 255 000 hectares. The proposal was divided into four different areas that were felt to be important components to include within the GAENP. As can be seen from the table the lowest cost per hectare is for land additions in the Karoo section of the Park. This land has a low commercial opportunity cost (for stock or crop farming) but supports a considerable range of plant and animal species, giving it importance from a conservation perspective. It would make sense therefore from a perspective of immediate species preservation benefit per rand spent for the Park to expand in this area. However, the economics of the decision are complicated if one looks at conservation rather than preservation. The eco-tourism opportunities presented by the expansion of the Karoo section would be less varied and attractive than those in other areas. This gives a good example of 'subsidisation' within parks, as the areas that are more attractive to tourists, but may not have as much diversity, can subsidise those areas that are genetically diverse but less attractive to tourists. If

[5] The Armstrong fence was designed in 1954 by Graham Armstrong the Section Ranger of the AENP at the time and it was the first ever elephant proof fence to be designed. It is constructed from railway sleepers and lift cables.
[6] In 2007 Rands this amounts to between R321.77 million and R421.88 million

we take an average of the cost amount to be R234 million (in 1998 Rands) with 255 000 hectares to be added, then the **proposed cost per hectare** will be roughly **R917.65**[7].

Other costs outlined by Le Quesne & Calverley (1998) in the SEA include the following (all in 1998 Rands):

- R2 million for the reintroduction of fauna
- Staff costs of R7.75 million per annum
- Roads – R1.5 million per annum
- Fence maintenance – R100 000 per annum

Le Quesne & Calverley (1998) contended that the GAENP would generate about 16 000 jobs in the Port Elizabeth area. This is considerably higher than the estimate provided in the study by Connor and Zimmerman (2008). Even though the latter took into account the multiplier effect on the area, as well as South Africa as a whole. Connor & Zimmerman (2008) suggested a direct employment effect of 1050 jobs (this figure includes the 350 jobs in the Park itself (including concessionaires), with 700 induced indirect additional jobs (Connor & Zimmerman, 2008)). These induced jobs were calculated using an 'internationally accepted tourism multiplier' which states that each tourism job creates two other jobs (Connor & Zimmerman, 2008:52).

There would certainly be multiplier effects into the Port Elizabeth area as a number of the businesses in the SRV use suppliers from this area, but many of these

[7] In 2007 Rands, this would equate to a **cost of R1458.14 per hectare**

suppliers exist independently providing services to businesses in and around Port Elizabeth. Changing patterns of land use in the SRV would have little effect on their levels of employment or gross income. Other firms, like tour companies, hire car companies and travel agents, are directly impacted by the existence of the Park. They would probably still exist even if the Park did not, but it is unlikely that they would be as successful. Very few of the inputs used by the Park or by the farmers are sourced directly from elsewhere in the SRV. For this reason the local multiplier from a supplier perspective is not very large, though since many inputs are drawn from the region i.e. Port Elizabeth area, the multiplier effects are felt regionally.

Table 8: Summary of the expected nominal development costs (GAENP, 2001)

Expense	Initial Expenditure
	(2001 figures)
Land	R56 230 950
Fencing	R21 662 500
Roads	R25 045 000
Water	R136 000
Game Facilities	R700 000
Game	R50 595 360
Buildings	R7 363 000
Reclamation, EIAs, etc.	R5 202 500
Tourism Developments	R19 860 000
Equipment	R2 240 000
TOTAL	**R189 035 310**[8]

Source: GAENP SEA, 2001:30

Table 8 shows that the greatest expenditure is on land purchase followed by the cost of game. This land purchase has been funded from internal sources and by donors e.g. the World Bank.

[8] In 2007 Rands: R253 414 465.98, i.e. roughly R253 million

Langholz & Kerley's (2006) study of private game reserves (PGR) in the Eastern Cape found that the median cost to set up a PGR was R42 million. The largest single item was land purchase (33.6%), followed by construction and building (23.0%) and purchasing game (12.5%) (Langholz & Kerley, 2006:27). Respondents paid an average of **R1977 per hectare**[9] (in 2005 Rands), compared to a study in 2004 where the amount per hectare was R1565 (Langholz & Kerley, 2006:27). As will be shown later in this chapter, this figure is somewhat higher than the average amount paid per hectare (R1115.32 in 2007 Rands) by the National Park for the expansion of the AENP. The high proportion allocated to land purchase is however consistent with the costs outlined for the national park in the SEAs and in this study.

Data gathered from valuations of farms within the GAENP 'footprint', actual sales, and data gathered from SANParks all indicate that the average cost per hectare of land in the SRV has been steadily increasing since 1991 in both nominal and real terms. One reason is that the land purchased has not been homogenous. The park pays for all developments on the land bought. Irrigated or cultivated land is more costly than natural vegetation, and the Park has paid considerably more per hectare (up to R22 000) for such land to be included in the GAENP (pers. comm. J. Adendorff, Conservation Manager, SANParks, 2008). Table 9 shows the steady increase in **nominal average cost per hectare** since 1991.

[9] R2140.30 per hectare in 2007 Rands

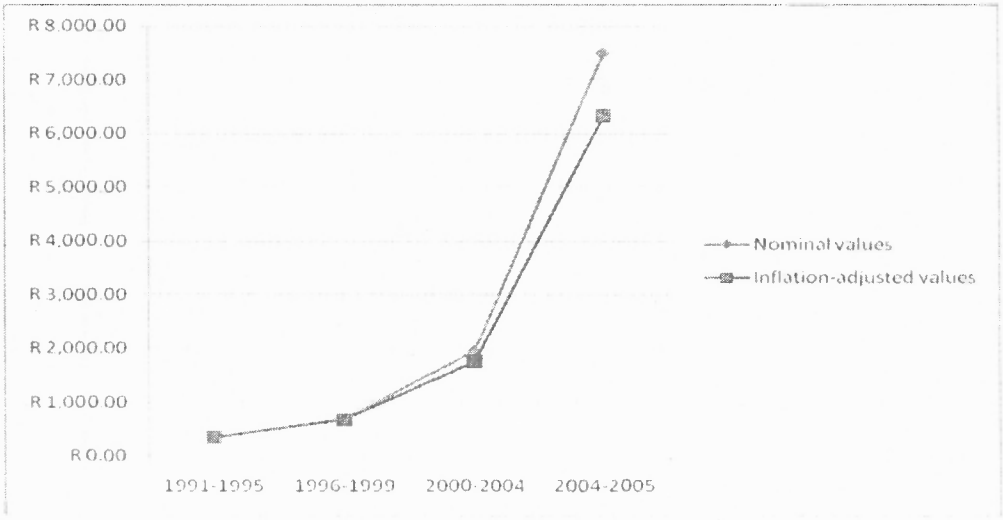
Table 9: Increase in average cost per hectare since 1991 (nominal values)

YEARS	LAND COST PER HECTARE - Nominal Rands	AVERAGE COST PER HECTARE – Nominal Rands
1991-1995	R200-R500	R350
1996-1999	R600-R800	R700
2000-2004	R900-R3000	R1950
2004-2008	R3000-R12 000	R7500

Source: pers comm. J. Adendorff, Conservation Manager, GAENP, SANParks, 2008

Graph 2 shows the increase in average cost per hectare of land purchased according to calculations done by SANParks, even when adjusted for inflation.

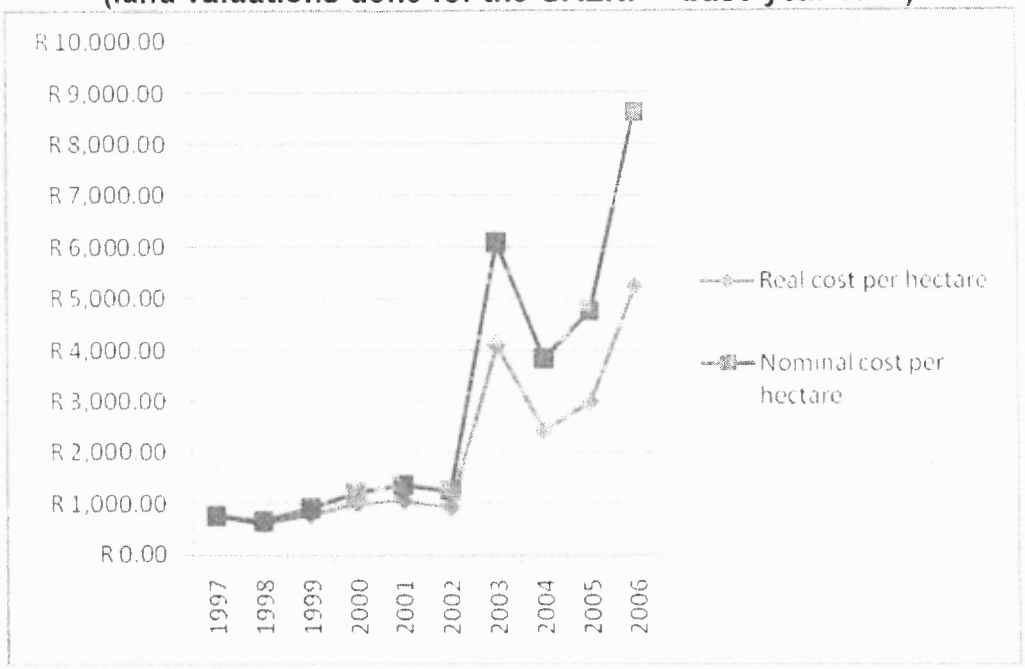
Graph 2: Nominal and Real average cost per hectare of land purchased by SANParks



Source: GAENP, 2008

The graph below shows the **estimated value per hectare** based on valuations of farms done for the GAENP during the expansion process.

Graph 3: Estimated nominal and real prices of neighbouring land per hectare
(land valuations done for the GAENP – base year 1997)



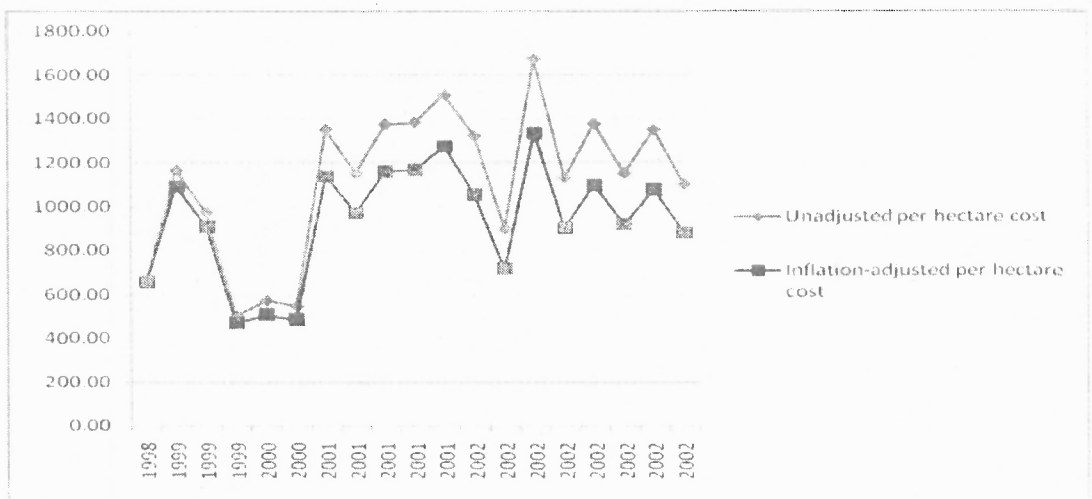
Source: GAENP, 2008

Graph 3 clearly shows an increasing trend in the prices of land surrounding the Park, particularly since 2002, even after the adjustment for inflation. It is difficult to accurately determine the reason for this. But there is the widespread belief (pers. comm. landowners in the SRV, 2007) that the planned expansion of the GAENP pushed up farm prices in the surrounding area. It could also be the result of the fact that the lower priced land was purchased first (lower opportunity cost) and that farms with higher values were only bought later (higher opportunity cost).

Land prices obviously depend on the characteristics of the farm: including land condition, buildings, position, water availability, etc. Three sales were excluded from the sample. These averaged a per hectare price of between R60 000 and R185 000. This was due to the fact that there was a large amount of

infrastructure on the farm. Effectively much of the payment was for improvements (many of which were later removed), therefore the farm prices did not truly reflect the price of the land in the area and so were excluded. Calculations done on prices of a number of farms sold (with varying characteristics) in the GAENP footprint area over the period 1997 to 2006, worked out to a **per hectare cost** of **R3288.21** (nominal value).

Graph 4: Average cost per hectare of land purchased by SANParks for the GAENP



Source: GAENP, 2008

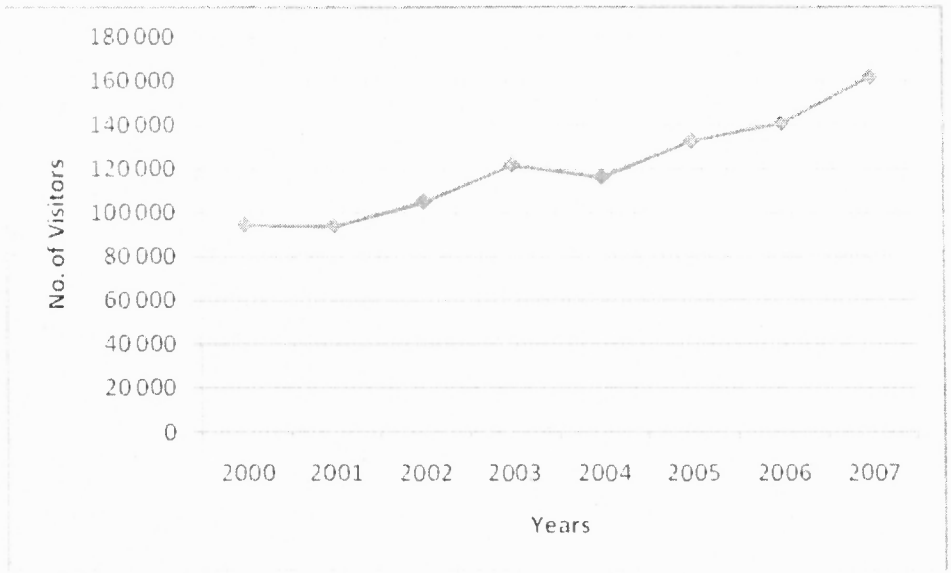
Graph 4 illustrates the variability of local land prices by focusing on the average cost per hectare of land actually purchased by SANParks for inclusion into the GAENP over a brief four year period. These variations reflect the condition, position and characteristics of the farms purchased. A breakdown of the purchases can be found in Appendix 1. This graph shows individual values for the various farms purchased, whereas Graph 2 shows the average cost of land purchased over a much longer period.

As mentioned earlier, expansion into the Alexandria area is largely precluded by the price of farmland there, largely driven by its suitability for dairy farming. From 1998 to 2002 farm prices in Alexandria varied between R1500 per hectare and R13 000 per hectare. While the **average amount paid per hectare** by SANParks for expansion of the GAENP over the same period was **R1115.32 (nominal value)**. These calculations illustrate the varying opportunity costs of buying land in the GAENP 'footprint'. It also shows that, on average, it appears that private game reserves spend more per hectare for land purchase than the National Park. It should also be noted however that a large number of the private game reserves are in the lucrative dairy farming area, which would result in higher farm prices.

3.6 Current (2008) Financial Performance of the GAENP

Since the formation of the GAENP there has been a year on year increase in visitor numbers. Graph 5 shows this increasing trend from 2000-2007. The rising visitor numbers to the GAENP have multiple origins, some demand side and some supply side. The latter involve increasing capacity. Accommodation on offer in the Park and surrounding areas has increased, moreover the Park's expansion means that more visitors can enter before congestion becomes a problem. On the demand side, the introduction of lions, and the wider range of ecosystems represented and facilities on offer, have made the park more attractive. Some of the rise in demand may also be attributable to a general rise in tourist numbers and is therefore independent of the Park's size and management (see Graph 1, page 41).

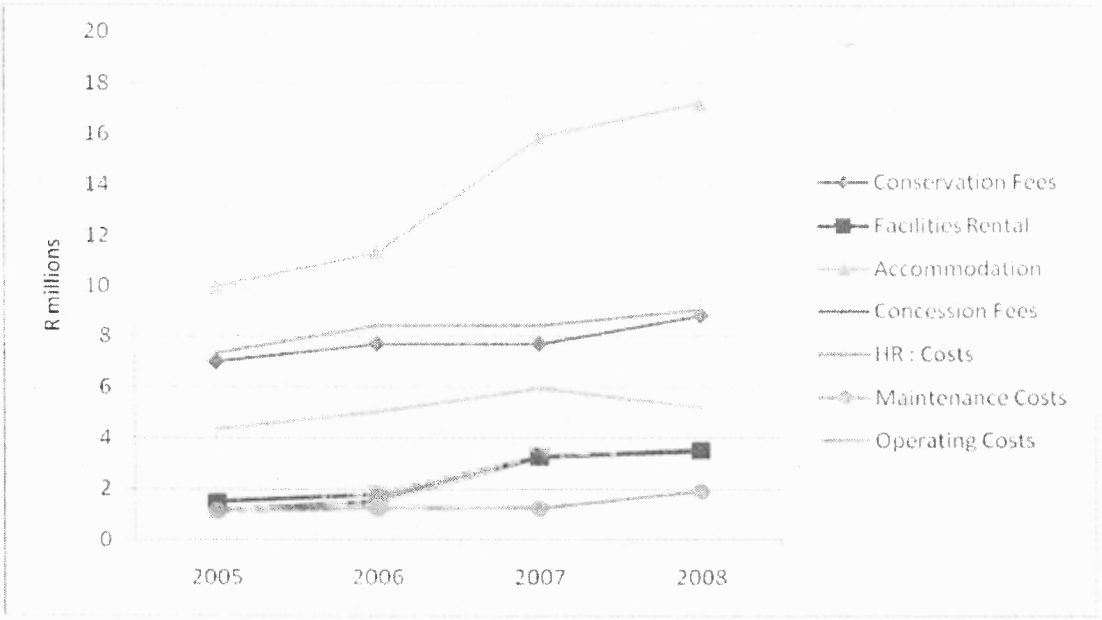
Graph 5: GAENP visitor numbers (2000-2007)



Source: GAENP Tourism Statistics, 2008

From an eco-tourism perspective, the GAENP is perfectly situated at the beginning/end of the Garden route, it is in a malaria-free area, and it offers a great diversity of fauna and flora, as well as a number of different accommodation options and experiences. All of this together with a general increase in tourism in South Africa resulted in an increase in the popularity of the GAENP as a tourist destination. It is very difficult therefore to ascertain the role of the expansion process on its own, as there are so many other variables involved, including stable management. A combination of all factors is most likely the reason for the growing success of the GAENP and increasing visitor numbers and resultant growth in income over the past few years.

Graph 6: Financial performance of the GAENP from 2005 to 2008, in nominal terms



Source: SANParks Financial Performance Statistics, 2007 & Connor & Zimmerman, 2008

In all areas there has been an increase over the years, with maintenance costs remaining the most stable. The relative increase in revenues is greater than the increase in costs, resulting in a net profit of R9.98 million in 2006 (SANParks Financial Performance Statistics, 2007). The graph shows that operating costs actually declined from 2007 to 2008.

In order to calculate the gross income per hectare the total area of the park is not used as the tourism facilities are currently only in the original 14 000 hectare section (Main section), as a result the figure is somewhat inflated; however there are private lodges/concessions in other sections of the park, and the income below is from the national park accommodation only. Working on these assumptions the **gross income per hectare** for the national park is **R1971.43** and the **net income**

per hectare is **R821.43 (in 2007 Rands)**. This result matches relatively closely with the figure found by Langholz & Kerley (2006). They found that the average gross revenue per hectare for private game reserves in the Eastern Cape was R976[10] (with a median R813).

Table 10: Occupancy and financial performance of the GAENP, 2000-2007 (in nominal terms)

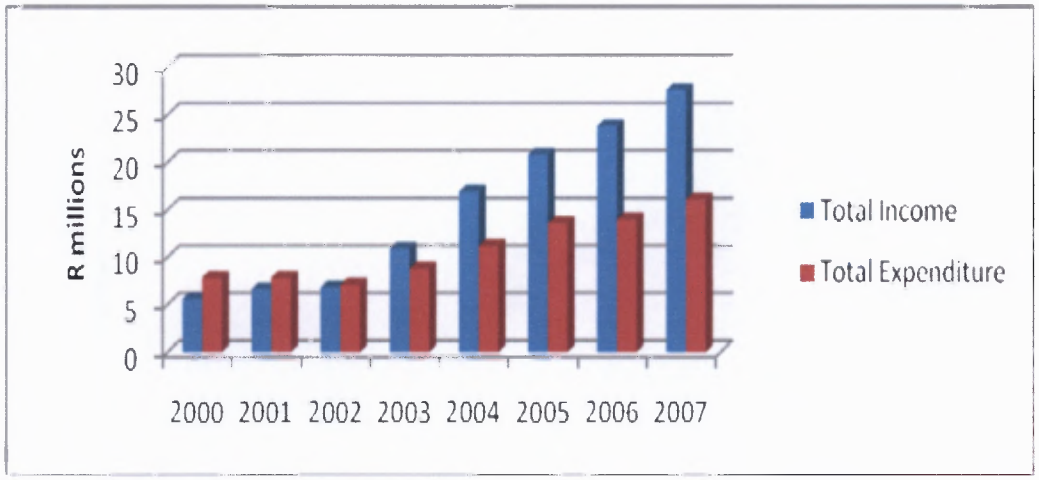
Year ended March	2000	2001	2002	2003	2004	2005	2006	2007
Visitors	94,669	93,976	105,028	122,123	116,484	132,734	140,745	161,884
Unit Occupation	81.2%	85.4%	81.2%	92.2%	89.3%	86.1%	90.8%	92.0%
Camp Occupation	56.8%	56.2%	60.2%	64.9%	72.3%	75.5%	76.0%	75.0%
Total Income (Rm)	R5,6	R6.6	R6.8	R10.9	R16.9	R20.8	R23.8	R27.6
Total Expenditure	R7.8	R7.8	R7.1	R8.8	R11.2	R13.6	R14.0	R16.1
Net Income(Deficit)	(R2.1)	(R1.2)	(R0.2)	R1.2	R5.7	R7.2	R9.7	R11.5

Source: AENP budget presentations, 2008, in Connor & Zimmerman, 2008

From Table 10 it can clearly be seen that the GAENP is performing very well from a financial perspective and has done so increasingly over the last few years. A unit occupancy of 92% for the year (2007) shows that there is still potential to expand. This occupancy is, to a certain extent, seasonal with peaks over the Christmas holiday season and all school holidays. The Park has however become increasingly busy in the winter season, largely due to increased marketing. The AENP has shown remarkable growth from a R2.1 million deficit to a profit of R11.5 million in 7 years (nominal values).

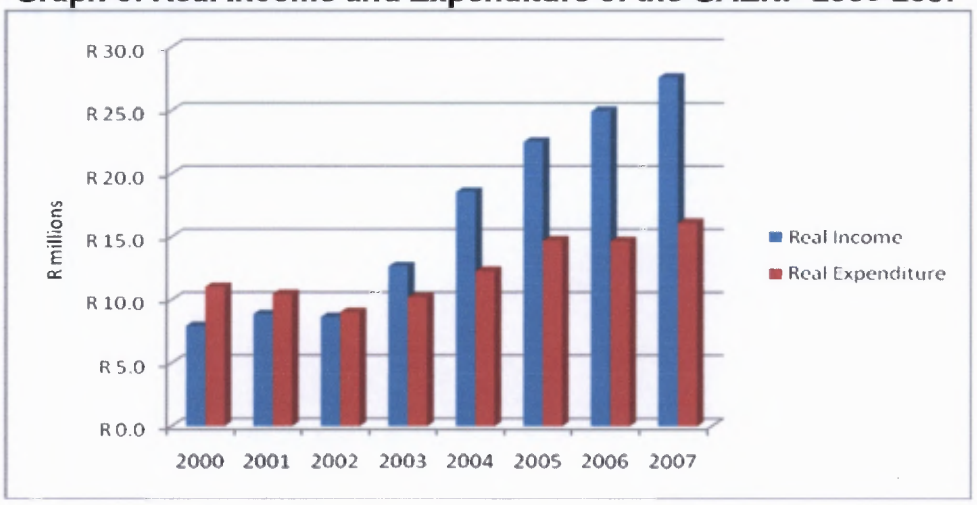
[10] R1021.87 in 2007 Rands

Graph 7: Nominal Income and Expenditure of the GAENP from 2000-2007



Source: GAENP Financial Performance, 2008

Graph 8: Real Income and Expenditure of the GAENP 2000-2007



Income has been increasing at a steady rate since 2002 with expenditure also increasing, but at a much slower rate. With an increase in the size of the park there is only a marginal increase in the expenses related to running the park (operating costs), but the potential gain from the increase in tourism is very large. Income has increased due to an increase in visitor numbers more so than because of an increase in rates. It is difficult to determine whether this increase was due to the expansion process or merely filling excess existing capacity. The National

Park has not increased entry fees and rates very much over the last 5 years as they aim to ensure that it is still an affordable experience, especially for South Africans. The conservation fee charged to international visitors for entry into the park is R100 per day and for South Africans, R25 per day (2008). The Park's ability to increase entry fees is constrained by the SANParks' mission: '*to develop and manage a system of national parks that represents the biodiversity, landscapes, and associated heritage assets of South Africa for the* ***sustainable use and benefit of all***' (www.sanparks.org).

Such constraints do not affect private conservation in the area. Langholz & Kerley (2006) found that in private game reserves (PGR) the gross revenues increased at a faster rate than the increase in the number of tourists. This was largely due to an increase in rates charged. The 4- & 5-star luxury lodges charge a much higher rate than the national park and this, increasing each year, has resulted in a sharp rise in gross revenues for PGRs. There has also been an increase in the occupancies of the PGRs over the last few years, which has added to this.

Table 11: Comparison of rates for different accommodation establishments in the Greater Addo Elephant National Park

Accommodation	Private or National Park	Rate (all rates are nominal values, 2008)	Dates Valid	Rate includes:
River Bend Lodge	Private – Contractual Park	Luxury Suite – R2800 per person sharing	1 Oct 2008-30 April 2009	Accommodation, all meals, teas & coffees, high tea, all safari activities with refreshments, park levies and entrance fees
Gorah Elephant Camp	Private Concession	R4995 per person sharing	1 Oct 2008 – 15 April 2009	Accommodation, all meals & teas, 2 game drives per day, non-alcoholic beverages and all beverages on game drives, park levies and entrance fees
Nguni River Lodges	Private Concession	R3670 per person sharing R4140 per person sharing	1 Sep 2008 – 31 Dec 2008 1 Jan 2009 – 30 April 2009	Accommodation, all meals, local alcoholic beverages and game activities
Addo Rest Camp Forest Cabins	National Park	R395 for 1 or 2 people + R100 per day conservation fee for International visitors and R25 per day for South Africans **(this conservation fee holds for all the park accommodation)**	1 Oct 2008 – 30 Sep 2009	Self-catering accommodation
Addo Rest Camp Rondawel	National Park	R600 for 1 or 2 people	Same as above	Self-catering accommodation
Addo Rest Camp Chalet	National Park	R605 for 1 or 2 people	Same as above	Self-catering accommodation
Domkrag Guest House	National Park	R1760 for 1-4 people	Same as above	Self-catering accommodation
Matholweni Rest Camp – Chalet	National Park	R605 for 1 or 2 people	Same as above	Self-catering accommodation
Narina Bush Camp	National Park	R640 for 1-4 people	Same as above	Self-catering accommodation

Source: www.riverbendlodge.co.za, www.hunterhotels.com, www.ngunilodges.co.za, www.sanparks.org

Table 11 illustrates the marked difference between the rates charged by the private accommodation establishments in the Park and the National Park accommodation itself. Note that the private accommodation includes the park levies and entrance fees, whereas all National Park accommodation does not.

Table 12: Actual Financial results (nominal values) for the AENP

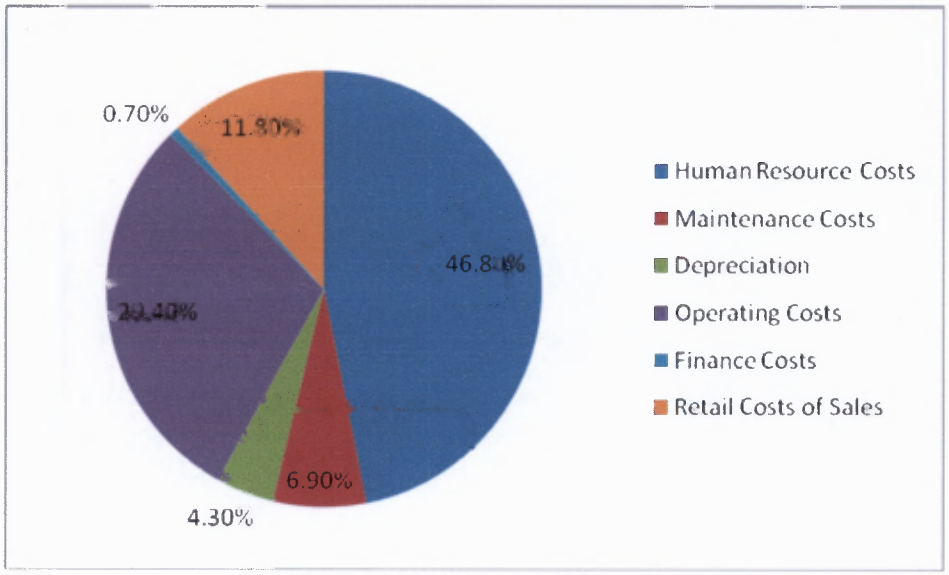
	ACTUAL FINANCIAL RESULTS*		
	MARCH 2007	MARCH 2008	%
Human Resource Costs	8,425,636	9,063,227	46.8%
Maintenance Costs	1,236,074	1,910,517	6.9%
Depreciation	781,619	865,398	4.3%
Operating Costs	5,295,577	5,202,952	29.4%
Finance Costs	128,687	145,156	0.7%
Retail Costs of Sales	2,121,616	2,481,281	11.8%
Total Expenses	17,989,209	19,668,531	100%

*these results are nominal values and not adjusted for inflation

Source: Connor & Zimmerman, 2008

Working on the total current park size of 168 000 hectares (2008) that would be incorporated in the operating costs we find an **average operating cost per hectare** of **R30.97** (in 2007 Rands). If one uses only 14 000 hectares in the calculation, the average operating cost per hectare works out to be R371.64 (in 2007 Rands).

Graph 9: Breakdown of Expenses for the GAENP



Graph 9 graphically represents the figures shown in Table 12. Human resource costs (wages, salaries and training of staff) are the largest single component

(46.8%) of the Park's running expenses. The Park employs permanent staff as well as casual labour in the form of builders, contractors, etc. The large amount of unskilled labour in the area means that there is scope for training and development. There is the necessity for a large amount of investment in human capital if there is to be the likelihood of an improvement in people's lives and future job prospects. The next largest expenditure is on operating costs (29.4%). These are likely to rise as the Park expands and extends its operations, though economies of scale in operation are likely. Tourism provides career and employment opportunities across the spectrum, from semi-skilled to highly skilled management levels and this allows a broader segment of the population to be impacted (Leechor & Fabricius, undated).

Table 13: Breakdown of Actual Income Received by the GAENP, in nominal Rands

	Actual Financial Results Nominal Rands		
	March 2007	**March 2008**	**%**
Conservation Fees (Gate – Per diem)	R7 716 651	R8 838 847	27.1%
Concession Fees (Rental & Turnover)	R3 277 651	R3 526 547	10.8%
Retail Turnover (incl. Gross Profit)	R2 246 831	R2 685 212	8.2%
Tourism Income (Accommodation)	R15 864 388	R17 216 852	52.8%
Other Income (Losses)	R648 648	R335 809	1.0%
Interest Received	R1 575		0.0%
Total Income	**R29 755 743**	**R32 603 266**	**100.0%**

Source: Connor & Zimmerman, 2008:45

In Table 13, the conservation fees are the daily rate charged to all visitors entering the park. The concession fees are the fees charged to private lodges for access of their guests to the park and operation within the park. The tourism income is from

the accommodation facilities in the main section of the park, including chalets, camping and caravan sites. From Table 13 it is evident that the largest income amount comes from people accessing and utilizing the Main section of the Park (almost 80%), showing the importance of the game-viewing experience to the success of the Park. The Main and Colchester sections are currently (2008) the only sections of the Park that are accessible to self-drive tourists, with the Main section being the only one of the two that has 'big game', such as elephants, lions, buffalo and rhino.

Table 14: GDP and Employment Multipliers for Operating Activities

GDP and Employment Multipliers For Operating Activities		March 2009 (nominal values)
Operations Leakage Effect	20%	R50 817 076
Operations GDP Impact (1.62)	R000's	R82 323 664
- National – RSA	1.62	R82 323 664
- Eastern Cape (84%)	1.38	R69 975 114
- AENP Precinct (% of E.Cape)	1.10	R55 980 091
Operations Employment Impact	Jobs/Rm	1 050
- National - RSA	16.53	1 050
- Eastern Cape (90%)	14.88	945
- AENP Precinct (% of E.Cape)	13.39	851
Operations Employment Impact and Skills	Jobs	1 050
High Level - Management	10%	105
Mid-Level - Administrative	11.5%	121
Semi-Skilled - Labourers	78.5%	824

Source: Connor & Zimmerman, 2008:52

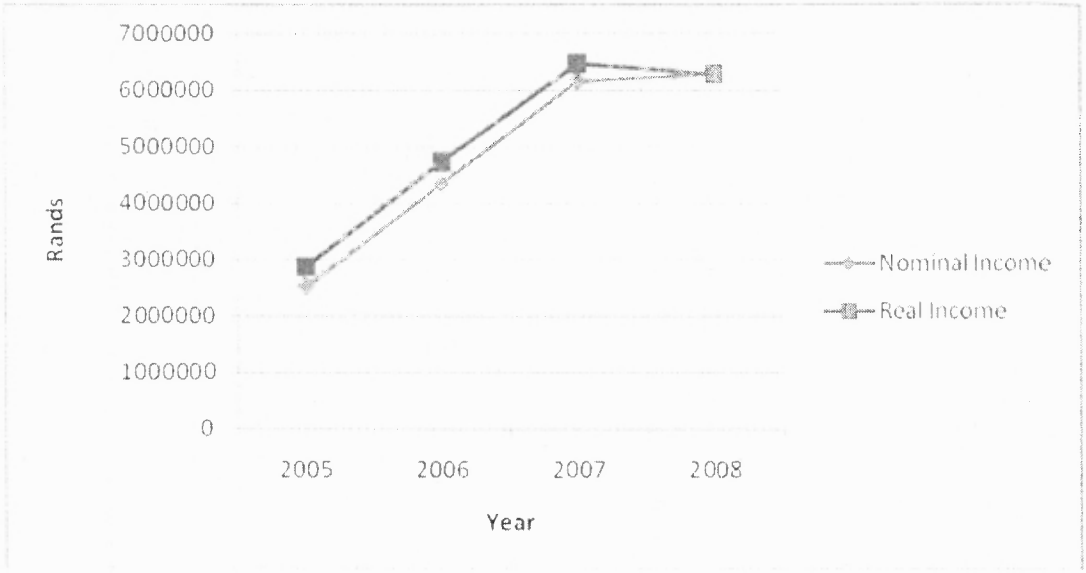
The multiplier effects computed by Connor & Zimmerman (2008) suggest that the GAENP would contribute over R82 million to the regional economy. Together with the employment impact of 1050 jobs, this would assist in reducing poverty and unemployment in the area.

Connor & Zimmerman (2008:49) claimed that the financial performance of *'the AENP shows a business which is undergoing strong organic growth, due to sound expansionary policies being implemented and matched by the provision of infrastructure and staff, in a cash positive environment'*. This growth may, in part, be due to an increase in tourism to the Eastern Cape, and specifically to the Addo Elephant National Park, independent of the Park's expansionary policy. The Park is certainly operating in a cash positive environment if one looks at the financial performance. Once again it is difficult to ascertain how much of this is due to the expansion of the Park, how much to normal economic growth and what is due to better management practices.

3.7 Other Sources of Income from Conservation as a land use

In June each year there is a game/wildlife auction held at the Kirkwood Wildlife Festival in the Eastern Cape Province. Game from National Parks as well as Private Game Reserves is sold at the auction. Income earned by the National Park from this auction is used to purchase more land for national parks. As can be seen from Graph 10 the income earned from the auction has increased over the years: conservation is to a certain extent 'paying' both for itself and for the expansion of land under conservation.

Graph 10: Income from Game Sales (2005-2008)



Source: GAENP Game Auctions, 2008

In a classic case of conservation rather than preservation, much of the game sold at this auction is purchased by trophy-hunting farms. The lesson for land management in the SRV is important: if managed properly, hunting can be a sustainable and ethical source of income and employment – whilst also being consistent with sound conservation practice. The next section looks at the costs to 'establish' land for use in conservation, i.e. the conversion costs associated with converting land from some other use to conservation. This gives a proportion of the opportunity costs associated with conservation as a land use.

3.8 Establishment Costs

Inclusion into the Park sometimes requires restoration of the land from an altered, sometimes degraded state, to its 'natural state'. The costs may include the

removal of buildings and internal fences, as well as the erection of game fencing along new Park boundaries. The definition of 'natural state' can be problematic as there are varying degrees of 'naturalness' and the question arises, how far back in history does one look to find out the 'original state' of the land? - an important point given the centuries of human habitation in the area and propensities of plants and animals to co-evolve with human societies over time.

Estimates obtained from the Park, based on what has been spent in the past to clear old infrastructure, show the establishment costs of roughly R20 -R30 per hectare in 2008 Rands (pers. comm. J. Adendorff, Conservation Manager, GAENP, 2008).

Once the old fencing and buildings have been removed the new area is fenced for game. There are two types of fencing currently used by the National Park:

- Predator-proof fencing – R34 400 per hectare @ R86.00 per running meter (in 2008 Rands)
- Standard game fencing – R30 400 per hectare @ R76.00 per running meter (in 2008 Rands)

(Source: pers. comm. J. Adendorff, Conservation Manager, GAENP, 2008)

Costs to establish the land as part of the Park thus amount to (using average R25 per hectare for infrastructure removal) **between R27 225 and R34 425 per hectare** (in 2008 Rands), depending on the type of fencing required and the shape of the land area to be added. The average fencing cost is likely to decrease with the number of hectares included. These costs do not include the restocking of the

area with game, which is often necessary. The calculated cost here is the cost needed to set aside the land in a way suitable for conservation, i.e. to ensure that it is not used for agriculture, development or any other use. Once established, there are operating costs associated with conservation. These are discussed in section 3.9.

3.9 Conservation Operating Costs

The costs of operating a National Park include both the tourism and conservation sides of the business. Tourism, the side which brings in income and cash flow to run the conservation, is often ignored in an analysis. Table 15 shows **average conservation operating cost per hectare** for the years 2000 to 2002, with projected budget figures for 2002/2003. This average figure also includes conservation management costs.

Table 15: Average Conservation Cost per Hectare for GAENP (including management costs)

Period	Conservation Cost per Hectare
2000/2001	R27.76
2001/2002	R28.12
Budget for 2002/2003	R50.89

Source: GAENP, 2008

The 2000-2002 period included Addo Main section and the Zuurberg section, whereas the budgeted 2002/2003 period also included the Woody Cape Section. The Woody Cape section required considerable expenditure on land restoration and on the removal of buildings and fences from dairy farms, hence the marked increase in conservation cost per hectare.

Table 16 shows the **average conservation** cost per hectare (excluding management costs) for the same periods.

Table 16: Average Conservation Cost per Hectare for the GAENP (excluding management costs)

Period	Average Conservation Cost per Hectare (excluding management costs)
2000/2001	R19.65
2001/2002	R20.91
Budget for 2002/2003	R32.21

Source: GAENP, 2008

2000/2001 and 2001/2002 included a total area of 115 000 ha. This comprised the Addo Main section and the Zuurberg section. The 2002/2003 period included an area of 140 000 ha, with the addition of the Woody Cape section. These results will be compared later in this section with more recent figures in order to confirm their accuracy.

Table 17 shows the **budgeted** operating conservation costs for the GAENP, with the budget for poverty relief programmes (*) included. This is included in the operating costs, as the Park would not be able to fulfill its function of alien vegetation control and rehabilitation of land without this money. Though the money is not from the SANParks budget per se, it is part of the operating function of the conservation section.

Table 17: Budgeted Conservation Operating Costs for the GAENP, nominal Rands (2008)

Section	Operating costs
Addo	R 1,600,000.00
Zuurberg	R 1,100,000.00
Woody Cape	R 2,300,000.00
Darlington	R 1,000,000.00
Kabouga	R 800,000.00
WfW Addo*	R 1,900,000.00
WfW Woody Cape*	R 692,000.00
Coast Care*	R 3,000,000.00
TOTAL	**R 12,392,000.00**
Total Hectares	168 000
Cost per hectare	**R 73.76**

* Poverty relief funds, Working for Water and Coast Care

Source: pers. comm. J. Adendorff, Conservation Manager, GAENP, 2008

The 2008 **conservation operating costs per hectare** shown above are considerably higher than the 2002 figure (excluding management costs) presented in Table 15. When management costs are included the conservation operating costs from the 2002/2003 budget in 2008 Rands is R71.51 per hectare, which is very similar to the figure calculated in Table 17. Allowing for rising prices the 2002/2003 budget amount would be R45.26 in 2008 Rands. However this is still substantially lower than the calculated R73.76 in Table 17. The Marine section of the Park has not been included in the total hectares, as employment figures and operating costs used do not include this section. The Park has expanded considerably i n the past 5 years and with that there have been higher costs associated with conserving the expanded area than was budgeted for. Section 3.10 looks at the impacts of conservation as a land use on employment in terms of employment creation, average wage, etc.

3.10 Employment

Much of the data used in this section relies on the recent work by Connor & Zimmerman (2008), who were investigating the socio-economic impacts of the GAENP.

Most bed and breakfast establishments in the area are situated on existing citrus or vegetable farms. Some would probably exist anyhow, albeit in a less profitable form. A number of the other businesses in the area would also still exist, e.g. service stations or garages which supply the citrus industry. It is difficult to determine exactly how many of the businesses in the area are totally dependent on the Park or would not exist if the Park were smaller? Looking at business growth in the area since the formation of the Park and through the period of its expansion, it is clear, however, that the relationship is positive. According to Connor & Zimmerman (2008), the contribution of the AENP to the economy of the Eastern Cape has become increasingly important with the overall decline in large scale agriculture during the recent years. A closer look suggests that they may have erred in this view at the local level. Though agriculture has indeed declined elsewhere in South Africa there has been an expansion of citrus cultivation in the SRV over the past few years (pers. comm. Citrus farmers SRV, B. Nel and A. Serfontein, 2008).

The Connor and Zimmerman report makes it clear however that regional agriculture has experienced difficulties in the recent past. In 2006, together with the Western Cape, the Eastern Cape had the lowest number of full-time

agricultural workers (11 428) and the lowest agricultural expenditure in the country (Survey of Large Scale Agriculture, www.statssa.gov.za). There have also been losses in the form of natural disasters, disease, theft, and absenteeism; problems that have led farmers towards employment of casual and part-time (seasonal) labour on farms (Connor & Zimmerman, 2008). With this shift, there has come reduced job security, increased seasonal unemployment and longer periods between jobs. All are evident in the SRV where few of the many semi-skilled and unskilled farm workers have been able to acquire the skills needed to change their employment patterns. Table 18 shows that in 2001 almost 7% of the economically active population in the SRV were seasonal workers. It is the author's opinion that this percentage has grown in the past 8 years.

Table 18: Economically Active population in SRV

	TOTAL
Employed	9775
Unemployed	5306
Scholar or student	2930
Homemaker or housewife	1003
Pensioner or retired person	2042
Unable to work due to illness or disability	956
Seasonal worker not working presently	1816
Does not choose to work	995
Not applicable	1568
TOTAL	**26391**

Source: Census 2001, Statistics for the SRV local municipality, www.statssa.gov.za

Conservation work does offer an escape: Table 19 shows the historic employment of 52 GAENP workers (Connor & Zimmerman, 2008). Importantly 65.3% of the interviewees were previously employed in the farming sector. Such a move from farming sector employment to the tourism industry has had a variety of consequences; it often increased the worker's wages (Langholz & Kerley, 2006

and Smith & Wilson, 2002), provided training and thus improved their future employment prospects.

Table 19: Previous employment patterns of AENP employees

Type of employment	Number	Percentage
Citrus picking	9	17.3%
Bush clearing	3	5.8%
Fencing	2	3.8%
Herding	2	3.8%
Farm work	18	34.6%
Tourist	11	21.2%
Other	7	13.5%
TOTAL	52	100%

'Other' refers to individuals either previously unemployed, or employed in the public sector

Source: Connor & Zimmerman, 2008

According to Langholz & Kerley (2006), 63.5% of tourism businesses invested in in-house education and training of staff. Such training and education allows individuals to acquire skills that will assist them in the job market in the future, if needed. Ecotourism can offer unskilled labourers the chance to develop new skills that exposes them to a wider variety of employment opportunities than agriculture would (Coastal & Environmental Services Strategic Environmental Assessment Report, 2001 and pers. obs. by the author, 2004-2008). A study done by Huggins et al (2003) (in Connor & Zimmerman, 2008)), found that 24% of farm workers were uneducated and that average household cash income was R698, a significant portion of incomes coming as performance bonuses ('payment in kind'). Connor & Zimmerman's study (2008) found that monthly salaries in tourism businesses averaged R1300.00 per person per month. From section 3.4 (page 51), it appears that their claim of a four times increase in salaries when converting from agriculture to eco-tourism is considerably exaggerated; the figure they found was just over

double a figure in the 2001 survey. Since then wages have generally inflated, and minimum wages were introduced for agricultural workers. From Table 21 it is possible to calculate the average monthly wage per employee currently employed in the GAENP: in 2007 Rands it works out to be R2047.08. When compared with the farm wages illustrated in the SEAs, this salary is about two and a half times higher, not four times as was claimed in the SEA (2002). Connor & Zimmerman (2008:24) found that wages ranged from R250-R350 for part-time workers (daily rates once, twice or three times a week) to R1800 and, at the top end of the scale R8000-R15000. They contend that, '*the tourism industry has clearly created a much better package for employees than the farming sector, through a combination of good wages, payment in kind and training and education*' (p24). The expansion of the park has also broadened the range of tourism activities available. This creates more employment for a wider group of people. The Park's expansion has also extended the employment impact to a broader area, not just around Addo Town, but as far as Jansenville (the Darlington section) and Kirkwood (the Kabouga section).

Despite these increases in wages and improvements in training, there are still a number of opportunities to include more of the local community in the benefits from the park through local business and employment. A commonly expressed opinion of the local communities (pers. comm. with members of the surrounding communities, 2008) was that though there have been a number of jobs created for them and their families, there are still unused opportunities for them to be personally involved in the tourism industry; township tours, local food restaurants, and curio sales were cited as examples. Greater involvement would not only assist

in reducing poverty and unemployment, but would also ensure the support of local communities in the expansion and conservation policies of the Park in the future.

As shown in Table 20, the number of people employed in businesses around the AENP has increased by more than 100% in the last five years. This clearly coincides with the growth in the tourism industry in the area but whether this growth in employment can solely be attributed to the growth and expansion of the AENP is uncertain. Other factors that may have played a role include generally increased tourism in South Africa and general economic growth. It does seem clear, however, that the Park has had a role.

Table 20: Number of Employees in Tourism Businesses around the GAENP

Time Period	Number of Employees
At inception	43
Five years ago	210
Currently	557

Source: Connor & Zimmerman, 2008

Connor & Zimmerman's survey (2008) found that of the 170 businesses around the GAENP, 150 businesses (88.5%) said that they owed their existence to it. In other words, they believed that they would not exist if the Park was not there. Projecting from an average of 10.71 workers per establishment these 150 businesses would employ 1606.5 employees. If each one of these employees supported a family of four, 8033 people would depend on the Park (Connor & Zimmerman, 2008). They adopt the rule of thumb that every one job in the tourism industry creates a further two jobs incrementally, this suggests 4819.5 employees per business as an extended figure for the AENP (Connor & Zimmerman, 2008:26). This figure

appears to be an over-estimate in an area such as the SRV. Although there is initially likely to be such an incremental increase, it is unlikely to continue as the number of jobs in tourism in the area increase. There is a point where the number of non-tourism jobs is likely to stop increasing. Further investigation of this rule of thumb should be conducted to ensure its validity in varying situations.

It remains unclear whether the trend tying local economic growth to Park size will continue with further expansion. Is there a saturation point that will be reached in the tourism industry in the SRV? Upcoming events such as the Soccer World Cup may suggest room for further expansion, but will all businesses survive after that – are there enough tourists to sustain the industry in the long term? Langholz & Kerley (2006:16) reported that the majority of private game reserves in the area felt that the tourism industry in the Eastern Cape was still in its infancy and had lots of room for expansion. As the Park expands and diversifies the portfolio of activities available to tourists, there is scope for a growth in tourist numbers. There are a number of reasons why park size need not correlate directly with its employment impacts. One is that jobs are tied more closely to tourists and the services they demand than to the Park's activities in ecosystem preservation. In trying to determine the number of employees per hectare, one needs to take into consideration that a large percentage of the park is currently pure conservation area, with very little employment and no tourism facilities. Job creation in such areas is minimal and the direct economic value of conservation activities on them is close to zero except where ecological impacts spill-over to enhance the value of adjacent Park areas open to tourism. The total size of the Park (end of 2008) is 168 000 hectares, including the Main section accommodation of the Park and

Mathoylweni and Narina Bush Camp, which are owned by the National Park, and the private accommodations at River Bend Lodge, Nguni River Lodges, Gorah Elephant Camp, Kuzuko Lodge, Darlington Dam Lodge and Intsomi Lodge. Calculating **average number of employees** per hectare results in a figure of **0.01 employees per hectare**. This is worked out from the number of people employed in surrounding businesses being 1606.5 plus those employed inside the AENP (343) – see Table 18 above, totaling 1949.5, divided into the 168 000 hectares of the Park. This calculation assumes that the surrounding businesses would not exist if it were not for the Park. If one uses only the employees directly employed by the GAENP then the **average number of employees per hectare** comes to **0.002** for the entire 168 000 hectares of the Park and **0.02 if one uses only the 14 000 hectares of Main section**, where the majority of the Park employees are employed. Although it does seem evident that the businesses surrounding the Park benefit from its existence, some of the businesses would still exist if the Park did not exist, though maybe not operate as profitably. The expansion decision is at the margin, not at the average. It is therefore unlikely that there will be one new park job for say every 50 hectares added to the park. This is an important point to note, because the average and marginal changes in citrus farming are likely to be more similar.

Sims-Castley (2002) found that for private game reserves in the Eastern Cape, the gross income/ha was R1944 and the jobs/ha was equal to 0.01. For national park the results were: gross income/ha of R485 and jobs/ha of 0.005. The employment figure for national park land was calculated in 2001 and based only on the size of the main section of the Park (14 000 ha). This figure is half that of the 0.02

employees/ha calculated for the main section above. Since both figures are in nominal terms the turnover of R345 per hectare per annum calculated by Connor & Zimmerman in 2008 (see Table 21 below) is well below that calculated by Sims-Castley six years earlier.

The GAENP has shown a steady increase in employment numbers over the years. Connor & Zimmerman (2008) assumed that the increase in employment in the AENP itself from 2007 to 2008 was due to the hiring of unskilled labourers to assist with infrastructure projects being implemented with external funding. If valid, their assumption would also explain the drop in average earnings over this period (see Table 21). If we take the human resource cost, from Table 12, of R8 425 636, and divide through by the total hectares of the park of 168 000, then the **mean wage payment per hectare** is **R50.15 per month**. The total hectares (168 000) of the Park are used in this calculation because the human resource cost includes all rangers and other staff employed in all sections of the Park, not just the Main section.

Table 21: Employee Statistics for the AENP

	Employee Statistics for the AENP	
	March 2007	**March 2008**
Total Employment in the AENP	343	400
Average Wage per Employee (p.a.)	R24 565	R22 658
Average Visitors per Employee per day	1.16	1.11
Total Hectares	171 647	304 705
Turnover per hectare (p.a.)	R345	R211

Source: Connor & Zimmerman, 2008: 49

An issue of debate arises from the popular notion that one job is created in the local economy for every ten foreign visitors (a generalization cited by Le Quesne & Calverley, 1998). This figure applies to South Africa as a whole. In 2007 the

average number of tourists to visit the park was 161 884 (AENP Statistics, 2008). Connor and Zimmerman found that the average number of jobs in businesses in the area and related to tourism was 4819.5. Adding this to the number of people employed in the park (343) gives a total of 5162.5 and an average of 1 job for every 31.3 tourists: quite different from the accepted ratio of 1:10. With an observed decline in total direct spending by foreigners (SA Tourism Report, 2008) it makes intuitive sense that even more tourists will now be needed to create one job than in the past. One should also consider that many of the tourists are visiting more than Addo: if they come to the Eastern Cape as 30% of their holiday, and spend half of this time at Addo, then it is only giving 15% of those jobs. The figure of 4819.50 stated by Connor and Zimmerman (2008) is based on a rule of thumb. Their direct observation was only 1606 jobs: this would make the actual direct job creation per tourist even lower at about 1 job per 100 tourists.

A problem facing conservation areas is that although they provide a positive impact on surrounding communities in terms of employment, income flow, etc. they may offer little in the way of skills training and upliftment. Most senior positions within the Parks, Lodges, Reserves, etc. are held by people who do not come from the surrounding communities, but from outside the area, and often outside the province. This is true of the SRV as well and is discussed further in Appendix 5.

3.11 Consumption Diary Results showing Flow of Income to Communities

The official household income and consumption surveys have contributed little to our understanding of the linkages between tourism generated incomes and the local economy in the Addo area. The social accounting matrices have given even less locally relevant information (pers. comm. K.Pauw, UCT SAMs, 2008). In order to shed some further light it was decided to do a short term consumption diary case study. The results and discussion of these consumption diaries are presented in Appendix 5.

3.12 Summary of conservation as a land use

In conclusion, it is clear that policy should be aimed at skills training and development to ensure that there is social upliftment and improved education and skills development of people living in the areas surrounding National Parks and private game reserves. Due to the poverty in the area, and the large number of unskilled jobs available, particularly in the citrus industry, there has been little incentive for the local community to gain further education or acquire skills. This needs to change if there is to be a long-term impact on poverty and unemployment. Empowering local communities is key to sustained development.

Based on the calculations in this chapter, the 'value' of land in the form of conservation can be summarized as follows:

Table 22: Summary of Conservation as a Land Use

Per Hectare Results	Amount (2007 Rands)
Gross Income	R1971.43*
Net Income	R821.43*
Employment per hectare	0.02 employees directly employed by the Park (14 000 ha) 0.002 employees directly employed by the Park (168 000 ha) 0.14 employees, if surrounding businesses dependent on the Park's existence are included
Average value of land upon purchase	R3288.21
Average cost of land per hectare	R1115.32 (nominal value)
Current value of the land	No less than R3000.00 per hectare**, and in some areas close to R7000/ha
Establishment Costs	R30 825 per hectare (average)
Operating Costs	R73.76 per hectare for conservation alone R30.97 per hectare for operating costs for the entire 168 000 hectares of the Park
Employment cost per hectare	R50.15

* Based on the Park size of 14 000 hectares, as the income figures used are for the Main Section of the Park only.

**This figure is an estimate gained from pers. comm. with J. Adendorff, SANParks, 2008, but is highly variable, depending on the section of the Park being assessed. Each biome differs from the others and the land values vary accordingly. As mentioned in the chapter, land in the Karoo biome is considerably cheaper than that in the coastal areas where dairy farming is widely spread.

The above figures apply to conservation as a land use under National Park management only. It appears from comparisons (section 3.6, pg. 60) that the situation is not very different under private management, though the average wage and income earned per hectare are in most cases higher under private management (Langholz & Kerley, 2006).

From a purely conservationist perspective, it matters little whether the land in a nature reserve is privately or publicly/state owned. It is true that some private landowners have introduced extra-limital species, but this has not been proved to undermine the conservation objective. From an employment and poverty alleviation perspective privately owned conservation areas offer more, but state-owned land is certainly a catalyst for economic growth.

The employment effect of conservation does not appear that substantial when looked at on a per hectare basis, but there is a large multiplier effect. The increased skills and training provided by jobs in eco-tourism also add to welfare in the area. Jobs in conservation and eco-tourism are also largely permanent and therefore more stable than seasonal jobs in agriculture and hunting.

Chapter 2 has discussed and summarized the available information on the direct costs and benefits of conservation as a land use in the SRV. More tenuous issues (some of which will be addressed separately in Chapter 4) are the non-use values conservation can add to the land in the form of carbon sequestration potential, watershed protection and biodiversity conservation. The success of private game reserves shows clearly that conservation can pay as a land use. What this chapter has tried to show is that State administered conservation activities that offer low cost enjoyment of nature to a broader public do not just provide utility to game viewers, but have financial, environmental, economic and social value that can add

to the social utility/welfare of the region and beyond. There is, however, an opportunity cost.

The next chapter looks at the possibility of restoring land and earning a passive income through the Clean Development Mechanism of the Kyoto Protocol. This land use is a relatively new option and gaining popularity but, as will be shown, there is a large amount of uncertainty and risk attached that may result in landowners being skeptical about this option. It is however a viable option from a number of different perspectives and for that reason has been included. It is also very topical and in our world of changing climate it is essential to have alternatives that are sustainable and help to mitigate climate change and enhance biological diversity. It is also a use that can be used in conjunction with citrus farming and conservation. Expanding the GAENP into current farming areas would not just mean more animals, but would also mean re-establishment or densification of the Subtropical Thicket. More conservation therefore also means more carbon capture. The opportunity cost of conservation is normally given as the agricultural and employment benefits sacrificed, while the benefits of conservation are the tourism revenues and jobs created. A further benefit, as will be shown in the following chapter, is that of carbon capture. This should be added as a further benefit over and above that of tourism incomes, jobs, etc.

4. IMPLICATIONS OF CARBON SEQUESTRATION BENEFIT FLOWS FOR CONSERVATION

A land use increasingly under consideration is restoring degraded land for conservation and carbon sequestration. Although this is always an aspect of rehabilitation (and some aspects of farming like citrus orchards), it can be regarded as a separate land use since the optimal level of vegetation rehabilitation for say game viewing and for carbon sequestration differ. Converting land to conservation and the subsequent restoration of the land results in carbon capture, which is therefore an added benefit of conservation as a land-use. This will be the topic of this chapter. Before discussing carbon sequestration and the associated benefits the chapter will look at climate change in South Africa, the legal framework relating to the carbon market and will give a short analysis of the carbon market. A detailed analysis of the Subtropical Thicket restoration project taking place in the Darlington section of the GAENP will follow, including analysis of the operating costs, employment effects and the financial implications of restoration.

4.1. Climate Change in South Africa

It has been conservatively estimated that climate change in South Africa will carry a cost of about 1 - 2% of Gross Domestic Product by 2050 (possibly up to 6%), due to changes in ecosystem productivity, ecotourism opportunities, disease vectors and agricultural production and infrastructural damage, among other effects (Turpie et al. 2004). The estimated damages are equivalent to about R80 per ton of carbon

emitted (through vegetation destruction and subsequent carbon losses), taking into account the fact that carbon contributes about 60% of total greenhouse gas emissions in South Africa (Scholes & van der Merwe 1995, Rowlands 1996 in Turpie et al, 2004). The sequestration of carbon by ecosystems thus has a positive economic value. (Turpie et al, 2004).

Increasing concern about global climate change and the setting of emissions targets to reduce global CO2 levels has led to an increasing interest in carbon sequestration[11]. One area of particular interest in this dissertation is the income generating potential of non-Annex 1 countries that offset emissions in Annex 1[12] countries. The sequestration of carbon from the atmosphere into soils or vegetation is one way to buy time for the implementation of alternative energy sources and thereby mitigate global climate change (Mills et al, 2003).

The ability of natural vegetation to sequester carbon depends on soil, water and climate. There is considerable spatial variation in the distribution of these across the SRV. The average annual rainfall for the Main section of the Park is around 350mm and not far away (about 5-10km) in the Zuurberg section it is about 700mm per annum. Soil fertility, slope, depth, drainage, etc. also vary across the Valley. This means that a single land use management practice cannot optimize carbon capture across an area like the SRV.

[11] Carbon sequestration is the 'locking up' of carbon in a solid state (Sims-Castley, 2002)

12 Annex I to the United Nations Framework Convention on Climate Change (UNFCCC) sets out a list of developed country Parties and economies-in-transition Parties that commit themselves under Article 4 to achieve certain quantified emission limitation and reduction objectives. If they have ratified the Kyoto Protocol, these Parties can authorise the participation of entities in CDM projects, but are not eligible to be host Parties (www.cdmrulebook.org)

The economic feasibility and competitiveness of carbon sequestration as a primary land use depends on the opportunity cost per ton of carbon, i.e. the opportunity cost per hectare of changing land use divided by the rate of carbon accumulation (Antle & McCarl, 2001:13). Spatial variability in land productivity means variability in these opportunity costs (Antle & McCarl, 2001). Restoration of natural vegetation is obviously the ideal from a biological diversity point of view, but **all** vegetation sequesters carbon to a certain extent. In the Sundays River Valley (SRV) the large areas of citrus trees also provide a sink and could play a role in the Clean Development Mechanism (CDM) – to be described in section 4.2. Plantation forestry can sequester considerable amounts of carbon, but is water demanding. A major problem in South Africa is water shortage, unreliable rains and the capacity of non-indigenous vegetation to consume large amounts of water. From this point of view, restoration of natural vegetation has an advantage (see Higgins et al, 1997).

4.2 Kyoto Protocol and Clean Development Mechanism (CDM)

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC). The Protocol commits the signatories to achieving set emissions reductions during the period 2008-2012. Under the Treaty countries are intended to meet their targets using domestic controls, but three market-based mechanisms are also provided for (http://unfccc.int/kyoto_protocol/items/2830.php). One of these three, the one of most immediate relevance, is the Clean Development Mechanism (CDM); the other two

are Emissions Trading (ET) and Joint Implementation (JI)[13]. The CDM allows entities from Annex I (developed) countries to develop emission-reducing projects in non-Annex I (developing) countries and generate tradable credits corresponding to the volume of emission reductions achieved by that project (www.cdmrulebook.org). This therefore allows developed countries who exceed their Kyoto limits to purchase offsets from a country or region that manages such carbon sinks (Zelek & Shively, 2003). These come through saleable certified emission reduction (CER) credits. Each CER is equivalent to one tonne of CO2, which can be counted towards meeting Kyoto targets (http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php). The carbon price is currently (2008) around 20 Euros a tonne, whereas the penalty for non-compliance of the Kyoto standards in the 2008-2012 commitment period is 100 Euros per tonne. It thus makes financial sense to engage in trading of some sort to meet targets if it cannot be done by internal methods alone.

Although CER prices showed remarkable stability during 2006 (Capoor & Ambrosi, 2007), mainly due to China's market power, following the 2008 decline in the global economy the price of CERs has fallen sharply. China had a dominant share (61%) of the CDM and through that influenced the overall market price through their informal policy of requiring a minimum acceptable price before giving approval to projects (Capoor & Ambrosi, 2007). The average price for CERs from developing

[13] **Joint Implementation (JI):** Mechanism provided by Article 6 of the Kyoto Protocol, whereby a country included in Annex I of the UNFCCC and the Kyoto Protocol may acquire Emission Reduction Units when it helps to finance projects that reduce net emissions in another industrialized country (including countries with economies in transition) (Capoor & Ambrosi, 2007:44)

countries in 2006 showed a 52% increase over 2005, and was US$10.90 or Euro 8.40 per tonne (Capoor & Ambrosi, 2007).

Africa only hosted about 3% of the registered projects, despite a very large potential to participate. Uncertainty and risk associated with the CDM, as well as the substantial financial investment required to register and certify a project are all factors that are deterring African countries from participating. The income potential from the CDM, as well as its very important role in combating climate change, could assist African countries in their social and economic development. Large tracts of land in African countries are d egraded and have the potential to be restored and used in the CDM projects, thereby promoting biodiversity, generating income and creating jobs through the restoration project, as well as improving the productivity of the land for future use.

According to Article 12.5 of the Kyoto Protocol, certification of project activities in the CDM requires:

(a) Voluntary participation by each Party involved;

(b) Real, measurable, and long-term benefits related to the mitigation of climate change; and

(c) Reductions in emissions that are additional to any that would occur in the absence of the certified project activity (the additionality clause).

(http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/).

All of the above conditions could be met through restoration projects in the SRV, making restoration hypothetically feasible as a land use option.

4.3 The Carbon Market

The market for sequestered carbon is now well established and formalized. Payments for carbon transactions are made using one of the following methods: cash, debt, equity, convertible debt or warrant, or in-kind contributions such as providing technology to abate greenhouse gas (GHG) emissions (Capoor & Ambrosi, 2007:14).

Capoor and Ambrosi (2007) provide a detailed description of the carbon transaction categories as well as other facets of the carbon market. Within the carbon market, the buyer of a carbon contract never actually takes delivery of the commodity. The commodity is therefore embodied as an asset that belongs to the land owner (Antle & McCarl, 2001).

In any agricultural or afforestation project, the net carbon accrual is a function of the amount of carbon fixed by photosynthesis less the amount of carbon released by the plant a t night, as well as soil respiration (Mills et al, 2003). Benefits associated with farming for carbon, other than the carbon 'fixing' include, amongst others:

- soil carbon is often highlighted as the key characteristic for soil quality (Gregorich et al., 1994, in Mills et al, 2003). This is because soil carbon tends to increase aggregate stability, water-holding capacity and nutrient-

holding capacity of the soil. By increasing soil carbon levels farmers are likely to increase productivity of their land due to greater availability of water and nutrients for crops;

- Restoring carbon stocks in degraded soils will often entail re-vegetation with indigenous plant species. Soil carbon sequestration programmes may therefore have associated benefits of increases in biodiversity;

- Furthermore, ecosystem productivity is likely to increase with an increase in soil carbon and this may result in associated benefits such as greater yields from livestock farming or wild-harvesting of produce such as fruits, flowers, thatch or timber (Mills et al, 2003);

- Water supply – vegetation provides watershed protection and the maintenance of water quality by retaining water in the soil, reducing erosion, filtering drinking water and regulating water flow (Sims-Castley, 2002).

A further benefit of this land use is that the land remains available for other natural resource-based uses such as eco-tourism and hunting (Lechmere-Oertel, 2003), which can be more sustainable in the long run and as discussed in Chapter 3 can often provide employment and training, along with the possibility of higher wages. Restoration and eco-tourism and/or hunting can co-exist even though game viewing and hunting in full thicket is difficult due to the height and density of the vegetation, it does provide food and security for the animals.

According to Turpie (2003) game farming with indigenous game favours the recovery of thicket, but the recovery is extremely slow. So though it is not ideal

from a recovery point of view, one could combine game farming, for eco-tourism or hunting operations, with a restoration project. The opposite also holds – creating areas for eco-tourism and hunting, results in a certain amount of natural restoration and this results in carbon capture that is important in terms of mitigating climate change. Restoration of this nature would not necessarily be able to be used in a carbon trading project, but it is certainly an added benefit of converting land to conservation/eco-tourism.

The incentive for a land manager to farm carbon depends on the price of carbon as well as the rate of carbon gain. The income that farmers may receive for carbon sequestration in the future is dependent on:

i) the amount of carbon that has been lost from virgin bush as a result of human-induced activities, e.g. agriculture, stock farming;
ii) the time required to restore the lost carbon;
iii) price of carbon; and
iv) amount of land available for sequestration (Mills et al, 2003).

The Marrakech Accords[14] stipulate that carbon sequestered in agricultural landscapes can be only be traded if the virgin ecosystems have not been damaged since 1990. Land management for sequestering carbon can thus include improved tillage/cropping practices on lands cultivated prior to 1990 and/or

[14] The Marrakesh Accords (2001) were a series of decisions adopted at the seventh Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC), related to the Kyoto Protocol (www.unep.org)

re-vegetation of such lands with indigenous vegetation of the region (Mills et al, 2003).

4.4 Uncertainty associated with the carbon market

There is considerable risk attached to sequestration programmes. There is uncertainty about the future of the Clean Development Mechanism (CDM) after the initial Kyoto period 2008-2012, uncertainty about the price of carbon, as well as uncertainty surrounding the possible inclusion of Avoided Deforestation (AD) into Kyoto and its effect on the price of carbon. Baseline measurement for the carbon storage capabilities also introduces uncertainty. Permanence and additionality are also issues to be considered. Permanence refers to how long the carbon will be stored and to the possibility of loss through fire, harvest, etc. Additionality[15] refers to proving that the carbon stored is 'extra' or over and above what would have occurred without the project. Payments will only be made if the carbon storage is additional to what would have occurred without the project. Measurement of this is problematic and therefore introduces uncertainty.

The topic of avoided deforestation (AD) is currently (2008) very much in the news and the possibility of its inclusion in Kyoto needs to be considered. There is a large amount of natural vegetation still occurring in the Eastern Cape; in terms of 'avoided deforestation' farmers who have kept their farms in pristine condition will be 'rewarded'. Such a policy would cause a drop in the price of carbon and

[15] ***Additionality:*** Refers to the carbon accounting procedures being established under the Kyoto Protocol, whereby projects must demonstrate real, measurable, and long-term results in reducing or preventing carbon emissions that would not have occurred in the absence of CDM activities (The Katoomba Group, www.ecosystemmarketplace.com)

reduce the attractiveness of thicket restoration as a land use. The issue remains uncertain as there are still a number of issues regarding baselines, additionality, permanence and leakage which still need to be worked out before AD can be included as an option in the CDM (Sedjo & Sohngen, 2007).

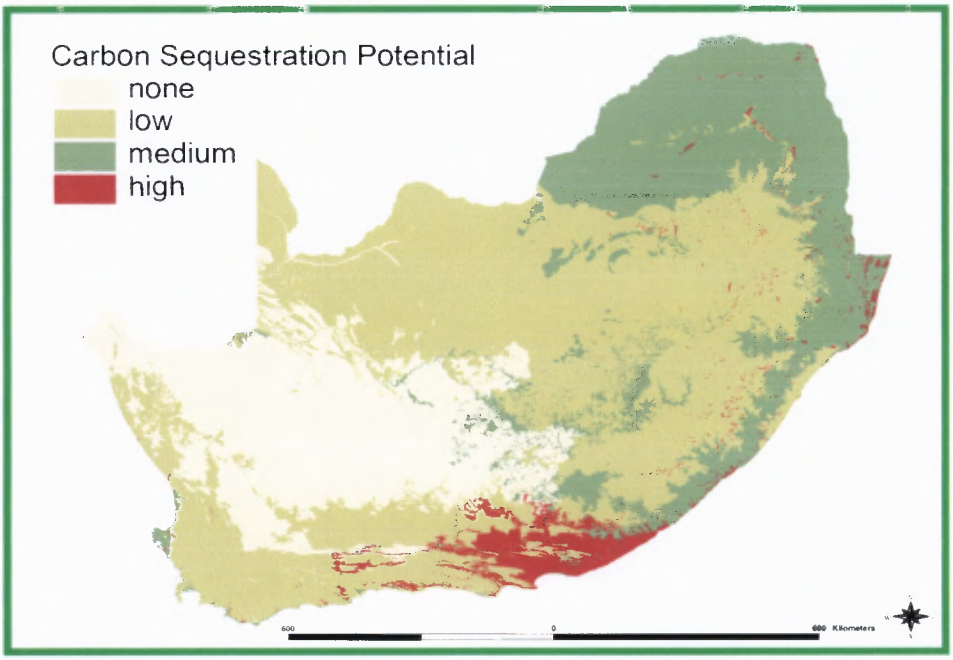
With uncertainty comes risk, and this needs to be taken into consideration when assessing restoration as a potential land use. Farming has traditionally been a risky business as it is dependent on so many random variables and as will be shown in Chapter 5, the agricultural markets concerned are themselves volatile. Restoration is not very different. However, many farmers/landowners are skeptical about the concept of 'farming carbon' and for this reason there is a need for further research and consolidation to ensure that landowners can make informed decisions that are sustainable. It is for this reason that including restoration as an added benefit of conservation is currently the most feasible and least risky option.

4.5 Carbon Sequestration

All vegetation sequesters carbon to some extent, but certain plants/trees sequester either more carbon, and/or at a faster rate than others. Certain vegetation types in South Africa, such as Subtropical Thicket, have been found to be more efficient at sequestering carbon than others.

The figure below shows the carbon sequestration potential throughout South Africa.

Figure 10: Carbon sequestration potential in South Africa



Source: Powell, 2007

Figure 10 shows that the area of highest carbon sequestration potential falls in the Eastern Cape Province. This is primarily due to *Portulacaria afra* (Spekboom or Elephant Bush), one of the dominant plants in the Subtropical Thicket biome of the area (to be described in more detail in section 4.6). As mentioned, large tracts of thicket have been destroyed by overgrazing, agricultural development and bad land management. This not only reduced the potential of the land to sustain livestock and/or game, but it also released large amounts of carbon (Pierce, 2003). Reversing such historic degradation, offers the potential to earn income from restoration projects. Once the area has been restored there is the possibility of an increase in earnings from an area that is more productive and more aesthetically pleasing.

Some vegetation types recover easily from overgrazing or degradation, but others less so, and depending on this recovery rate certain land uses are more suitable in certain areas. It has been found that once thicket has been degraded it does not recover via natural regeneration, as some other vegetation types do, and active intervention is therefore required to restore the system to a productive and sustainable state (Powell & Mills, 2006). Research done on carbon storage in three different areas of South Africa (Mills et al, 2005: 189) found that carbon storage in thicket was exceptional for a semi-arid region and that it was similar to a forested area with several times the mean annual precipitation. They also found that the semi-arid sites, which included xeric shrubland and thicket, were more sensitive to the effects of land use on carbon storage than the more mesic grassland site (Mills et al, 2005:189). These results are of importance in determining the most sustainable land use in the SRV.

In a competitive market, the price of land will capture the present value of the earnings it generates. A rise in farmland prices following a carbon sequestration programme, however, need not indicate a rise in the productivity of the land involved. Instead a carbon sequestration program may increase agricultural land prices by reducing the supply of cultivable land. As more land is restored and less is available for agriculture, the price will rise. This may lead farmers to convert forest land to agricultural land, thereby offsetting some of the effects of the carbon sequestration program (Lubowski et al, 2005).

Mills et al (2007) argue that tourism potential is likely to be greater for restored thicket, than for transformed, degraded landscape as it provides a more 'natural'

wilderness experience. They contend that degraded, eroded land is less aesthetically pleasing, so restoring l and should increase the tourism potential. Restored thicket will increase wildlife stocking capacity due to increased browsing potential, which in turn gives the possibility of better game viewing.

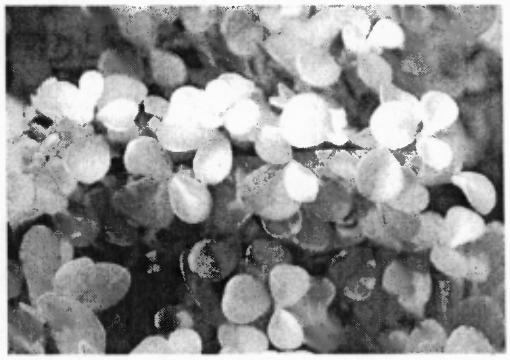
In contrast, however, it could be argued that restored thicket will not necessarily result in better game-viewing, as naturally-occurring thicket, as the name suggests, is very thick and impenetrable, reducing visibility. The stocking capacity may be greater, but it does not always follow that viewing will also then be better. According to Boshoff et al's survey results (2007:194), the sighting rate of elephants in the AENP remained reasonably constant from 1996 to 2006, despite an increase in elephant density. The author's personal experience conducting game drives in the Addo Park suggests that tourists are often attracted to the more degraded, open areas of the Park, as it is easier to view animals in these areas.

The next section describes the plant that is associated with the high rates of carbon sequestration in the SRV.

4.6 Portulacaria afra (Spekboom or Elephant Bush)

This plant is abundant in the Sundays River Valley and as it is a stem succulent it has a remarkable propensity to grow from cuttings (pers. comm. M. Powell, Subtropical Thicket Restoration Group, 2008). It is also indigenous to the area, grows well in dry environments (drought-resistant) and it does not burn, which is an important feature in reducing risk for a CDM project.

Figure 11: *Portulacaria afra* (Spekboom)



The sequestration of carbon is not only in the plants' living biomass, it also affects sequestration in local soils. Lechmere-Oertel (2003) found that *Portulacaria afra* has a very high level of leaf turnover that contributes to soil organic matter (SOM) content, which was abnormally high for a semi-arid region. SOM levels that were found for *P. afra* were comparable with deciduous and some tropical forest. This species alone adds 2500 kg per hectare per year of organic matter onto the soil surface in intact Subtropical Thicket (Lechmere-Oertel, 2003). *P. afra* leaves comprise around 45% dry carbon, which suggests that around 1000 kg per hectare per year of carbon are added to the soil underneath solid stands of this species (Lechmere-Oertel, 2003:87). This is not just a contribution to carbon capture, it also adds to the productivity of the soils.

Due to the fact that fire is largely absent from Subtropical Thicket (Kerley et al, 1995) and that leaf litter production is the main agent of biomass turnover (McNaughton et al, 1989 in Lechmere-Oertel, 2003), a portion of the atmospheric carbon that is incorporated into the plant structures is sequestered in the soil either directly by litter fall or, to a lesser extent, through defecation by herbivores

(Lechmere-Oertel, 2003:88). Carbon in this system is therefore more stable in the long term. This is once again an important factor in a CDM project. It also illustrates that the high carbon storage is dependent on the existence of the thicket. Clearing of the vegetation, therefore, will reduce the soil carbon and soil productivity.

The *Portulacaria afra* truncheons and other plants that are used in the rehabilitation project can easily be transplanted from other farms that are being cleared for other land uses, e.g. citrus farming. In this way the negative externalities of de-bushing for citrus farming can be negated to a certain extent. Source plants can also be obtained from within the AENP or other private game reserves for example in areas which are being developed for roads or other infrastructure (AENP Rehabilitation Plan, 2008).

The next section looks at the costs involved in a restoration project in terms of the establishment of the plants. The chapter goes on to discuss the operating and employment benefits and costs.

4.7 Establishment Costs

A cost-benefit analysis of thicket restoration over a fifty year period using a discount rate of 8% was developed by Mills et al (2007). This showed that there are potentially positive financial benefits to be obtained from a restoration project, though the internal rate of return on the investment may be fairly low.

The costs of restoration depend on a number of factors. The most important is the initial planting density (Mills et al, 2007). This planting density in turn depends on the remaining shrub cover, as well as whether the restoration programme involves planting only *Portulacaria afra* or establishing a variety of species (Mills et al, 2007). A preliminary estimate of the present value of all costs for a restoration project, with less than 25% of the original biomass remaining, is approximately $722 per hectare with *Portulacaria afra* only and $862 per hectare using a variety of different species (Mills et al, 2007: 185). These costs include:

- sourcing reproductive material;
- seedling propagation;
- initial establishment of the vegetation;
- replacement of dead cuttings after two years;
- custodianship (which includes controlling alien plant invasion and domestic livestock); and
- project management, administration, monitoring and evaluation (Mills et al, 2007:185).

These costs converted into Rand amounts with an exchange rate of R8.20 to the US Dollar (22nd June 2009 - http://www.xe.com/ucc/), amount to roughly **R5920.40 per hectare** for *P. afra* only and **R7068.40 per hectare** for a variety of species. The long-term accuracy of these figures is being assessed through a restoration project now under way in the Darlington section of the GAENP. This restoration project is described in the next two sections of this thesis.

4.8 Subtropical Thicket Restoration Project

The aim of the Subtropical Thicket Restoration Project is 'to fix carbon, restore lost natural capital, improve biodiversity and create enabling environments for rural communities to sustainably harvest ecosystem services' (Powell & Mills, 2006)

The aim of any restoration project is to return a degraded system to some form of cover or state that is protective, productive, aesthetically pleasing or valuable in a conservation sense (AENP Rehabilitation Plan, 2008). The Subtropical Thicket Restoration Project (STRP) began in 2004: its main aim over the past few years has been to ascertain the biological, economic and financial viability of farming carbon. From there they aim to offer guidance to farmers to assist them with thicket restoration and thereby ensure the conservation of this biodiversity-rich vegetation type.

There has been a large amount of research done by the Subtropical Thicket Restoration Project on restoring Thicket in terms of the biological aspects, i.e. carbon 'fixing' rates, growth rates, etc. in the Eastern Cape, South Africa (particularly in the Baviaanskloof and the Great Fish River Reserve) and there is still a lot of ongoing research. This has provided figures that can be used in calculating the possible returns to a farmer of a restoration project.

The first goals of a **land rehabilitation project** are:

- to improve the organic content of the soil;
- to increase species composition of the vegetation;

- to retain the clumpy structure of the vegetation; and
- to increase the plant cover of the indigenous woody species (AENP Rehabilitation plan, 2008) and from there:
- to possibly make money selling carbon credits

The Subtropical Thicket Restoration Project that is currently in place in the Eastern Cape also has as one of its objectives to create skills and opportunities for unemployed people in rural areas (Powell & Mills, 2006). This is an important objective in light of the high rates of unemployment in the rural areas. The project is labour intensive and it employs several contract teams to harvest plant material, prepare sites, and plant the cuttings in the degraded areas (Powell & Mills, 2006). The aim of this is to create entrepreneurs and micro-enterprises (Powell & Mills, 2006) that will be self-sufficient in the future.

The Subtropical Thicket Restoration Project currently uses the Working for Water[16] and Working for Woodlands project groups to implement the programme. Both groups are a part of the Poverty Relief Programmes of the Government, they offer employment to previously disadvantaged groups and have a large number of conditions of employment to ensure equity. For example the person has to be the only person employed in the household, the group has to have a certain % of women, disabled, youth, etc., to ensure that the employment is spread over a large group of people, to ensure equity. Though there are many farmers who are conducting their own restoration projects on their farms, it would make economic

[16] The Working for Water programme aims to restore natural bush back to its original state by co-ordinating the removal of alien invasive plants, and in certain situations, restoring erosion damage and replanting indigenous plants (Pierce, 2003:2.11)

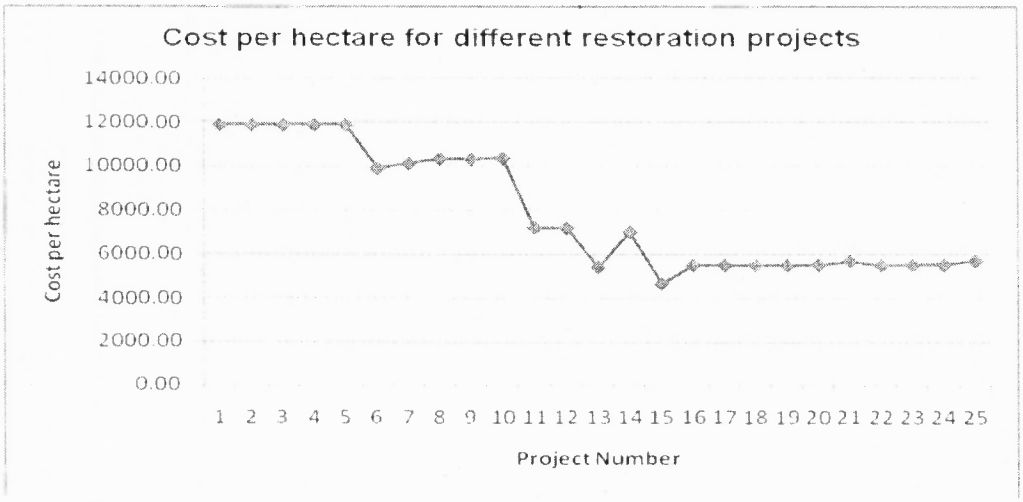
sense to have a group such as the Subtropical Thicket Restoration Project (STRP) to oversee and manage restoration in the Eastern Cape to take advantage of their expertise, minimize costs and to maximize the possible returns from a restoration project. This group now falls under Working for Woodlands (2008) and is under the Department of Water Affairs.

4.9 Restoration Project – Darlington Section of the GAENP

4.9.1 Operating Costs

As an example of the costs associated with a restoration project, the current project being run in the Darlington section of the Greater Addo Elephant National Park will be used. These costs can be taken as unusually high; the project is constantly being refined and improved and, for that reason, the costs should be reduced and the efficiency of the project improved over time (pers. comm. M. Powell, Subtropical Thicket Restoration Project Manager, 2008).

Graph 11: Average cost per hectare to restore thicket in the Darlington section of the GAENP (Nominal rands)



Data source: M. Powell, Restoration Project, Darlington Section, GAENP, 2008

Graph 11 shows a trend of decreasing average costs as restoration project sizes increase. The X-axis shows restoration contracts of differing areas (the numbers represent different contract sizes), with increasing area being restored in the later contracts. This is as a result of costs decreasing as the number of hectares restored per project increases (economies of scale). The costs per project are detailed in Appendix 3. Some costs have been exceptionally high at about R15 000 per hectare, but the mean has been found to be around R5000-R6000 per hectare for the first treatment (pers. comm. M. Powell, 2008). The cuttings planted in each project have varying mortality rates; some projects may require a second treatment, which adds to the costs. The **average cost per hectare** for the Darlington section calculated across all the projects was **R7895.33**. This is more than the amount for the *P.afra* alone and the variety of plants presented earlier (Mills et al, 2007).

4.10 Employment

The following section describes the employment benefit/costs associated with restoration. Currently, the Working for Water programme consists of a team of 12 workers, a driver and a contractor. Each team restores about 5-7 hectares per month, with each hectare using 40 person days. Taking an extreme position, if the aim were to restore all degraded Subtropical thicket (roughly 400 000 hectares in the Eastern Cape), 100 teams doing 610 hectares per month would take 50 years (pers. comm. M. Powell, 2008). Of course, this would have a huge cost in agricultural jobs. The long-term sustainability of thicket restoration employment is also questionable; once the land has been restored there is only a maintenance

role for labour. The restored land, if it is used commercially however, for example for eco-tourism, will provide long-term employment effects that are beneficial to society as a whole and will increase social welfare. Again there is a trade-off, this time between conservation and preservation in finding the optimal restoration/degradation balance for game-viewing.

In terms of climate change mitigation and biodiversity conservation, restoration as an alternative land use is appealing. The opportunity costs associated with this alternative are related to the foregone income that could have been earned if the land was retained for cultivation or for grazing of livestock. Lechmere-Oertel (2003) suggests that degraded thicket results in degraded soils and therefore lower productivity and, would not be sustainable for agriculture in the long term. The ideal situation would involve a slow rotation system of planting. Table 23 below illustrates the total labour costs associated with a restoration project.

Table 23: Total labour costs for a restoration project, in nominal Rands (2008)

Personnel Type	Daily Rate	No. Employed	No. of Days	Total (Nominal Rands)
Contractor	R145.00	1	20	R2900.00
Technicians	R46.00	4	20	R3680.00
General Worker	R43.00	8	20	R6880.00
Driver	R61.00	1	20	R1220.00
Sick leave fund	R33.88	1	20	R677.60
Family Responsibility Fund	R8.47	1	20	R169.40
Public Holiday fund	R31.05	1	20	R621.00
Total Labour Costs				**R16148.00**

Source: Data provided by M. Powell, Restoration Project, Darlington Section, GAENP, 2008

If, as above, we use the example of an average 6 hectares restored in a month, then the total **employment cost per hectare is R2691.33 per month**. This cost only applies to the initial restoration phase of the project and a smaller amount to the follow-up phase, after which there will be no employment costs. Eradication of alien vegetation is an ongoing exercise and provides employment for a longer period.

Table 24: Total costs for a restoration project, in nominal Rands (2008)

Description	Daily Rate	No. Employed	No. of Days	Total
Boots	R2.79	13	20	R725.40
Goggles	R0.10	2	20	R4.00
Overalls	R0.77	13	20	R200.20
Gloves	R0.15	13	20	R39.00
Hard Hats	R0.06	13	20	R15.60
Masks	R1.46	2	20	R58.40
Rain Suits	R0.48	2	20	R19.20
Knapsack (Herbicide)	R0.70	1	20	R14.00
First Aid	R1.45	1	20	R29.00
Transport	R240.00	1	20	R4800.00
Administration	R700.00	1	20	R700.00
Camping Allowance (General Worker)	R26.00	4	10	R1040.00
Total – Contract Only				**R27 022.40**
Ancillary Costs	**Cost**	**Teams**	**Time**	**Total**
Project Manager Transport	R7000.00	4	1	R1750.00
Project Manager Wages	R9827.00	4	1	R2456.75
GIB Manager Fee	R7083.00	4	1	R1770.75
Subtotal Ancillary Costs				R5977.50
Grand Total of Costs				**R32 999.90**

Source: Data provided by M. Powell, Restoration Project, Darlington Section, GAENP, 2008

The particular example contract size in Table 24 is equal to 180 000 cuttings. The actual number of *Portulacaria afra* cuttings that were planted was 181 400,

therefore the total cost per *Spekboom* cutting (contract only) is R0.15. If, once again, we use the average of 6 hectares restored, then the **operating cost per hectare** comes to **R5499.98**. This together with the total labour cost per hectare of R2691.33 comes to **R8191.31**. This is very close to the figure of R7895.33 obtained as the average cost per hectare calculated from the total projects in Darlington. It seems safe to say that the average **cost per hectare to restore land** in the Eastern Cape at present (2008) is approximately **R8000.00**.

4.11 Financial Implications of Restoration

An example given by Powell (2007) for a 1000 hectare farm in the thicket biome, with more than 70% of the farm degraded, gives the following results:

Costs to rehabilitate = R5 000 000 (low estimate of R5000 per hectare to rehabilitate)

Costs to certify = R500 000 (this cost only applies if 4 farmers join together to reduce the certification, verification and auditing costs)

Total = R5.5 million

Mills et al (2007) calculated a mean annual carbon accrual of 3 ton/ha/year = 3000 tonnes of carbon. This is equal to a carbon dioxide equivalent of about 11 000 tonnes CO2 equivalent[17] per annum. The average price of a Certified Emission Reduction (CER) credit last year was around $10.90 per ton, therefore the income earned could be $119 900 per annum. With an exchange rate of R8.20 – 22nd

[17] In order to convert carbon to CO2 equivalents one multiplies by 3.67

June 2009 (Currency converter - http://www.xe.com/ucc/), the amount earned for 1000 hectares would be R983 180 per annum. This will result in the farmer breaking even after about 6 years, and thereafter receiving a passive income of approximately R990 000 per annum for 12 years (depending on the carbon price and the prevailing exchange rate). Growth rate and carbon accumulation are not the same thing, but both have been found to peak at 20-50 years (depending on certain variables such as rainfall and herbivory) (pers. comm. M. Powell, Thicket Restoration Project Manager, 2009). The profitability is heavily reliant on the carbon price that is being traded at the time and the transaction costs. To get the *Spekboom* back and to get the nutrient cycles back to normal will take about 50 years, and at least another 50-100 years to get it close to resembling thicket in its 'natural state' (pers. comm. M. Powell, Thicket Restoration Project Manager, 2009). These results are only valid for arid and semi-arid thickets and the results are dependent on the degree of degradation. There is a tipping point after which natural regeneration is not going to happen. It will also take possibly hundreds of years in a worst case scenario and it will be excessively expensive (pers. comm. M. Powell, Thicket Restoration Project Manager, 2009).

According to projections a project that restores 10 000 ha a year would employ about 2 000 labourers (i.e. **5 workers employed per hectare**). In addition to the jobs, rehabilitation could provide a number of long-term benefits to local communities. Among those mentioned are, improved browse and sustained access to fuel wood (dry, decaying trees), timber, fruit and medicines (http://ww2.mg.co.za/article/2008-06-22-super-plant-mops-up-co2).

Carbon sequestration as a land use is unlikely to be very popular without significant support. This could take a number of forms which are briefly outlined in the next section.

4.12 Policy Options and Issues to Enhance Adoption of Restoration

Restoration is initially very costly and benefits only start to accrue after a number of years. For this reason, it is important that policy is designed in such a way as to encourage landowners to restore their land. A few possible policy options that could be introduced follow in this section. As discussed, if farmers initially convert to conservation, the associated carbon capture benefit will accrue over time as the thicket restores, but will not necessarily result in a passive income, unless it is part of a registered CDM project.

4.12.1 Institutional Support

Few landowners interviewed knew about the CDM and the carbon market in South Africa. There is a clear need for an institution to provide guidance and advice, while acting as a "bank" or governing/administrative institution for the CDM. Once carbon has been accumulated it can be bought by the institution and sold on international markets. Such an institution could be wholly private or a joint government and private initiative. In the Eastern Cape there is already such an institution in place, but its role is still undefined. It was originally private and called the Subtropical Thicket Restoration Project (described in section 4.8), but now falls under the Department of Water Affairs and is administered under Working for Woodlands (2008). This group aims to advise farmers on their restoration projects,

and ultimately to act as a 'broker' for farmers in buying carbon credits. There is a necessity for strong financial/economic support and knowledge within the institution, as well as ecological knowledge and support.

The rules for monitoring are internationally determined. The monitoring options below will have to conform to the Kyoto Protocol and other guidelines. Monitoring of the restoration project will be essential in order to assess the amount of carbon sequestered, and also to ensure that the land remains restored and/or is not deforested. The monitoring could be done by a governmental agency, but from an efficiency perspective, it may be better to involve an NGO to monitor. The government could play a role in subsidising the NGO responsible for monitoring.

4.12.2 Industry Sponsorship

Another possible policy option would be for industries associated with carbon emissions (e.g. car manufacturing) to sponsor restoration projects in order to capitalise on the carbon sink potential (Mills et al, 2003) Funding such projects would not only allow such companies to negate their carbon emissions, but would also enhance their public image, as they would be helping to conserve biological diversity, increase employment (poverty alleviation) and mitigate climate change (Mills et al, 2003).

4.12.3 Interest Rate Options

A lowering of interest rates to allow farmers to borrow money for restoration. The current very high interest rate in South Africa and the possibility of future increases

is a major deterrent to farmers. The initial restoration and certification costs for the CDM are high and there are few farmers who could afford to cover them without borrowing. A lowering of the interest rate to farmers for borrowing for restoration would certainly provide an incentive to them.

4.12.4 Grants

The allocation of grants to farmers to restore their farms is another policy option. In the past government grants were given to farmers in the Eastern Cape to clear their land for farming of major crops, for example wheat. Similar grants could now be given for restoration to encourage farmers to restore their land.

4.12.5 Tax Incentives

Tax incentives on profits, whereby farmers can invest their tax liabilities into carbon projects. Instead of tax liabilities being paid to government they can be used for the establishment and certification costs for restoration projects.

4.12.6 Subsidisation

The government or an institution could purchase carbon credits at a favourable, subsidised price for a contract period to remove the risk to the farmers or government could also subsidise or fund farmers or farmers' unions to certify for the CDM.

It may not be necessary to use only one of these options, but possibly a combination of a few of them.

4.13 Summary of restoration as a land use and added benefit of conservation

The table below gives a summary of the main points in the chapter, as well as a breakdown of the income potential, employment and various other values associated with land restoration.

Table 25: Summary of Restoration as a land use

Per Hectare	Amount
Income potential per hectare	R900.00 passive income per hectare (depending on the prevailing carbon price and the amount of carbon sequestered)
Employment per hectare	5 jobs per hectare during restoration; After restoration, employment depends on the future land use
Current value of the land	Depends on the use and the stage of restoration
Establishment costs per hectare	+-R8191.31
Operating costs	Zero once the project is established, except possibly a small cost for maintenance
Employment cost per hectare per month	R2691.33

These values show that the costs of and following restoration are relatively low. The income generated is also small in comparison to income earned from citrus farming. However these figures do not reflect the future potential of land once it has been restored, either for eco-tourism or stock- or game-farming. Thicket rehabilitation has a place in conservation efforts, and if it is done well, it might even be able to pay for itself, though the private returns on land with high agricultural potential are clearly below those of citrus farming. Restoration for the sake of carbon credits as an alternative land use is not generally justifiable. As an added

benefit that may increase the value of other conservation based activities however it could be very important, especially where the viabilities of different land uses are very similar, as it could swing the balance in favour of conservation in such marginal cases.

The next chapter outlines agriculture as a land use, with specific reference to the citrus farming industry in the Sundays River Valley.

5. AGRICULTURE AS A LAND USE

South Africa has a dual agricultural economy containing both a very well-developed commercial sector and far poorer and less developed subsistence-oriented sector, including small-scale artisanal farmers (www.southafrica.co.za/agriculture_29.html). Agriculture in the Sundays River Valley (SRV) is largely commercial, though there are a few small-scale farmers growing maize and vegetables and keeping cattle primarily for subsistence. A number of citrus farmers also grow vegetables and/or lucerne on their farms to supplement income in the non-citrus months from October to April. Farm workers are also, on occasion, given an area of the farm to grow vegetables or keep stock for subsistence. Large sections of the Addo Elephant National Park are surrounded by a very successful dairy industry. These sections do not fall into the SRV area but, as mentioned earlier, have affected land cost and partially explain the current fragmentation of the Park. Further expansion of the GAENP is likely to extend into citrus areas and it is for this reason that citrus farming will be the focus of this chapter.

The most important factor limiting agricultural production in South Africa is water availability. In the SRV this issue was resolved with the building of the Fish-Sundays River Scheme and Darlington Dam (formerly Lake Mentz), resulting in the permanent availability of water in the Valley and a consequent growth in the citrus industry.

5.1 Agriculture and the environment

Carbon emissions are not the most important environmental costs associated with agriculture, but as chapter four focused on the uptake of carbon through conservation, it makes sense to begin with this issue with respect to agriculture.

The Kyoto Protocol (discussed in Chapter 4) m entions agriculture as both an emitter of greenhouse gases (GHGs) and a sink (McCarl & Schneider, 2000). Annex A of the protocol lists agriculture as an emitter in a number of areas. The areas that apply to citrus farming include: agricultural soils, deforestation, field burning of agricultural residues, and 'other' (http://unfccc.int/resource/docs/convkp/kpeng.pdf). Crops are able to sequester carbon and in this way they act as a sink. Citrus trees which are, on average, productive for about 30 years, can act as carbon sinks and in this way play a role in mitigating climate change. Removal of the trees after their productive life span does however result in a loss of carbon. The farms become carbon neutral if the wood is not kept aside once the trees are uprooted. If it is burnt or dumped, the farm is adding nothing as a carbon sink.

McCarl & Schneider (2000) generalized that developing countries' agriculturally based emissions come mostly from land degradation and deforestation, while developed countries' agricultural emissions are largely fossil-fuel based, through energy use and emissions from fertilizers (McCarl & Schneider, 2000). South African agriculture combines both of these categories: land degradation, emissions

from fertilizers and pesticides and fossil-fuel based emissions are all prevalent in the country's agricultural sector.

A second environmental issue in the debate between agriculture and conservation as land uses is the impact of farming on biodiversity. Agriculture can affect biodiversity in numerous ways. The most immediate ways are through the conversion, destruction and modification of natural habitats, the fragmentation of remaining natural habitats and the concurrent loss of landscape connectivity (Harvey et al, 2004). Other impacts include the pollution of streams, rivers, and groundwater with pesticides and fertilizers, changes in ecological processes (e.g. water cycles, pest dynamics), the invasion of exotic species, and the side effects of changes in infrastructure that usually accompany agriculture (Harvey et al, 2004). At a policy level it is argued that any efforts to mitigate the impact of agriculture on biodiversity should not only focus on ensuring that agriculture does not extend into existing protected areas or remaining areas of natural habitat, but it should also find ways to intensify production systems without the associated negative impacts on biodiversity and should encourage landscape-level changes which positively affect conservation efforts.

Within the SRV citrus farming is water intensive. Where this demand cannot be met from irrigation quotas it is drawn from underground and this in turn affects the ground water levels. Ground and surface water are also affected qualitatively by return flows and runoff containing fertilizers and pesticides used in citrus farming,

though there has been a move over the years, in keeping with EUREPGAP[18], to more organic and less harmful products. To ensure that citrus is suitable for foreign markets, the farmers have to use more environmentally-friendly and therefore, less harmful, fertilizers which has been beneficial for the environment as well as for the people living in the SRV.

Due to rising input costs, citrus farms have been expanding in order to maintain their profits (pers. comm. Citrus Farmers in SRV, B. Nel & A. Serfontein, 2008). Along with this expansion in farm size, there has been an intensification of production systems, with more effective pesticides and fertilizers being used, etc. This has resulted in greater efficiency. Over the years farming techniques have changed a number of times (pers. comm. citrus farmer, C. Marais, SRV, 2008). The aim of this is to ensure the most cost-effective and efficient technique is adopted in order to maximize yields, and therefore profits. It is hoped that this will also result in a move to more environmentally-friendly practices and products, as they are more sustainable in the long run, and therefore also more efficient.

As mentioned there are external benefits and costs associated with agriculture. Some of the external costs of agricultural production that were found by Tegtmeier & Duffy (2004) in the U.S. also apply in South Africa.

They include:

- Damage to water resources
- Damage to soil resources

[18] The EurepGAP standard is primarily designed to maintain consumer confidence in food quality and food safety. Other important goals are to minimize detrimental environmental impacts of farming operations, optimize the use of inputs and to ensure a responsible approach to worker health and safety (http://www.eurepgap.org/Languages/English/about.html)

- Damage to air resources
- Damage to wildlife and ecosystem biodiversity
- Damage to human health

Each one of these external costs can be mitigated to a certain extent, but intensive high-yielding agricultural production would not survive without the use of pesticides, fertilizers, extensive irrigation, etc. It is important therefore, to recognize these costs in an assessment of agriculture as a land use, though valuing them can be difficult.

Dale & Polasky (2007) also contend that agricultural practices have environmental impacts that affect a wide range of ecosystem services, including water quality, pollination, nutrient cycling, soil retention, carbon sequestration and biodiversity conservation. They further add that these ecosystem services in turn affect agricultural productivity (Dale & Polasky, 2007). It is certainly true that there is an interaction and inter-connectedness between ecosystem services and agriculture and the ideal is not necessarily one or the other, but rather a combination of the two working together in the most optimal way. The question is what combination provides the optimal situation? The answer depends on an array of factors, such as:

- soil conditions,
- water availability,
- slope and
- biodiversity

Expansion of crop production results in natural vegetation being removed from the land increasing the risk of soil erosion, as well as diminishing the biological diversity of that area. The vegetation removal also results in nutrients being removed from the landscape (Mills & Fey, 2003). Unless these nutrients are returned in some way, such as in fertilizers then a 'nutrient mining' situation occurs, whereby soil fertility is depleted over time (Mills & Fey, 2003). Leaching of nutrients from the soil can be accompanied by salinization of that soil when crops are irrigated. On the other hand, fertilization can increase nutrient levels above what was found in the virgin soils, and as a result, can potentially improve soil quality (Mills & Fey, 2003). One impact is in fluvial plant growth. Local river guides have commented on changing plant densities on the river and it is believed that this to be due to increased nitrogen from the fertilizers (pers. comm. C. Pickels, Crisscross Adventures Owner and River Guide, 2008). Rising prices of water and fertilizer have mitigated the problem, providing an incentive for citrus farmers to shift towards the now widely-used drip irrigation system.

Mills & Fey (2003) found that it is not inevitable that soils under cultivation have a loss of organic matter. They found that the deterioration of soil quality depends on the type of tillage, fertilizer and irrigation management. As mentioned, there is the possibility of increasing the soil carbon beyond that of virgin soils and this raises the possibility of using the soils for carbon sequestration (Mills & Fey, 2003). They also found that irrigation of crops in semi-arid areas, under which the SRV falls, will also tend to increase the soil carbon. This can be seen as a positive externality of agriculture and means that cultivation need not entail a cost in terms of carbon

sequestration at a soil level, though the clearing of virgin thicket will certainly result in a loss of stored carbon and biodiversity, and this needs to be taken into account.

Globally the focus of agricultural policy has been shifting from traditional subsidy and trade policies to the conservation and environmental aspects of agriculture (Stoorvogel & Antle, 2008). The consequence in modern South Africa has been a reduction in the rights associated with land ownership. Access rights to underground water and in-stream fluvial flows were the areas initially affected; but latterly the right to clear land has also been curtailed. The National Environmental Management Act (NEMA) No. 7 of 1998 has imposed set procedures that farmers have to follow before expanding t heir cultivated areas by clearing virgin land. NEMA focuses on sustainable development and ensures that farm expansions do not encroach on environmentally sensitive areas. Environmental Impact Assessments (EIA) have to be carried out for farm expansions of a certain size or more (+-100 ha) in order to determine the socio-economic and conservation impacts of expansion. Permission to clear virgin bush has to be given by the Department of Environmental Affairs and Tourism. The Department of Agriculture determines the soil suitability for agricultural production as part of the EIA.

The next section focuses specifically on agriculture in South Africa.

5.2 Agriculture in South Africa

Data from agricultural censuses in South Africa show that while there was a steady increase in the amount of cultivated land between 1911 and 1965, this leveled off in the past two decades (Palmer et al, 2006). This could be as a result of the

decline in agricultural subsidies and support or merely in line with basic Ricardian rent theory and the idea of the extensive margin, whereby the most productive agricultural land would already have been used and the remaining land is either less productive, or not productive at all, or a combination of the two. Conservation initiatives and a focus on sustainable development could also have played a role in this leveling off process.

By the late 1990s the total cultivated area in South Africa had stabilized. At that stage cultivated land in the Eastern Cape comprised only 4.2% of the total land area (Erasmus, 1996 cited in SEA, 2001). There had been a number of changes in the commercial agriculture sector over the preceeding two decades. Erasmus (ibid pg. 11) lists the following as the main changes: a decline in the number of farms, an increase in the average farm sizes, increased specialization, greater capital investment and declining full-time employment. This certainly seems to be true in the SRV with an increase in farm size to capitalize on the economies of scale, and a decline in permanent labour and a consequent increase in seasonal labour. This will be discussed further later in the chapter.

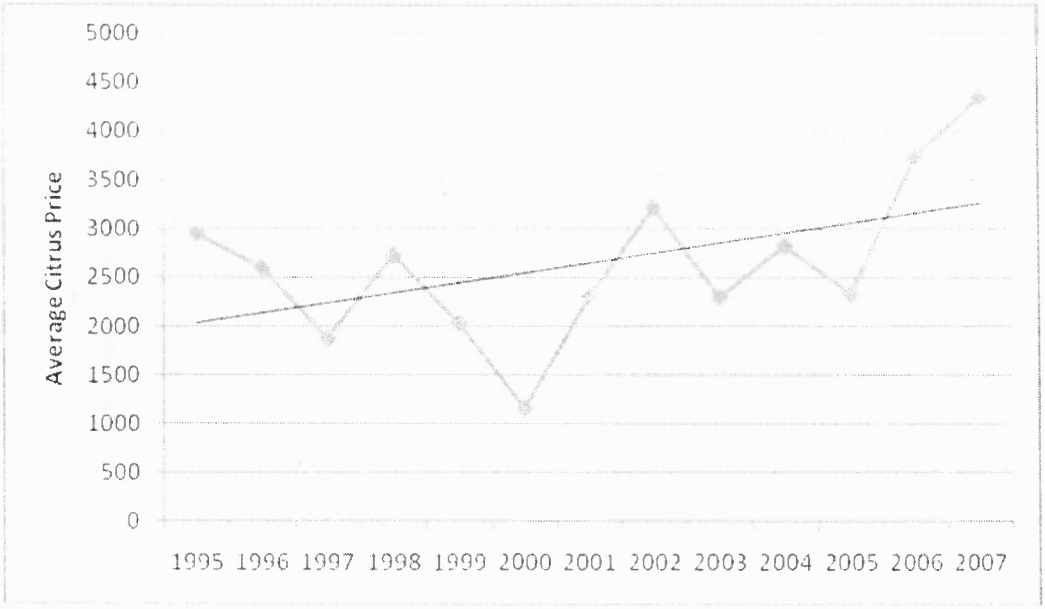
As the SRV is dominated by citrus farming, the discussion turns now to focus specifically on citrus farming and the associated benefits and costs.

5.3 Citrus Farming

Citrus farming is sensitive to a number of economic factors, including: exchange rates, diesel price, the interest rate and world market conditions which drive the Rand price of citrus and the costs of production. The citrus price obviously affects

farm incomes and the opportunity cost of conservation. They are also affected by input costs, which have been increasing faster than citrus prices. This has forced farmers to produce more in order to maintain the same level of profitability year on year.

Graph 12: Nominal average citrus price 1995-2007, in Rands



Source: Based on data provided by the Sundays River Citrus Company (SRCC), 2008
The price reflected is the price per trailer (2.6 tons)

As can be seen from Graph 12 the trend line illustrates that the citrus price has been increasing, but has a history of volatility. The data in the graph (collected from the SRCC, 2008) is the average of 8 different citrus variety prices over the years from 1995 to 2007. In Appendix 2 are two graphs showing the individual citrus variety price changes over the years. The volatility of the prices for individual varieties can be seen clearly in these graphs. Though the average price shows a trend of increasing, this is not necessarily the case for the individual varieties. 2008 presented good citrus prices (pers. comm. citrus farmers in SRV, 2008) but

each year is different and, as mentioned, much depends on the world markets and supply from producing countries such as Spain, as well as the exchange rate.

The relationship between the citrus industry and the conserved areas is not entirely 'trade-off based'; they exhibit some interdependence. For example, Pierce (2003:1.12) argues that honey bees are one example of this. The fruit industry depends on African honeybees for flower pollination, and subsequently, good fruit yields. The African honeybee in turn relies on natural intact bush for pollen and nectar when the fruit trees are not flowering. Pierce argues that the loss of intact natural bush would cost the economy millions of Rands in lost export revenues, so it makes economic sense to protect the natural habitats (Pierce, 2003). One can counter argue that stands of exotic trees, for example *Eucalyptus sp.,* would provide even better habitat for the pollinators. This would, however, impose other external costs in the form of the loss of biodiversity from natural vegetation, and also the loss of water resources, due to high rates of transpiration from such exotic species. This is a critical factor in a semi-arid region such as the SRV.

5.4 Negative Externalities associated with agriculture

Negative externalities associated with agriculture are an important aspect of the opportunity cost of citrus farming in the SRV.

According to Picazo-Tadeo and Reig-Martinez (2006), when farming techniques can be held responsible for welfare-reducing environmental pollution then there should be a change in agricultural practices to alleviate this sort of externality. This is often easier said than done, as certain pesticides and fertilizers cannot readily be

changed. Though, over the years, there has been a change in pesticides and fertilizers in order to minimize the negative externalities, there are still associated negative effects. The smell of the chemical sprays at blossom time (October) and fruiting time (April-August) is unmistakable in the SRV, and results in a rise in the number of people suffering from sinusitis, asthma, etc. (pers. comm. local doctor, Dr. S. Parkes, Riverside Family Clinic, Addo, SRV, 2008)

Citrus farmers in the SRV use two main insecticides. The one is Methidathion, which is an organophosphate insecticide (Washburn, 2003). This insecticide has the potential to runoff into surface water depending on use conditions and environmental factors (Washburn, 2003), though there is a low likelihood of it leaching into groundwater, as it has a short soil half-life. Methiadathion is relatively mobile in soil and has the potential to move off-site after application in surface water runoff, and it has been found to be acutely toxic to aquatic organisms (Washburn, 2003). This presents a serious negative externality that is difficult to accurately quantify. The other commonly used insecticide is Confidor, which is also toxic to fish and wildlife. It is a systemic water dispersible granule insecticide for the control of aphid, red scale, thrips, leafminer and psylla on citrus trees (Bayer Crop Science website, 2008 - http://www.bayercropscience.co.za/admin/uploads/files/products/Confidor_70_WG_Eng.pdf). The half-life of Methiadathion depends on the ph of the soil and varies between 13 and 48 days, so there is not usually a large build up of the toxins in the soil over time (Washburn, 2003). The warning on the pack for Confidor states that one must allow 212 days between application and harvest for citrus trees indicating that the 'toxic' elements of the insecticide last less than 7 months.

The commonly used fertilizers in the citrus industry in the SRV are: Lime/Ammonium nitrate (L.A.N); Ammonium Sulphate; Urea; Potassium Nitrate and Urea/Ammonium Nitrate (U.A.N) (Pers. comm. SRCC, 2008). There has been a move towards organic farming, but it is not widespread, and these farmers face the threat of pests, and diseases from surrounding farms. For organic farming to work effectively in the SRV there would have to be a large-scale move towards it and this would initially be very costly, but could be more sustainable in the long run.

5.5 Brief History of Citrus Farming in the Sundays River Valley (SRV)

The first export of citrus from South Africa was in 1908 and by 1956 the income in the Sundays River Valley (SRV), from citrus alone, was estimated at well over one million Pounds (Meiring, 1959). According to historical records (Meiring, 1959), citrus was introduced into the SRV as early as 1818, with the first commercial orchard being planted in 1885. In July 1917, Sir Percy Fitzpatrick (a farmer in the SRV, and author of the book Jock of the Bushveld) received a letter from R.A Davis, the Director of Agriculture, stating:

'*I consider primarily that a citrus fruit business should receive most attention, the soil there is eminently suitable for it and when your water supply is perfected, that district will be hard to beat as a citrus one; oranges and grapefruit should comprise the bulk of the citrus fruit planted there, as I do not regard tangerine or lemons as profitable fruit to grow at present....*' (Meiring, 1959). After the building of Lake

Mentz (present day Darlington Dam) and later the Sundays River Irrigation Scheme there was a steady supply of water to the SRV, enabling an increase in commercial citrus farming. The Sundays River Citrus Co-operative Company was formed in 1924 with the objective of disposing of member's citrus fruit in the most profitable manner (Meiring, 1959). With a steady water supply, good soils and an organized co-operative the citrus industry boomed and continued to expand.

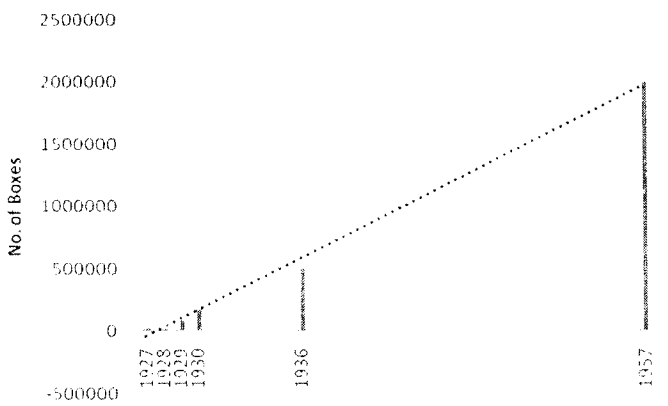
Table 26: Historical citrus export figures for the SRV

Year	No. of Boxes
1927	28 000
1928	19 500*
1929	83 900
1930	174 389
1936	+-500 000
1957	Over 2 million

Source: Meiring, 1959

*due to drought

Graph 13: Historical Citrus Exports from the Sundays River Valley



Graph 13 shows the exponential growth in citrus exports over the 30 year period from 1927 to 1957 based on the data in Table 26. This trend appears to be continuing, though the market displays short run volatility, with exports varying year

on year, depending on a number of random variables (see graph 16, pp 141 for present-day exports). According to Conradie (2002) the SRV contributes about 10% to South Africa's export crop. The Sundays River Citrus Company (SRCC) exports more than 1 million cartons of navels per year, making it the biggest single packhouse export in the country (Sundays River Municipality, 2005). This demonstrates the importance of the citrus industry in the SRV to the economy of the region and South Africa as a whole.

5.6 Present-day Citrus Farming in the Sundays River Valley (SRV)

Approximately 25% of South Africa's navels and about 7% of the country's lemons are grown in the SRV (Sundays River Municipality, 2005). Most of the areas' citrus farms produce a variety of citrus, including oranges (there are a large number of different orange varieties), lemons, grapefruits, naartjies and clementines. The range of citrus varieties allows farmers a 'diversified portfolio' which is important due to the volatility of the different citrus prices, as well as the crop yields. The different varieties are also harvested at different times which gives farmers a longer harvest season, greater ease in harvesting (as it is not all at the same time), better seasonality of cashflow and extends the period of seasonal employment.

The typical harvest season in the SRV is from March/April until August/September, with the peak in June/July. Though citrus farming creates a large amount of seasonal employment, it leaves many people seasonally unemployed which can have serious social impacts, including drinking problems and increased crime (pers. comm. local residents SRV, 2008)

Many farms in the SRV are not exclusively citrus producers, but grow a mix of other crops such as tomatoes, lucerne, potatoes, flowers, cabbage, etc. These mixed crops provide important out-of-season income. They are also usually grown on areas that are less suited to citrus or on small areas where it would not be financially feasible to plant a few citrus trees. In this way farmers maximize the productive potential of their land and also ensure a more stable income flow for a longer period.

The price of farm land depends on a number of factors, including its use, productivity, location, subsidy payments to farmers, etc. (Strange et al, 2006). In the SRV the general consensus is that farm land planted with productive citrus will sell for around **R100 000 per hectare** (pers. comm. citrus farmers in SRV, 2008). This price varies according to the age of the citrus trees. Citrus trees have a productive life span of around 25 years, usually taking around 6 years for the first harvest to be profitable. Water accessibility and availability will also affect the farm price, as well as the amount of established infrastructure on the land. The 'land' price does not truly reflect the value of the land per se, but the present value of the stream of earnings it could generate as a unit, inclusive of managerial, capital and labour inputs, as well as distortions generated by the government system of agricultural management, i.e. much of the price will reflect the value of the citrus trees and infrastructure on the land.

The next section looks at the costs involved in establishing a citrus farm in the SRV i.e. a measure of some of the opportunity costs associated with converting land from conservation to agriculture.

5.7 Establishment Costs

In order to establish a citrus orchard there are a number of costs involved. These costs vary according to a number of different factors, including: previous use or state of the land, availability of water, condition of the soil, amongst other things. Citrus trees take, on average, about six years to mature, and then have a productive life of up to another 25 years (Conradie, 2002). The establishment costs are also dependent on the levels of mechanization to be used and are affected by the size of the existing operation i.e. economies of scale impact on the establishment costs.

Table 27: Costs of Establishment for Citrus Farming in nominal Rands (2005/2006)

	Nominal R/ha
Bush clearing (virgin soil)	R 4,750.00
Land preparation – ridging	R 5,500.00
Trenching for mainline	R 475.00
Trees (R17.50/tree) - 555-1000 trees/ha (ave. 800)	9700-17000 (ave.14 000)
Irrigation system - microjets	5500-6000
- drip	6000-7250
Windbreaks	R 1,500.00

Source : Sundays River Citrus Company, 2008

Dam building (if required)	Nominal Rands
* R10/cubic metre - citrus requires +-15 000 cubic metres per hectare	150 000
Clay lining for the dam	75 000

Source: Sundays River Citrus Company, 2008

Land used for citrus farming can take many forms prior to development. The land can be virgin bush, degraded farmlands, or overgrazed land, amongst others.

Debushing for citrus farming results in a large amount of carbon being released into the atmosphere, as well as a loss of biodiversity. It is also an expensive process to remove the vegetation. If one assumes that land has to be cleared of virgin bush which is usually the case in farm expansion in the SRV, and planted with 700 trees, then based on the figures above, the **establishment cost** would be around **R29 975.00 per hectare**, excluding a dam. The cost of developing the water access has been excluded as it varies considerably depending on the size of the expansion, the size of the existing farm, etc. According to data collected from a single private citrus farm in the SRV (2008), their establishment costs are between R90 000 and R120 000 per hectare, depending on the levels of mechanization. These figures are a lot larger than the figure obtained from the SRCC figures, and would include the water related development as well. If one takes the dam building costs from Table 27 into account then it would be safe to say that to establish a citrus orchard, including water accessibility would amount to an average of about **R100 000 per hectare** (2008 Rands).

As mentioned, expansion of citrus farms results in varying costs depending on the size of the original farm, as well as the size of the increased area. This is as a result of economies of scale and the lumpiness of capital. For example, the number of pumps needed for a dam will remain the same up to a certain increase in farm size after which there will be an extra pump needed. From the initial increase until the second pump is needed there is no difference in the pumping costs. It therefore makes economic sense to increase until the second pump is needed. The same applies to a number of other issues related to citrus development, which often determines the size of expansion.

Other than all the establishment costs, and production/operating costs, there are also a number of other costs associated with the export of citrus. Compliance with EUREPGAP standards entails numerous extra costs in terms of record-keeping, maintenance, etc. (pers. comm. citrus farmers, SRV, 2008). These costs have not been included in this analysis.

5.8 Operating Costs

On-farm production costs vary for the different citrus varieties, as they require different pesticides, fertilizers, etc. Due to differing yields the average costs are also different. Table 28 shows the on-farm production costs for three different citrus varieties in the SRV over a single month. The amount below the citrus variety is the yield per hectare.

Table 28: On-Farm production costs (nominal values) per hectare for different citrus varieties

Bearing orchards (R per ha)

Oct-06	Navels 45T/ha	Valencias 55T/ha	Lemons 75T/ha
Fertilizer	1400	1850	2500
Pest Control (1)	2550	1150	2000
Pest Control (2)	400	250	350
Weed Control	325	325	325
Disease Control	300	1200	1200
Crop Manipulation		500	
Pruning	275	275	275
Picking (Casual) R20/G	2600	3250	5000
Labour (Permanent) 12 x R1250	2250	2250	2250
Management	2000	2000	2000
Fuel/ R&M (2007 Prices)	1500	1500	1500
Crate Hire	180	220	300
Fruit Transport	1650	2000	2500
Electricity	650	650	650
Water	600	600	600
Total per hectare	**16680**	**18020**	**21450**

(1) Thrips, red scale, mealybug, fruitfly - annual control measures required
(2) Bollworm, budmite, alternaria - occassional control required - pro-rata over a number of seasons
Bollworm 50 (3) ; Budmite 350 (2);
Alternaria 150 (3)
Source: SRCC, 2008

The costs for lemons tend to be higher as lemons usually have more than one crop a year, resulting in a higher yield per hectare, at the expense of increased picking/labour and spraying costs. These costs also vary with the diesel price which affects the transport costs significantly. The fuel cost per bearing hectare shown in Table 28 rose considerably over the ensuing year, due to high US dollar oil prices and a weakening rand.

Table 29 below shows average net income and expenses per hectare for three different citrus varieties. Navels and valencias are two orange varieties. Lemons show a higher income per hectare because, as mentioned, they usually yield two harvests a year, instead of one. The expenses are also slightly higher for lemons, but the income is proportionately higher.

Table 29: SRV citrus mean pre-tax profit per hectare (2006)

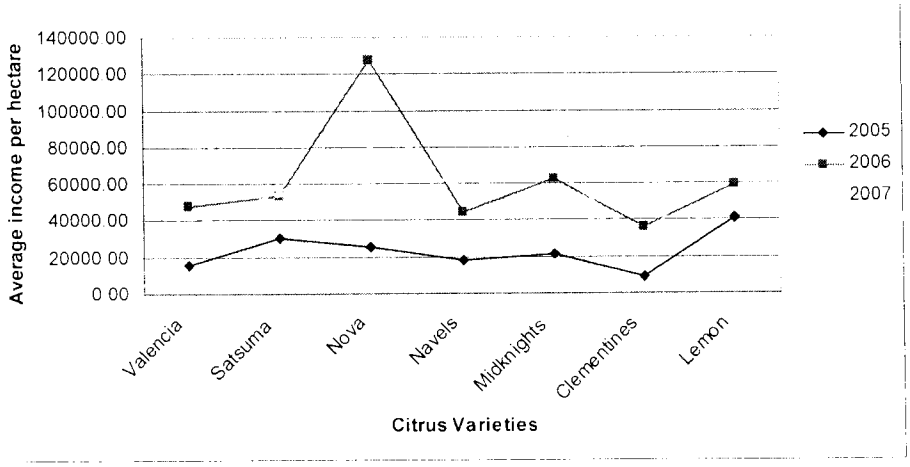
AVERAGE NET INCOME PER HECTARE	AVERAGE EXPENSES PER HECTARE	(Nominal Rands)	
2006	**2006**	**Net Profit**	
R 44,422.02	R 16,680.00	R 27,742.02	Navels
R 47,524.01	R 18,020.00	R 29,504.01	Valencias
R 59,661.73	R 21,450.00	R 38,211.73	Lemons
R 151,607.76	**R 56,150.00**	**R 95,457.76**	**Total**
	Average Profit for Citrus	**R 31,819.25**	**per hectare**

Source: Sundays River Citrus Company (SRCC), 2008

The figures in Table 29 reflect accounting net earnings only; there is no imputation for externalities or for the opportunity cost of the land. The price of the land is also not included in these calculations or the establishment costs, which are substantial.

There is a large amount of uncertainty in citrus farming. Crop yields, and therefore profits, can be affected by weather conditions, the price of citrus on the international market and input costs, which vary according to the prevailing exchange rate and world oil price. The **average net income per hectare** for the three varieties above works out at **R50 535.92** and the **average expenses per hectare** for the three is **R18 716.67**[19]. Conradie (2002) found that in 1999 prices, the gross margins for citrus ranged between R9762 and R42 874 per hectare[20]. This accords with the figures calculated above.

Graph 14: Average net income per hectare, in nominal Rands



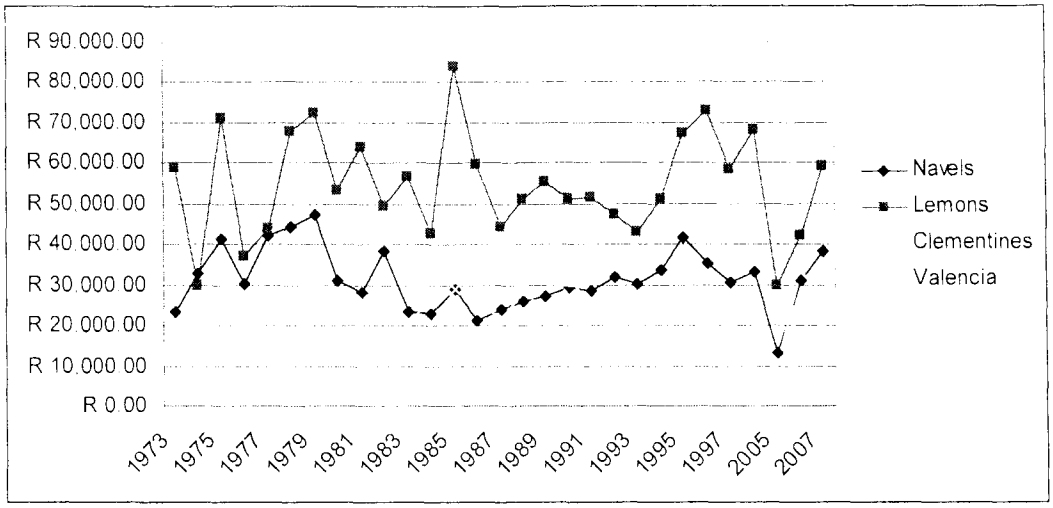
Source: Based on data provided by the SRCC, 2008

The graph above was drawn using data gathered by the Sundays River Citrus Company (SRCC) for 4 farms, including a total of 131 orchards. It shows that on average the nominal incomes obtained per hectare for all varieties of citrus have increased from 2005 – 2007, with the exception of clementines and nova oranges.

[19] In 2007 Rands an average income per hectare of R 52 911.11 and an average expenses per hectare of R19 596.56

[20] In 2007 Rands it is between R14 510.54 and R63 729.25 per hectare

Graph 15: Citrus Gross Real Incomes 1973 to 2007 (in 1999 Rands)



Source: Conradie (2002) and SRCC (2008)

* Exports of clementines only began in 1987.

Graph 15 illustrates the volatility of citrus incomes. There have been large variations between varieties as well as between the years.

Costs are also volatile. There are not only on-farm production costs associated with citrus farming, but also costs involved in the export of the product. If the product is sold locally, these export costs are obviously not included, but there is a trend towards export due to a higher export price per tonne.

The following are costs associated with citrus export:

Table 30: Costs associated with citrus export (2008 Rands)

Description	Amount (per carton)
Carton cost	R10.50
Labour, Packhouse Maintenance	R6-R8
Inspection Cost	32c
Citrus Grower's Association	32c
Transport	R1.50
Total	**R19.64**

Source: Sundays River Citrus Company, 2008

The total cost therefore per carton is around R19.64. On average a citrus tree will produce 5 cartons of fruit, of which roughly 4 (80%) will be suitable for export (pers. Comm. Technical Division, SRCC, 2008). **Total e xport cost per tree** would therefore amount to approximately **R78.56**. Given the average of 700 trees per hectare the **total export cost per hectare** amounts to **R54 992.00**. Most of this accrues as income to local workers and enterprises. This is a key issue if one is looking at the opportunity cost of converting from citrus to conservation.

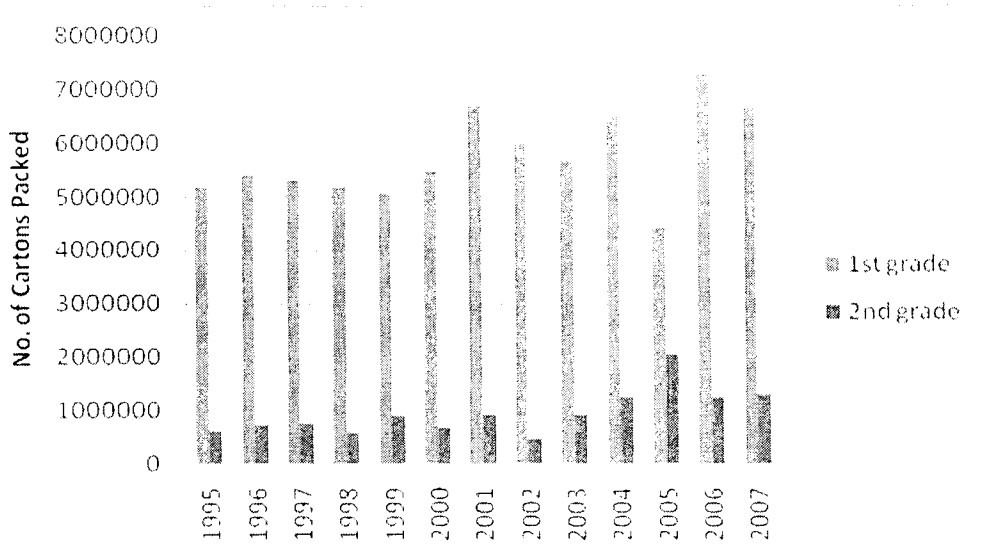
Graph 16: Total Number of Cartons (1st and 2nd Grade) packed by the SRCC

Source: Sundays River Citrus Company, 2008

Graph 16 shows an increasing trend from 2000 onwards on the number of cartons packed by the SRCC for export, with peaks in 2001, 2004 and 2006. The drop in cartons packed in 2005 was due to a number of factors: increased competition from other countries citrus exports, which resulted in a low citrus price and erratic weather conditions which affected crop yields being the two most important. The graph also clearly shows the volatility in the citrus export market. In 2007 there were roughly 8 million cartons packed by the SRCC, with 3000 seasonal packers

employed and 160 permanent salaried employees (pers. comm. D. Erasmus, SRCC, 2008). The 3000 seasonal packers employed by the SRCC, and numerous others employed by other packhouses in the area, provide much-needed income to a very poor section of the population, even if only for a few months of the year.

Graph 17: Breakdown of No. of 1st and 2nd Grade cartons packed by the SRCC



Source: SRCC, 2008

Graph 17 shows the breakdown of 1st and 2nd grade cartons packed by the SRCC:- the importance of the export market and the very low amount of 2nd grade fruit packed are clear. In 2008 many citrus farmers in the SRV sold their non-exportable fruit to juicing plants for a higher price than they would have received as a whole fruit on the market (pers. comm. L. Bower, Addo citrus farmer, SRV, 2008). The graph also shows even more clearly that though exports have marginally increased, there is substantial year on year variation.

5.9 Employment

It is often argued that citrus farming plays an integral role in employment creation in the SRV. This section looks at the employment impacts of citrus farming, including workers per hectare, employment costs and average wages.

According to Mathers & Greenburg (2003), the citrus industry has reflected significant changes in the labour market. Farmers have shifted to a smaller, more settled workforce, while the remainder of the workforce is hired on a temporary or seasonal basis according to the work rhythms (Mathers & Greenburg, 2003). This trend has also been followed in the SRV, largely due to the increase in the minimum wage and other labour-related issues. Mathers & Greenburg (2003) found that this process was not restricted to the farms, but was also found in the former co-operatives and new packhouses. Since 1988 there has been a downward trend in large-scale agricultural employment, from 1.2 million in 1988 to 914 000 in 1996 (Department of Agriculture, 2000). Census 1996 results for the entire country suggest a predominantly male labour force in the agricultural sector (Department of Agriculture, 2000). Though this is true for the agricultural sector as a whole and largely for the permanent labour force in the citrus industry, amongst seasonal workers there are a large number of women employed as pickers and packers in the SRV. This is of importance as women have traditionally been unemployed in the SRV, or engaged in domestic work, with a very low wage.

A social survey carried out by Connor (2001) for the Strategic Environmental Impact Assessment of the GAENP (in Connor & Zimmerman, 2008) found that the

average number of workers per hectare on farms amounted to one worker per 272.5 hectares and that seasonal workers in the citrus industry were earning between R10-R25[21] a day. Data collected from the Sundays River Citrus Company shows that in 2007, the average earning for a seasonal worker in the citrus industry is now around R40 per day, and there are on average 0.9 workers per hectare. This daily wage is still very low and the top end of the daily wage (R33.41) in the 2001 study, when adjusted for inflation, does not vary considerably from the current wage.

Table 31: Average number of workers on a citrus farm

Type of Employment	No. Employed	Size of Farm (in ha)	Monthly Wage	Workers per hectare
Seasonal (March to Oct.)	174	245.89	R799.04	0.71
Out of Season (Nov. to Feb.)	14.5	245.89	R898.02	0.06
Permanent	40	245.89	R1467.07	0.16
Total	**228.5**	**245.89**		**0.93**

Source: pers. comm. citrus farm accountant, SRV, 2008

According to Table 31, **in season** citrus farms employ an average of **0.93 workers per hectare** and **out of season** an average of **0.22 workers per hectare**. There is clear inter-farm variation in employment per hectare. The figures above suggest greater employment levels than were implied in comments obtained from a single private citrus farmer (2008) who stated that he employs on average 1 permanent employee per 10-20 hectares, but in season augments this workforce with roughly 1 temporary employee per hectare. The **average daily wage for seasonal**

[21] In 2007 Rands the wage is between R13,41 and R33,51

workers is **R39.95**, and for **permanent staff** it is **R73.35** and for **out-of-season workers** it is **R44.90** (all 2008 figures). The total wage bill for workers in season amounts to R210 737.05 which works out at a **per hectare employment cost** of **R857.04 per month**. This cost does not include the salary of the farm manager, which would raise the labour cost considerably. The permanent staff are kept throughout the year to take care of and maintain the orchards and if the farm has mixed crops to work in those areas. It appears that wages paid to employees on citrus farms varies as one private citrus farmer (2008) stated that on average they pay permanent staff R2500 per month and seasonal staff R1500 per month. These figures are considerably higher than those obtained for the collection of farms in Table 31.

Conradie (2002) found that permanent workers were earning about R1000/month and casual labour was hired at R180/week. These figures, once corrected for inflation at an average rate of 5%, support the figures obtained in Table 31.

From Table 31 it can be calculated that there are **0.16 permanent workers per hectare** (roughly 1 worker for every 6 hectares). Conradie (2002) found that there were 0.14 permanent workers per hectare (or 1 for every 7 hectares). The results above align with Conradie's (2002) findings and suggest that there has been less change in the permanent labour force on farms in the SRV between 1999 and 2006 than was widely expected with the advent of agricultural minimum wages.

The 2007/2008 average wage for a seasonal worker was just below R40 per day. This yields a monthly average salary of R799.04, where workers work for 8 hours a day for four (five day) weeks. A large majority of the citrus farms in the Sundays

River Valley (SRV) offer an incentive on top of the daily wage. The incentive is based on the amount of citrus picked each day and though it does add to the wage costs, it serves to increase productivity.

There are a number of labour issues in the citrus industry. In the course of personal communications with farmers (2008) it was commonly said that despite the high unemployment rate in the SRV (20%), local communities lack an interest in employment in the citrus industry. A number of farms are bringing in picking teams from outside the area and sometimes even from outside the province. In some cases, workers are being bought in from Zimbabwe, because of greater worker reliability which is important when there are contractual obligations for the farmers to fulfill. This parallels the problems faced by conservationists: how to get locals involved in the industry? The difference is, however, that conservationists face this as an imperative: they need local support. Citrus farmers would like it as a way of keeping costs down, but they don't need it and are not obliged to encourage it.

A large percentage of the labour force employed in the citrus industry is poorly educated and has little other work experience. This indicates the importance of the citrus industry in the SRV in terms of employment for many people who would not be able to find other work elsewhere. As demonstrated in the surveys with the consumption diaries there is a large degree of dependency. This further indicates the importance of work that is available. There are better opportunities for the poorly educated in agriculture, at least for now. The tourism and conservation

sector and agriculture are therefore not competing for scarce labour, but rather complementing each other in the jobs that they offer.

Over and above the employment benefits of the citrus industry there are other benefits that may not be as obvious to assess. Industries involved in the manufacture of the cartons, fertilizers, pesticides, transport of the citrus, etc. are all affected by the citrus industry. These linkages generate multiplier effects in the regional and national economy. This is in line with the situation in conservation and tourism, where many inputs are imported from outside the local economy.

In summary, below are comparison tables of the related research in the citrus industry comparing the current research (SRCC, 2008) with that of Connor (2001) and Conradie (2002):

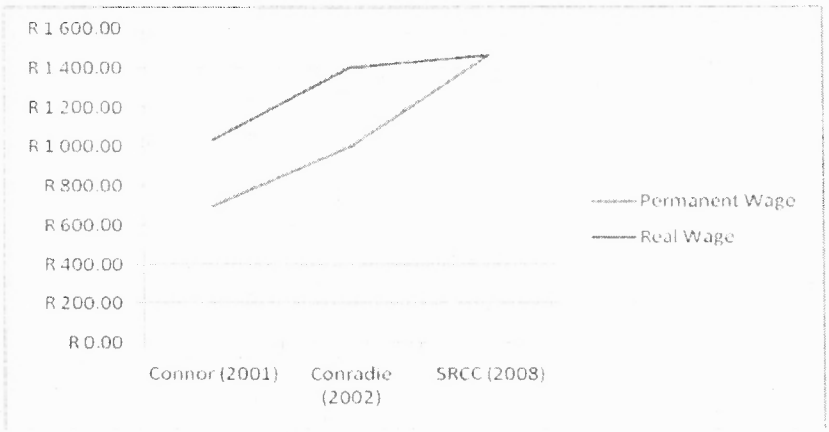
Table 32: Comparison of Employment per hectare (2001, 2002 & 2008)

	Employment per hectare
Connor (2001)	0.004 employees/ha
Conradie (2002)	0.14 employees/ha
SRRC (2008)	0.16 employees/ha

Table 33: Real and Nominal Monthly Wages of Permanent Workers (2001, 2002 &2008)

	Permanent Worker's Mean Wage
Connor (2001)	R 698.00 (R1032.77 in 2008 Rands)
Conradie (2002)	R 1 000.00 (R1405.14 in 2008 Rands)
SRCC (2008)	R 1 467.07

Graph 18: Real and Nominal Monthly Wages of Permanent Workers (2001, 2002 & 2008)

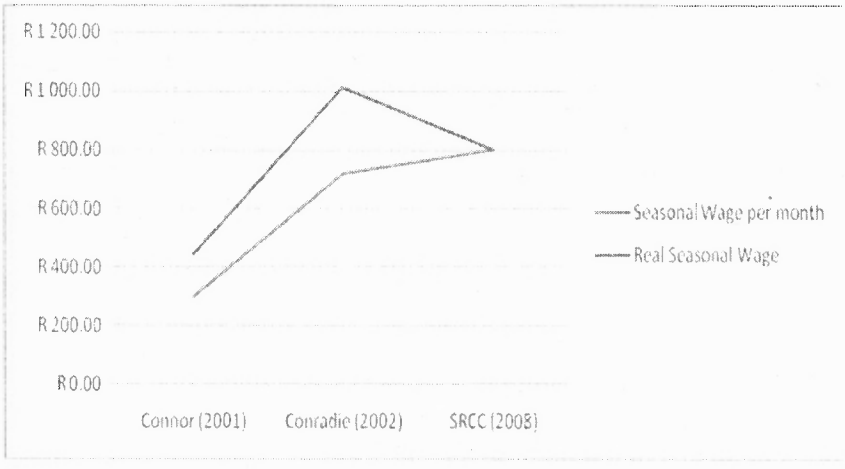


Indicating that, in real terms, the permanent wage has not changed substantially over the period 2002 to 2008.

Table 34: Real and Nominal Monthly Wages of Seasonal Workers (2001, 2002 & 2008)

	Seasonal Worker's Mean Wage per month
Connor (2001)	R 300.00 (R443.88 in 2008 Rands)
Conradie (2002)	R 720.00 (R1011.70 in 2008 Rands)
SRCC (2008)	R 799.04

Graph 19: Real and Nominal Monthly Wages of Seasonal Workers (2001, 2002 & 2008)



It appears that seasonal wages differ from farm to farm, and although there is a decrease in the seasonal wage in 2008 this is only for the co-operative and private farms may be paying more to seasonal workers.

5.10 Summary of citrus farming as a land use

Taking averages from the data presented in this chapter, the following table summarizes the direct costs and benefits, in terms of employment and income associated with citrus farming as a land use in the SRV.

Table 35: Summary of Citrus Farming as a Land use

Per Hectare	Amount (in 2007 Rands)
Average Net Income per hectare	R52 911.11
Net Revenue per hectare	R33 314.75
Average expenses per hectare	R19 596.56
Employment per hectare	0.93 in season 0.22 out of season
Value of land under citrus	R100 000 per hectare for established citrus, but this value depends on the age of the trees and the spread of cultivars
Establishment costs	+- R29 975 per hectare, excluding dam development* +-R100 000 per hectare**
On-Farm Production costs (Operating Costs)	R18 716.67 per hectare
Employment cost per hectare per month	R857.04
Export Cost per hectare	R54 992.00

* This figure represents the costs to clear the area, plant trees, trenching. Irrigation and wind breaks only

**This cost is very variable, depending on the level of mechanization, size of expansion, etc.

Despite the negative externalities associated with it, citrus farming in the SRV clearly makes a profound contribution to the regional economy, as well as to the economy of South Africa as a whole. If off-farm employment is included in the analysis, in-season employment is substantial and plays an important role in poverty reduction in the area. There is however a lack of skills development and empowerment, which undermines long-term poverty alleviation and social welfare.

The next chapter summarizes the results from the previous three chapters and attempts to compare land uses in order to determine a socially optimal mix of land use.

6. COMPARISON OF VARIOUS LAND USES

This chapter aims to bring together the most pertinent points from the preceding chapters and from there to make a general comparison of the two main land uses under discussion, as well as land restoration as a land use on its own, and as being an incremental benefit of conservation. Before proceeding to the comparison, this chapter first looks at the development framework of the Sundays River Municipality to ensure that the land use question is put into a legal framework and context.

6.1 Sundays River Municipality

The Sundays River Valley Municipality envisages itself as:

'A transformed and integrated organisation which subscribes to the principles of developmental Local Government which provides a sustainable quality of life including a safe and healthy environment for all our communities, especially the poor and rural communities.' (Sundays River Municipality, 2005:46).

In these terms land use in the SRV should be sustainable and safe, as well assisting the poor. 'Safe' is an interesting term, which could be interpreted as free from violence or could also mean 'safe' in terms of the allowable amount of environmental pollution, or in other words, 'safe' to one's health. There are certainly aspects of current land management that pose hazards. The lions and elephants in the park, and tick concentrations associated with dense thicket are

potential hazards of conservation, while the sprays used on citrus are linked to health conditions such as sinusitis, and asthma (pers. comm. Dr. S. Parkes, Local Doctor, SRV, 2008).

According to the SRV Spatial Development Framework (2005:47) policy, administrative practice and town planning regulations should promote efficient and integrated land development by, amongst other things:

- promoting a diverse combination of land uses; and
- encouraging environmentally sustainable land development practices and processes.

The Framework (2005:50) also states that '*Decisions about land uses must be based on sound planning where a number of different factors, such as population projections, economic growth strategies, the environment and other factors are taken into account'*, and that no land use should be favoured above any others. The reason for the last part of this guideline is that in the past certain land uses, e.g. mining and agriculture were favoured above other uses, which severely constrained developing land for other uses. This policy also resulted in the clearing of large tracts of land for farming and the removal of natural vegetation and a consequent loss of biodiversity. Those areas that were most easily accessible and most fertile, usually along the rivers were cleared first, leaving the natural vegetation in the less accessible places. This is clearly evident in the SRV, along the Sundays and Coerney Rivers, where land was cleared for the development of citrus and wheat farms.

The SRV Spatial Development Framework (SDF) (2005:67) also has as one of its guidelines that '*high production potential areas should be retained exclusively for agricultural purposes*'. Land use decisions made by the municipality in the Environmental Impact Assessment process will thus have this guideline in mind. It makes intuitive sense to use such areas for agriculture and to keep the less productive areas for other uses provided that the land is managed sustainably to ensure that it remains productive and does not become degraded (as discussed in relation to the soil carbon associated with thicket). Despite the intuitive sense behind this guideline, is it necessarily the right option to take? Should all productive land be used for agriculture?

Another requirement of the SRV SDF (2005:78) is that '*all developments within the Sundays River Valley Municipal area should be sensitive of the park expansion initiative*'. These two guidelines could appear to be mutually exclusive, but they are not, and can be achieved concomitantly. The Municipality obviously has as its chief concern the reduction of poverty and unemployment in the area, so as such, will make land use decisions accordingly.

6.2 Landowner's land use decision-making process

The next section looks at mixed conservation and farming (i.e. conservation buffers around farmed lands). This is a completely different approach to either of the two extremes (pure conservation or pure citrus) covered earlier.

Dale & Polasky (2007) make the point that conservation buffers in agricultural developments can benefit ecological conditions by reducing erosion, improving water quality, increasing biodiversity and expanding wildlife habitats. However such buffers leave a number of 'pockets' of conserved areas rather than creating a contiguous whole. The question that arises and will come up again later, is whether or not these small conserved areas are 'valuable' in terms of conservation, biodiversity, etc. or whether they lose their value because they are isolated and often small?

The value of agricultural land is best viewed in a landscape context (Dale & Polasky, 2007). The same is true for most land uses and their associated value. One piece of land may be worth a large amount in terms of agriculture because it is fertile, drains well, etc. While the land next to it may be unsuitable as it is rocky, steep slope, etc. and may therefore be worth a lot less in value in terms of agricultural productivity, but may have great biodiversity value. Together the two pieces of land will have a different value to what they have individually. The same is true for conservation land, as it may be more valuable if it has good grazing and therefore a good carrying capacity. Whereas degraded land will not have as much grazing material or aesthetic appeal from the point of view of eco-tourism and will therefore have less value in conservation terms, but better possible game viewing and, therefore, value in eco-tourism terms. Yet again, land has different values from a preservation perspective as well.

Landowners will generally, in one way or another, solve a dynamic optimization problem to choose the best use for their land at each point in time (Pfaff et al,

2000). They will choose the path with the highest returns. Returns depend on a number of things: land characteristics, current and past land use, prices and yields of different crops, costs of production, access to markets, the cost of changing land uses and the expected future values of these factors (Pfaff et al, 2000). This optimization problem features uncertain returns, credit constraints, limited information, insecure tenure (particularly pertinent to South Africa), and irreversible actions (Pfaff et al, 2000). Each landowner will have different time frames, as well as different definitions of returns, and different requirements in terms of earnings. The rising interest rate in South Africa also has an effect on investment decisions. Each farmer has different private preferences and risk profiles, and therefore, different opportunity costs.

Farmers' livelihoods are being increasingly threatened due to rising input costs, climate change, etc. The question that arises is whether or not it is necessary for government to respond with increased income support or should attempt be made to create new income streams? In South Africa, it appears that the latter option is the one being taken, as agricultural subsidies have over the years been reduced. It is the author's opinion that the latter alternative is more sustainable in the long run and is the option that should be encouraged in the SRV, as well as large areas of Africa in general and that this can be done through restoration and the CDM as well as sustainable eco-tourism ventures, or a combination of the two.

Conservation can also create a negative externality for surrounding agriculture, as has been observed in the SRV. Insects that breed on the *Pappea Capensis* (Jacketplum), which is found abundantly in the Thicket biome, pose a problem to

citrus farms as they feed on the citrus fruits (pers. comm., Prof. R. Cowling, 2008). Another negative externality that needs to be considered is the fact that if all land in the area is converted to conservation a number of businesses that offer services to the citrus industry, e.g. cartons, fertilizers, pesticides, transport, etc. will suffer, and this will, in turn, have a negative effect on the people employed in these businesses, and the associated poverty levels, in terms of income and employment effects. Optimal land use therefore has to take into consideration all these impacts, externalities and effects. The net effect depends on structural rigidities in the system, flexibility of employment, etc.

It is difficult to compare the three land uses looked at in this paper in terms of income and expenses per hectare alone, mostly because of the large degree of spatial heterogeneity of soils and the distribution of rainfall across the SRV and the differences in marginal and average changes. There are a number of other important factors that also need to be looked at and alternatives also need to be considered in the long term. Certain alternatives that may appear to be lucrative in the short-term may not be sustainable in the long term and vice versa, due to changing market conditions, changing environmental conditions, etc.

There is also a need to build in sufficient flexibility in policy design and implementation so as to incorporate changes in science and economics. Walker (1999) argues that making biological resources the main form of land use in regions that are marginal for agriculture will not lead to an ecological, economic and socially sustainable region on its own.

The following section summarizes the results obtained and offers a comparison of the three land uses discussed.

6.2 Summary of the Results

Saayman & Saayman (2005) show that the GAENP has a significant impact on the region and that its contribution to the local economy is the second largest after agriculture. The assessment in this dissertation also showed that the GAENP was second to agriculture in terms of income and employment effects per se, but did not take into account the biodiversity impacts, etc.

At the beginning of the study, it was believed that restoration's establishment costs would be higher than the other two options being examined. But it was found that restoration as a land use results in a lower initial investment than the other two options but also a much lower earnings potential as well. Along with this is the risk and uncertainty associated with the carbon market at present, especially considering the crash in the carbon market late last year (2008). Income earned through the restoration project will however be passive income, resulting in no extra cash outlay after the initial investment. As such it can be seen as investment in an interest-earning asset. The initial investment cost for restoration is once off, with a small amount carrying over for the maintenance of the restored site. The added benefits of mitigating climate change, enhancing biodiversity, stabilizing soils, etc. should also be considered in this evaluation. From a purely financial perspective looking at income earned per hectare, it has been shown that citrus farming is the most profitable alternative, but, as discussed, this financial analysis

does not take into account the negative externalities and impacts associated with citrus farming and the opportunity costs associated with the citrus development.

A combination of land uses is an alternative that needs to be considered. This is already being used in the GAENP, where they have implemented a restoration project in the Darlington section of the Park, therefore combining restoration and conservation as land uses. Some citrus farmers also maintain some of their farm in its pristine condition and may introduce game into these areas. This often occurs on the steeper areas of the farms and in this way the natural vegetation assists in preventing soil erosion, excess water runoff, etc. and also provides natural vegetation for the honey bees that help to pollinate the citrus plants. Restoration of degraded land on citrus farms should also be encouraged as an alternative and a possible future source of passive income. There will also then be the added benefits of reducing soil erosion, stabilizing the soils and increasing soil carbon and therefore the productivity of the land. The carbon capture also helps to mitigate climate change, even if only to a small degree. Alternative land uses are not mutually exclusive, and can be managed in such a way as to complement each other and maximize the benefits, private and social.

Table 36 presents a comparison of the figures obtained in the three preceding chapters in terms of employment, income and costs.

Table 36: Comparison of Three Land uses in the SRV

	Conservation	Citrus Farming	Restoration
Employment per hectare	0.02	0.93 in season 0.22 out of season	5 (during the restoration phase only)
Establishment costs per hectare	R30 825	+-R100 000	R8191.31
Operating costs per hectare	R107.08	R18 716.66	0
Employment costs per hectare	R50.15	R857.04	R2691.33*
Net Income per hectare	R821.43	R33 314.75	R900
Biodiversity Impact (5 being most positive, 1 being most negative)	5	1	4**

*This figure will only be for the actual restoration phase. Once the planting and follow-up have been completed, there will be no employment costs, despite possibly a small cost for maintenance and administration for the carbon assessments. The future use of the land will also determine any further employment costs as well as income potential. The cost of registration for the CDM has not been included, but is discussed in Chapter 4.

** This figure could also be 5, but depends on the restoration programme and the diversity of plants restored.

6.2 Financial Costs and Benefits of Land Use Conversion

Cost-benefit analysis attempts to appraise investment projects in ways that correct for market failure (Perman et al, 2003). It is an application of welfare economics which is intended to select projects according to efficiency criteria (Perman et al, 2003). The basic approach is to use the various costs and benefits of each project, over a period of time, using a selected discount and interest rate and to calculate a ratio of the benefits to costs. If the ratio is greater than 1, it indicates that the

project would provide a net benefit to society. The results of the benefit-cost analysis conducted in this dissertation are to be found in Appendix 4.

According to this benefit-cost analysis, over a 30 year+ period using the middle cost range, all three land uses have a B/C ratio greater than 1, indicating that they would provide a net benefit to society. For the middle range of costs: restoration has the highest ratio, followed by conservation, and then citrus farming. After only 10 years, restoration is the only option with a B/C ratio over 1. Conservation and citrus farming have a ratio of less than one, indicating that they do not offer a net benefit to society in the short-term. These results are intuitive if one looks only at financial values, but if one were to include all the non-use benefits and other economic terms then the analysis would look very different. In the sensitivity analysis below, all three land uses present B/C ratios over 1 under all cost ranges over a 30 year+ scenario.

Table 37: B/C Ratio – Sensitivity Analysis

	Conservation	Citrus	Restoration
High	2.83	1.83	4.4
Medium	3.11	1.92	5.4
Low	12.92	2.02	8.8

From a purely financial perspective, citrus farming is the most lucrative land use option, followed by restoration and then conservation. In terms of biodiversity, conservation is the best alternative, followed by restoration, and then lastly citrus farming. This does not hold if the areas to be conserved were previously farmland as they then have to be restored. The discount rate used in these calculations was 8%, adjusting it does not affect the results in any significant way over the 30+ year period. The biodiversity impacts of restoration are dependent on the type of

restoration that is done and the particular species restored. It is not always a given that restored land will enhance biological diversity.

It is also often argued that citrus farming provides a large amount of employment in the SRV. During the picking season, from April to September, it does employ a large number of casual workers, but the calculated employment per hectare shows that this number is below that employed by conservation and restoration initiatives. This citrus employment figure does not include the employment in the packhouses which would certainly increase this number to a large extent. It is this employment multiplier effect that could swing the argument in the direction of citrus farming as the largest employer in the area, but on a per hectare farm basis it is not. It would be useful to include this employment effect in future calculations.

Due to the fact that the Park is relatively large in size, with a large part of it being preserved, the income per hectare is probably lower than would be found on a large number of private farms. The fact that these farms charge higher rates as well would also result in them having a higher gross income. From a purely financial perspective therefore it appears that privately owned conservation areas are more lucrative in the long term.

Conservation, in the form of National Parks and Private Game Reserves, as well as citrus farming, both have multiplier effects in terms of employment and GDP impact. Both result in a number of other businesses, services, etc. being created and from there further employment generated. The employment figure per hectare represents direct employment, but there is also a large amount of employment

created indirectly. Restoration does not offer as much indirect employment, but this depends on what the restored land is used for. Tourism also results in a large amount of capital investment in terms of roads, airports, facilities, etc. Along with this there are also associated multiplier effects in terms of income and employment.

Due to time constraints in the data collection period of this dissertation it was not possible to collect accurate data on the costs of the various externalities, or the impacts of off-farm employment with respect to citrus. The comparison and analysis are therefore limited in the scope of their applicability but they do give an indication of the important issues and the various costs and benefits associated with each land use.

A key problem with this analysis is that the figures are all based on averages, but conversions occur at the margin. It is clear that for citrus the average and marginal impacts will be much closer to each other than one will find in eco-tourism, where expanding the area conserved may not have any impact on employment or visitor numbers.

The next chapter offers a summary of the dissertation and discussion of the findings.

7. SUMMARY AND DISCUSSION

With respect to the expansion of the GAENP there are a few important questions that arise: is unlimited expansion **really** the ideal situation, surely there is a point where expansion of the Park is no longer the socially optimal land use? Does expansion of the GAENP increase the socio-economic benefits indefinitely? If not, what is this optimal point and how do we determine it? In trying to determine the socially optimal conservation outcome, one needs to take into account short term as well as long term effects/impacts of each land use. Can one justify increasing the amount of land under conservation on a spread of land types? Or should 'inferior'/ low grade land be allocated to conservation as was historically the case and the good quality land used for farming? This argument often makes economic sense but will not please the pure conservationists among us.

Ideally one would continue to expand the Park until the marginal benefits of expansion are equal to the marginal costs of expansion. The benefits of expansion include: more land under conservation, increased biodiversity, more eco-tourism and employment opportunities and non-use values, as discussed in Chapter 3. The costs include: the cost of the land itself, the cost to rehabilitate and restore the land, and the operating/management costs. The opportunity cost of the land should also be included in this analysis, as by keeping the land in conservation, one is foregoing the income and benefits that would have accrued from the alternative use, in this case, citrus farming.

Under ideal conditions, from a conservation/preservation perspective, one would continue to expand the park indefinitely, as development of any sort is viewed as detrimental to long-term preservation/conservation goals. In this way, one would be increasing the area under conservation, maintaining eco-systems, conserving biodiversity and increasing the potential for more eco-tourism activities, and thus revenue and employment opportunities. But this is not the case, as there are inevitably budget constraints on the amount of expansion, competition for land (i.e. opportunity costs) and management constraints. It is necessary therefore to determine whether or not expanding the park would raise the economic benefits or just improve the conservation aspect or both.

In South Africa, National Parks, though given grants and support, have to, to a large extent, generate their own income. This in itself puts a constraint on the conservation objective as it is the tourism activities that pay for the conservation of the land, so design of the park has to be along those lines – i.e. conservation is required to pay for itself. Tourism and conservation objectives are not always in line and there are often conflicts that arise. For example, tourists, to ensure greater satisfaction, want to see as many animals as possible and a large variety, but there are, from a conservation perspective, limitations to the stocking (carrying) capacity of all parks, especially of the mega-herbivores e.g. elephants, buffalo. Park management therefore has to decide whether or not to fulfill its conservation objectives or to satisfy the tourists, who are essentially funding the Park. Ideally, a balance needs to be found between the two. This can at times be difficult but it is not impossible and for the long term sustainability of conservation it is essential that the two find a balance and work together. A number of animals that are also

regarded as 'popular', such as giraffe, did not naturally occur in the SRV. Despite this a number of private game reserves have introduced them because of their public appeal. This once again begs the question of whether or not one should strive for conservation or eco-tourism objectives. And whether or not a balance that is sustainable can be found. Ecological integrity is one aspect, another is the effect of tourist congestion in parks. These manifest themselves in management decisions like whether to build watering points. Doing this raises the feasible stocking density and improves viewing for tourists, but at a cost to the ecology and integrity of the park, and may lead to visitor congestion at certain points, as well as degradation of areas by large concentrations of animals around these watering points. This is clearly evidenced at Hapoor watering point in the GAENP. The building of roads is another activity that can have problematic effects. One of the advantages of large parks is that they allow managers to have both pure high integrity ecological preservation, and ordinary tourist driven conservation in different areas. Introduction of a differential pricing system for the different sections of the Park may also assist in reducing visitor congestion in some of the areas and attracting more visitors to less congested areas and thereby possibly creating more employment in these areas.

Choosing areas to conserve is a complex stochastic combinational optimization problem (Heal, 2004). Conservation biologists have been studying the choice of conservation areas for many years but have not always looked adequately at the cost and opportunity cost issues that are inherent in making these choices (Heal, 2004). From an ecological perspective, it is often the system as a whole that is more important than the individual species (Heal, 2004). It is often easier,

however, to focus the public's attention on charismatic species, such as the elephant and black rhino, than on the system of which they are a part (Heal, 2004). Once again the preservation/conservation debate also plays a role. Protected areas (PAs) effectiveness is often limited by the fact that many PAs are too small and isolated to sustain a full range of ecosystem services (Pagiola et al, 2004). This is an important point to note in the further expansion of the GAENP, a number of isolated ecological fragments are likely to be captured, and it is important to determine whether or not this makes economic and/or conservation sense.

As discussed in the dissertation, there are positive and negative externalities associated with conservation. An important point to note is that the value of conservation is not necessarily always positive. There may be certain cases where the value of the additional services obtained by converting an area to an alternative use exceeds the value of the services obtained under conservation (Pagiola et al, 2004:26). Conservation is not always the preferred option from an economic perspective. In terms of climate change, areas that are currently conserved may not, in the future, be the areas where there is the greatest biodiversity or the need to conserve. Though this is a very long term view, and will not currently be in the management time frame of the parks, it is a point that needs to be considered. Bird and mammal movements according to climate and associated vegetation changes may necessitate a shift in reserve/park boundaries if the goal of these reserves/parks is to conserve/preserve the greatest number of species.

Another way forward could be an approach such as the 'set aside' notion in the UK and consists of entering into contractual agreements with land owners around the

existing park (Vidaeus, 2002). This offers an alternative to outright land purchase and therefore results in an increase in land under conservation, but with a more efficient use of financial resources (Vidaeus, 2002). This option has been used in the GAENP, for example in the Kuzuko Contractual area and RiverBend concession area. Under such agreements the Park does not buy the land, but it is incorporated into the GAENP according to a specific agreement with the landowner concerned. As mentioned in Chapter 3 it would not be financially feasible for the GAENP to purchase all land that is intended to be incorporated, so such contractual agreements offer a solution to this and also extend the conservation initiative to private enterprises. This public-private partnership offers many benefits, both financial and economic. The private enterprises often bring with them relevant knowledge and expertise that can be used to train and assist the surrounding community members. They often also have more resources at their disposal to invest in training and development.

Vidaeus (2002) suggests that the GAENP presents a model of protected area management which can be replicated within SANParks and other conservation agencies in South Africa, as well as in other African countries. Some caveats should be attached to this view as the GAENP is unique or unusual in a number of ways. Particularly noteworthy are the wide range of biomes within it, the combination of good surrounding infrastructure, high population density and high unemployment in surrounding areas, the high opportunity cost of the land and the high cost of restoring farmlands to their natural state when added to the park. It has been noted that finding that *one* specific conservation measure is worth undertaking and is a success is no guarantee that *all* conservation measures are

worth undertaking, nor does it mean that this same measure is necessarily worth undertaking in a different situation (Pagiola et al, 2004).

South Africa has committed to setting aside 12% of its land area for conservation (Jackelman, Holness, & Lechmere-Oertel, 2007). It would obviously not make sense to have all this land concentrated in one province or area. This begs the question, how should the 12% be split up and on what grounds should this decision be made? Including small pockets of land under conservation increases the diversity of areas and species conserved, but beyond some point this is traded off against economic sustainability. Small and fragmented reserves are often uneconomic. There are also the issues of edge effects discussed in Chapter 3, economies of scale in management, fencing costs, and ecological costs of fragmentation. Does fragmentation reduce the conservation value of a given area of land? It is the author's belief that small pockets of conserved areas do not fully achieve either the goal of conservation or eco-tourism. Interviews and discussions with international visitors (pers. comm., Tourists in private lodges, 2004-2007) suggest a desire to see contiguous conservation areas, not disjointed areas that are separated by fences, roads, railways. The "wilderness feeling" contributes to visitor satisfaction/utility: an important determinant of return visits and word-of-mouth marketing that will promote further income flows in the future.

The socially optimal size of the Park is therefore that size which maximizes the benefits associated with conservation in such a way that it outweighs the costs, including the opportunity costs. This does not mean that there should be no citrus development as there is certainly a place for citrus farming in the SRV, particularly in terms of the foreign exchange earnings and essential employment it provides.

8. CONCLUSIONS AND RECOMMENDATIONS

Land use is a topical issue that does not necessarily have one right or wrong answer making it all the more interesting. Issues that are currently pertinent in the land use decision-making process were not as important in the past, indicating that in the future too there will be other issues that will become important and ones that will no longer be of importance. This leads to the point that policy regarding land use needs to be flexible and adaptable to the changing variables in the environment and the economy. Research on externalities, income flows, costs, etc. needs to be encouraged and carried out continuously so that landowners and government can make informed decisions that will result in sustainable land use now and in the long term.

Despite the negative externalities associated with citrus farming, there is certainly a place for it in the SRV as it provides employment and very important foreign exchange earnings for the country. It also provides a carbon sink to assist in mitigating climate change. Though expanding the Park indefinitely appears the ideal from a conservation/preservation perspective, it is not necessarily the ideal from an economic or social welfare perspective. Whether land is publicly or privately conserved has little effect on the conservation objectives of the country, but does appear to affect the employment and income potential. Some would however argue that the introduction of extra-limital species by the private reserves is contrary to the conservation objectives of the country and therefore should not be allowed. It can affect the conservation objectives, but the increased revenue

earned and consequent jobs created by the increased tourist numbers is perhaps greater and of more importance in a country like South Africa. It would be interesting for future research to assess this conflict of objectives by looking at different private reserves, some with extra-limital species and others with only locally indigenous game and whether either option is more preferable to visitors. An economic and financial analysis of the different conservation effects with or without extra-limital species would also be of interest and use in determining optimal land allocation.

A socially optimal conservation outcome is not necessarily the same as the economic or financial one, but ideally the situation which maximizes social welfare will ultimately be acceptable from an economic perspective and will also be the one that is accepted by the most parties.

With respect to fragmentation, it would appear that it is not the ideal from a conservation or eco-tourism perspective and for that reason policy should be aimed at increasing conservation areas as contiguous wholes rather than allowing fragmentation. In the world of climate change it would also appear that maintaining whole, productive eco-systems would be more beneficial than isolated areas to conserve a few, individual species.

Future detailed research on the income flows to the surrounding communities should be carried out to ascertain whether or not conservation is truly having a beneficial impact on the lives and social welfare of people and to what extent. The fulfillment of the objective of poverty alleviation will also be assessed more clearly

in an analysis of this type (research is currently being conducted by the author in 6 southern African countries). As mentioned, detailed research on all the externalities and impacts of various land uses would also be beneficial to the land-use decision-making process.

Due to the heterogeneous nature of land it is almost impossible to conclude what land use is best, but guidelines can be drawn up for certain areas to assist policymakers in making more informed decisions.

It is important to point out that conservation is not always the best use of the land and it is not always the most feasible either. Compromise therefore needs to be reached between conservationists, economists and accountants in order to establish a sustainable, workable balance that aims to promote biological diversity, mitigate climate change, reduce poverty and unemployment and maximize social welfare. Based on the analysis and discussions in this dissertation the ideal land use in the SRV would include a mix of agriculture in the high potential agricultural areas and conservation/eco-tourism in the remaining areas, as this would maximize social welfare and assist in meeting conservation objectives.

9. REFERENCES

8.1 Internet Sources

Bayer Confidor Insecticide Group Code 4A - http://www.bayercropscience.co.za/admin/uploads/files/products/Confidor_70_WG_Eng.pdf

Cacadu Municipality - http://www.cacadu.co.za/municipality/22/background/

Clean Development Mechanism (CDM) Rulebook - www.cdmrulebook.org

Department of Agriculture - http://www.nda.agric.za/

Department of Environmental Affairs and Tourism (DEAT) – www.environment.gov.za

EUREPGAP - http://www.eurepgap.org/Languages/English/about.html

Hunter Hotels – Gorah Elephant Camp, Addo Elephant National Park - www.hunterhotels.com

The Katoomba Group – Conservation Economy Backgrounder – Ecosystem Marketplace (2007) – www.ecosystemmarketplace.com

Global Environment Facility, 2003, What kind of world? The challenge of land degradation – www.theGEF.org

Kyoto Protocol to the United Nations Framework Convention on Climate Change

- http://unfccc.int/resource/docs/convkp/kpeng.pdf
- http://unfccc.int/kyoto_protocol/items/2830.php),
- http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php

Mail & Guardian Online article "Super plant mops up CO2" - http://ww2.mg.co.za/article/2008-06-22-super-plant-mops-up-co2

Nguni River Lodges, Addo Elephant National Park - www.ngunilodges.co.za

Restoration Research Group (R3G) – www.r3g.co.za

River Bend Lodge, Addo Elephant National Park - www.riverbendlodge.co.za

Rhodes University - www.ru.ac.za

Statistics South Africa, Census 2001 - www.statssa.gov.za/census01/html/default.asp

South Africa Explored - http://www.sa-venues.com/maps/south-africa-provinces.htm

South African National Biodiversity Institute – Threatened biodiversity research programme – www.sanbi.org/frames/researchfram.htm
South African National Parks Official Website – www.sanparks.org

South Africa Online – www.southafrica.co.za/agriculture_29.html

South African Tourism : Highlights of tourism's performance in 2007 (May 2008) - www.southafrica.net/satourism/research

Sundays River Citrus Corporation, pers. comm.

Sundays River Valley Tourism - www.sundaysrivervalley.com

United Nations Environment Programme – www.unep.org

XE – Universal Currency Converter - http://www.xe.com/ucc/

World Travel and Tourism Council (WTCC), 2009 – *Travel and Tourism Economic Impact: South Africa,* http://www.wttc.org/eng/Tourism_Research/Tourism_Economic_Research/

8.2 Personal Communications

Bower, L., Addo Citrus farmer, 2008

Community members, Sundays River Valley, 2004-2008

Cowling, R. (Prof.), Rhodes University lecturer, 2008

D. Erasmus, Sundays River Citrus Corporation (SRCC), 2008

Local residents SRV, 2008

Mike Powell, Subtropical Thicket Restoration Project, 2008, pers. comm.

Parkes, S. Local doctor, Riverside Family Clinic, Addo, 2008

Pickels, C., Crisscross Adventures Owner and River Guide, 2008

Private citrus farmers, B. Nel, C. Marais & A. Serfontein, Sundays River Valley, 2007 & 2008

Lucius Moolman, SANParks Regional Manager, Frontier Cluster, 2007 & 2008

John Adendorff, Conservation Manager, GAENP, 2007 & 2008

Songhurst, A. Currently researching human-elephant conflict in the Okavango Panhandle, Botswana, 2008-2009

Sundays River Citrus Corporation (SRCC), Addo, 2007-2008

8.3 Journal Articles, books and all other sources

Addo Elephant National Park (AENP) Rehabilitation Plan, 2008

Antle, J. & McCarl, B., (2001), *The Economics of Carbon Sequestration in Agricultural soils*, preliminary version of a chapter published in 2002 in The International Yearbook of Environmental and Resource Economics, Tietenberg, T. & Folmer, H., eds, Edward Elgar Publishing, Cheltenham, UK and Northampton, MA, pp 278-310

Armsworth, P.R, Kendall, B.E. & Davis, F.W. (2004), 'An introduction to biodiversity concepts for environmental economists', *Resource and Energy Economics,* 26, pp 115-136

Boshoff, A., Landman, M., Kerley, G. & Bradfield, M. (2007), 'Profiles, views and observations of visitors to the Addo Elephant National Park, Eastern Cape, South Africa, *South African Journal of Wildlife Research*, 37 (2), pp 189-196.

Capoor, K. & Ambrosi, P. (2007), *The World Bank: State and Trends of the Carbon Market, 2007.*

Chomitz, K., Alger, K., Thomas, T., Orlando, H. & Vila Nova, P., (2005), 'Opportunity costs of conservation in a biodiversity hotspot: the case of southern Bahia', *Environment and Development Economics,* 10, pp 293-312

Coastal and Environmental Services, (2001), '*Proposed GAENP – Strategic Environmental Assessment Report (SEA), Volume 1 & 2 – Specialist Reports*'

Connor, T. & Zimmerman, D., (2008), *Socio-Economic Survey of the Addo Elephant National Park and surrounds',* prepared on behalf of South African National Parks.

Conradie, B. (2002), *The value of water in the Fish-Sundays scheme of the Eastern Cape*, School of Economics, University of Cape Town, report to the Water Research Commission on the project "The value of water as an economic resource in the Great Fish and Sundays River catchments", WRC Report No. 987/1/02

Cousins, J. A., J. P. Sadler, and J. Evans, 2008, Exploring the role of private wildlife ranching as a conservation tool in South Africa: stakeholder perspectives. *Ecology and Society* **13**(2): 43.

Dale, V. & Polasky, S., (2007), Measures of the effects of agricultural practices on ecosystem services, *Ecological Economics,* 64, pp 286-296.

DEAT (2004) Cost Benefit Analysis, Integrated Environmental Management, Information Series 8, Department of Environmental Affairs and Tourism (DEAT), Pretoria

Eastern Cape State of the Environment Report – Chapter 1, 2004

Foley, J., DeFries, R., Asner, G., Barford, C., Bonan, G., Carpenter, S., Chapin, F., Coe, M., Daily, G., Gibbs, H., Helkowski, J., Holloway, T., Howard, E., Kucharik, C., Monfreda, C., Patz, J., Prentice, C., Ramankutty, N. & Snyder, P., (2005), 'Global Consequences of Land Use', *Science*, 309, 5734, ProQuest Educational Journals, pp 570-574

Geach, B., (1997), 'The Addo Elephant National Park as a model of sustainable land use through ecotourism', submitted in partial fulfillment of the MSc at the University of Port Elizabeth.

Gunderson, L, and C. Folke. 2008. A different future. *Ecology and Society* 13(2): 57.

Hamilton, K., Tembo, G., Sinyenga, G., Bandyopadhyay, S., Pope, A., Guillon, B., Muwele, B., Simasiku, P. & Pavy, J-M., (2007), *'Economic and Sector Work: Economic and Poverty Impact of Nature-Based Tourism'*, World Bank Draft Report, Zambia

Harvey, C., Alpizar, F., Chacon, M. & Madrigal, R., (2004), *Assessing linkages between agriculture and biodiversity in Central America: historical overview and future perspectives',* A Report submitted to The Nature Conservancy.

Heal, G. (2004)., Editorial: Economics of biodiversity: an introduction', *Resource and Energy Economics*, 26, pp 105-114.

Higgins, S., Turpie, J., Costanza, R., Cowling, R., Le Maitre, D., Marais, C., & Midgley, G., (1997), 'An ecological economic simulation model of mountain fynbos ecosystems Dynamics, valuation and management', *Ecological Economics,* 22, pp 155-169.

Jackelman, J., Holness, S. & Lechmere-Oertel, R., 2007, *The National Protected Area expansion strategy, 2008-2012: a framework for implementation,* prepared for SANBI and the National Department fo Environmental Affairs and Tourism.

Kerley, G., Knight, M. & De Kock, M., (1995), 'Desertification of Subtropical Thicket in the Eastern Cape, South Africa: Are there alternatives?', *Environmental Monitoring and Assessment*, 37, pp 211-230

Kerley, G., Geach, B. & Vial, C. (2003), 'Jumbos or bust: do tourists' perceptions lead to an under-appreciation of biodiversity?', *South African Journal of Wildlife Research* 33(1), pp 13-21.

Langholz, J. & Kerley, G. 2006. *Combining conservation and development on private lands : an assessment of eco-tourism based private game reserves in the Eastern Cape.* A report commissioned by the Wilderness Foundation, South Africa.

Lechmere-Oertel, R.G. (2003), *The effects of goat browsing on ecosystem patterns and processes in succulent thicket, South Africa*, in partial fulfillment of Phd in Faculty of Science, University of Port Elizabeth, South Africa.

Leechor, C. & Fabricius, M., undated, *Developing Tourism in Botswana: Progress and Challenges* – Discussion draft

Lepper, C., (2006), *Community-based Natural Resource Management, Livelihood Diversification & Poverty alleviation: a case study of NG22/23 & associated communities, Okavango Delta, northern Botswana,* in partial fulfillment for the Degree of Master in Environment and Development, University of Kwazulu-Natal

Le Quesne, T., & Calverley, G., (1998), *A Greater Addo National Park – Issues, Costs and Policies – a preliminary review,* www.saep.org/Coega/98LequesneAddo.htm

Lubowski, R., Plantinga, A. & Stavins, R. (2005), 'Land-use change and carbon sinks : Econometric estimation of the carbon sequestration supply function', *Journal of Environmental Economics and Management,* 51, pp 135-152

Mathers, C. & Greenburg, S., 2003, 'Market liberalization in post-apartheid South Africa: the restructuring of citrus exports after deregulation', *Journal of Southern African Studies*, Vol 29, No 2.

McCarl, B.A. & Schneider, U.A (2000), 'U.S Agriculture's role in a Greenhouse Gas Emission Mitigation World: An Economic Perspective', *Review of Agricultural Economics,* Vol. 22, No. 1, pp 134-159

McConnell, C.R. & Brue, S.L, (2005), *Economics: Principles, Problems and Policies*, United States: McGraw-Hill Irwin

Meiring, J., 1959, Sundays River Valley: Its History and Settlement, *A.A. Balkema: Cape Town-Amsterdam*

Mills, A. & Fey, M., 2003, 'Declining soil quality in South Africa: effects of land use on soil organic matter and surface crusting', *South African Journal of Science,* 99, pp 429-436.

Mills, A., O'Connor, T., Skowno, A., Bosenberg, D., Donaldson, J., Lechmere-Ortel, R. and Sigwela, A. (2003) *Farming for carbon credits : implications for land use decisions in South African rangelands.* Submitted to the International Rangelands Congress, Durban, July 2003.

Mills, A., O'Connor, T., Donaldson, J., Fey, M., Skowno, A., Sigwela, A., Lechmere-Ortel, R., Bosenberg, J, (2005), 'Ecosystem carbon storage under different land

uses in three semi-arid shrublands and a mesic grassland in South Africa', *South African Journal of Plant Soil*, 22(3), 183-190

Mills, A., Turpie, J., Cowling, R., Marais, C., Kerley, G., Lechmere-Oertel, R., Sigwela, A. & Powell, M., (2007), 'Assessing Costs, Benefits and Feasibility of Restoring Natural Capital in Subtropical Thicket in South Africa', Chapter 21, in *Restoring Natural Capital. Science, Business and Practice,* eds J. Aronson, S.J. Milton, & J. Blignaut. Island Press, Washington D.C.

Naidoo, R. & Adamowicz, W.L., (2006), 'Modeling Opportunity Costs of Conservation in Transitional Landscapes', *Conservation Biology*, Vol. 20, No.2, pp 490-500

Norton-Griffiths, M. & Southey, C., (1995), 'The opportunity costs of biodiversity conservation in Kenya', *Ecological Economics*, 12, pp 125-139.

Norton-Griffiths, M., (1996), 'Property rights and the marginal wildebeest: an economic analysis of wildlife conservation options in Kenya', *Biodiversity and Conservation*, 5, pp 1557-1577

Pagiola, S., von Ritter, K. & Bishop, J., 2004, World Bank Environment Department Paper No. 101, *Assessing the Economic Value of Ecosystem Conservation.*

Palmer, A., Kakembo, V., Lloyd, W. & Ainslie, A., (2006), *Degradation patterns and trends in the succulent thicket*, presented at the 2006 Thicket Forum, South Africa.

Perman, R., Ma. Y., McGilvray, J. & Common, M. (2003), *Natural Resource and Environmental Economics*, Essex: Pearson Education Limited.

Pfaff, A., Kerr, S., Hughes, R., Lui, S., Sanchez-Azofeifa, G., Schimel, D., Tosi, J. & Watson, V. (2000), The Kyoto Protocol and payments for tropical forest: an inter-disciplinary method for estimating carbon-offset supply and increasing the feasibility of a carbon market under the CDM', *Ecological Economics*, 35, pp 203-221

Picazo-Tadeo, A.J. & Reig-Martinez, E., (2006), 'Agricultural externalities and environmental regulation: evaluating good practices in citrus production', *Applied Economics,* Vol. 38, pp 1327-1334

Pierce, S.M. (2003), The STEP Handbook. Integrating the natural environment into land use decisions at the municipal level:towards sustainable development. *Terrestrial Ecology Research Unit Report No. 47.* University of Port Elizabeth, South Africa

Powell, M. & Mills, A. (2006), Department of Water Affairs and Forestry, Working for Woodlands Programme: *The Subtropical Thicket Rehabilitation Project – The Baviaanskloof Node.*

Powell, M., Mills, A. & Marais, C., (2006), *Carbon sequestration and restoration: challenges and opportunities in subtropical thicket*, presented at the Subtropical Thicket Forum Woodlands Symposium, South Africa

Powell, M. 2007. *The Carbon Economy and Subtropical Thicket.* Talk given to the Subtropical Thicket Forum Field Trip, 24th October 2007, Great Fish River Megareserve.

Saayman, M, & Saayman, A., (2005), *Socio-economic impact of the Addo Elephant National Park*, North-West University, Potchefstroom Campus, Report prepared for South African National Parks

Sedjo, R. & Sohngen, B., October 2007, *'Carbon Credits for Avoided Deforestation'*, RFF Draft Paper 07-47

Sims-Castley, R. (2002), A Preliminary Review of Gross Financial Incomes Generated by Industries dependent on Thicket Vegetation, *Report No. 37 Terrestrial Ecology Research Unit, University of Port Elizabeth*

Smith, N. & Wilson, S., 2002, Changing Land Use Trends in the Thicket Biome: Pastrolism to Game Farming, *Terrestrial Ecology Research Unit, Report No. 38*

Sterner, T. (2003), *Policy Instruments for Environmental and Natural Resource Management, Washington :* RFF Press

Stoorvogel, J.J & Antle, J.M. (2001), Regional land use analysis : the development of operational tools, *Agricultural Systems,* 70, pp 623-640

Strange, N., Rahbek, C., Jepsen, J. & Lund, M. (2006), Using farmland prices to evaluate cost-efficiency of national versus regional reserve selection in Denmark, *Biological Conservation,* 128, pp 455-466.

South African Tourism, May 2008, Highlights of Tourism's performance in 2007

Suh, J. & Harrison, S., (2005), 'Management Objectives and Economic Value of National Parks: Preservation, Conservation and Development', *Discussion Paper No. 337,* May 2005, School of Economics, The University of Queensland

Sundays River Municipality, *Sundays River Valley Spatial Development Framework*, (2005), Final Draft, Moses Mabida, Kirkwood.

Tegtmeier, E.M. & Duffy, M.D. (2004), 'External costs of agricultural production in the United States', *International Journal of Agricultural Sustainability*, Vol 2, No 1

Turpie, J. (2003), *An Ecological-Economic Appraisal of Conservation on Commercial Farm Land in Four Areas of South Africa,* Final report on the Ecological-Economics Research Component of the Conservation Farming Project, report submitted to the National Botanical Institute

Turpie, J. (2004), Maloti Drakensberg Transfrontier Conservation and Development Programme: Ecosystem Services Trading Project -
Ecosystem services supplied by the Maloti-Drakensberg bioregion

Vidaeus, L. (2002), *South Africa: Greater Addo Elephant National Park Project Submission for Work Program Inclusion,* World Bank Office Memorandum for GEF Program

Walker, B. (1999), 'Maximising net benefits through biodiversity as a primary land use', *Environment and Development Economics*, 4, 1999, pp 204-214

Washburn, A. (2003), '*The Environmental fate of Methiadathion'*, Environmental Monitoring, Department of Pesticide Regulation.

World Bank Report No. 25655-SA, (2004), *South Africa the Greater Addo Elephant National Park Project*

Zelek, C. & Shively, G. (2003), 'Measuring the opportunity cost of carbon sequestration in tropical agriculture', *Land Economics,* 79 (3), pp 342-352

Appendices

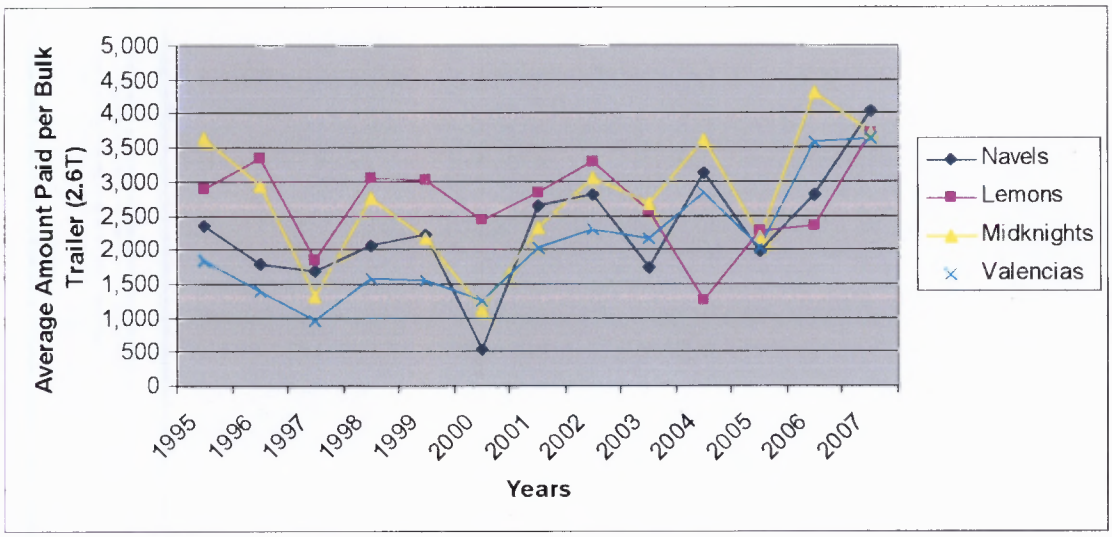
Appendix 1 – Breakdown of Sales to SANParks for the Expansion of the Addo Elephant National Park

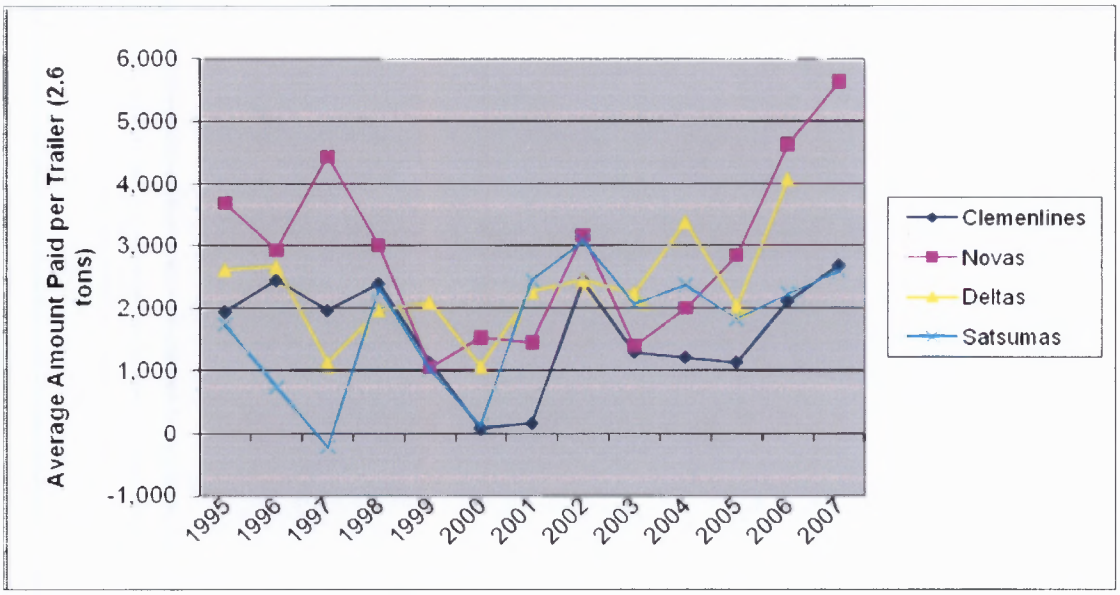
Area	Size	Value	Value Per Hectare	Year
	(ha)	(nominal Rands)	(nominal Rands)	
Farm 45 bought by SANParks	648.08	R 425,000.00	R 656.00	1998
Farm 213 bought by SANParks	1401.67	R 1,653,000.00	R 1,166.00	1999
Farm 19/21 bought by SANParks	2516.12	R 2,450,000.00	R 974.00	1999
Farm 286/0 by SANParks	967.77	R 485,000.00	R 501.00	1999
Farm 338/2 & 286/5&3 by SANParks	1394.39	R 798,000.00	R 572.00	2000
Farm 233/2 & 3 by SANParks	823.55	R 450,000.00	R 546.00	2000
SANParks	430.36	R 580,981.00	R 1,350.00	2001
SANParks	217.22	R 250,000.00	R 1,151.00	2001
SANParks	447.51	R 615,000.00	R 1,374.00	2001
Farm 410/0 by SANParks	2885.25	R 3,990,000.00	R 1,383.00	2001
Farm 410/1, 164/4 & 296/0 by SANParks	4637.42	R 7,004,147.00	R 1,510.00	2001
SANParks	691.69	R 914,614.00	R 1,322.00	2002
Farm 286/7 by SANParks	861.56	R 775,000.00	R 900.00	2002
Farm 410/3 & 230/7 & 2 by SANParks	3436.01	R 5,752,115.00	R 1,674.00	2002
Darlington property by SANParks	3595.00	R 4,060,000.00	R 1,130.00	2002
Farm Weltevrede - SANParks	447.00	R 615,000.00	R 1,376.00	2002
Farm Nuwepost -SANParks	217.00	R 250,000.00	R 1,152.00	2002
Farm Weltevrede - SANParks	430.00	R 580,981.00	R 1,351.00	2002
Farm Saagkuil - SANParks	285.00	R 314,250.00	R 1,103.00	2002
		Total	R 21,191.00	
		Average per hectare	**R 1,115.32**	

Values in this table are nominal values and have not been adjusted for inflation

Appendix 2 – Summary of Citrus Prices over the Period 1995-2007

The following data was obtained from the Sundays River Citrus Corporation (SRCC) and shows the citrus prices over the period 1995 to 2007 for 8 different varieties of citrus. They have been graphed on two graphs to make it easier to see the changes in the individual prices. As can be seen for all varieties, the prices are very volatile and though there is an upward trend in certain varieties, the prices tend to fluctuate greatly. This is due to a number of factors, including: changes in world trends/tastes, exchange rate changes.





AVERAGE AMOUNT PAID PER BULK TRAILER (2.6 TONS)

11/06/2008

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
NAVELS	2,343	1,795	1,691	2,057	2,210	530	2,635	2,795	1,740	3,122	1,975	2,800	4,036
LEMONS	2,878	3,329	1,842	3,060	3,033	2,425	2,822	3,285	2,563	1,252	2,274	2,353	3,714
MIDKNIGHTS	3,626	2,933	1,302	2,758	2,168	1,116	2,336	3,051	2,671	3,611	2,198	4,305	3,723
VALENCIAS	1,840	1,382	957	1,570	1,554	1,250	2,032	2,295	2,164	2,832	2,039	3,583	3,630
CLEMENTINES	1,946	2,451	1,965	2,395	1,128	79	161	2,447	1,299	1,216	1,137	2,123	2,688
NOVAS	3,690	2,931	4,438	3,005	1,059	1,534	1,455	3,174	1,398	1,999	2,848	4,630	5,633
DELTAS	2,622	2,673	1,136	1,973	2,099	1,070	2,266	2,449	2,246	3,384	2,035	4,070	
SATSUMAS	1,740	744	-209	2,309	1,017	130	2,451	3,085	2,070	2,378	1,831	2,244	2,596
TOTAL	20,685	18,238	13,122	19,127	14,268	8,133	16,158	22,581	16,150	19,794	16,337	26,108	26,020
AVERAGE	**2955**	**2605.43**	**1874.57**	**2732.43**	**2038.29**	**1161.91**	**2308.29**	**3225.84**	**2307.14**	**2827.76**	**2333.85**	**3729.71**	**4336.67**

Navels, Midknights, Novas and Deltas are all varieties of oranges. There has been a steady upward trend in the prices of novas, clementines and navels.

An increase in input costs over the years, results in each hectare of citrus having to produce more to ensure returns. The other alternative is that more citrus needs to be planted, and therefore more natural vegetation cleared for this purpose.

Appendix 3 – Contracts for Restoration Projects in the Greater Addo Elephant National Park

CONTRACT MONTH	HECTARES PLANNED	HECTARES COMPLETED	DEGRADATION LEVEL	ACTUAL PERSON DAYS	CONTRACT COSTS	Cost per Hectare
Oct/Nov 2007	3	3	Bad	264	R 35,678.97	R 11,892.99
Oct/Nov 2007	3	3	Bad-Medium	264	R 35,678.97	R 11,892.99
Oct/Nov 2007	3	3	Bad	264	R 35,678.97	R 11,892.99
Oct/Nov 2007	3	3	Bad	264	R 35,678.97	R 11,892.99
Oct/Nov 2007	3	3	Bad	264	R 35,678.97	R 11,892.99
Nov/Dec 2007	3.2	3.2	Bad	220	R 31,669.91	R 9,896.85
Nov/Dec 2007	3.2	3.2	Bad - Medium	240	R 32,404.70	R 10,126.47
Nov/Dec 2007	3.2	3.2	Medium	240	R 33,075.93	R 10,336.23
Nov/Dec 2007	3.2	3.2	Medium	240	R 33,075.93	R 10,336.23
Nov/Dec 2007	3.2	3.2	Bad- Medium	240	R 33,207.72	R 10,377.41
Jan-08	4.5	4.5	Medium	240	R 32,423.24	R 7,205.16
Jan-08	4.5	4.5	Bad	240	R 32,404.70	R 7,201.04
Jan-08	6	6	Medium	240	R 32,413.97	R 5,402.33
Jan-08	5	5	Medium	240	R 35,084.77	R 7,016.95
Jan-08	7	7	Medium	240	R 32,553.04	R 4,650.43
Feb-08	5.9	5.9	medium	240	R 32,404.70	R 5,492.32
Feb-08	5.9	5.9	Medium	240	R 32,404.70	R 5,492.32
Feb-08	5.9	5.9	Medium	240	R 32,404.70	R 5,492.32
Feb-08	5.9	5.9	Medium	240	R 32,404.70	R 5,492.32
Feb-08	5.9	5.9	Bad	240	R 32,451.05	R 5,500.18
Mar-08	5.9	5.9	Medium	240	R 33,555.48	R 5,687.37
Mar-08	5.9	5.9	Medium	240	R 32,423.24	R 5,495.46
Mar-08	5.9	5.9	Medium	240	R 32,511.92	R 5,510.49
Mar-08	5.9	5.9	Medium	240	R 32,502.92	R 5,508.97
Apr-08	5.9	5.9	medium	240	R 33,614.84	R 5,697.43

Appendix 4 – Benefit-Cost Calculations for the three land uses covered in the study

δ 0.08

r 0.01

Conservation

t	Bt	Ct	Nt	Discounted Bt	Discounted Ct	Discounted Nt
0	0.00	30825.00	-30825.00	0.00	28541.67	-28541.67
1	2300.00	107.08	2192.92	2129.63	99.15	2030.48
2	2323.00	108.15	2214.85	2150.93	100.14	2050.79
3	2346.23	109.23	2237.00	2172.44	101.14	2071.29
4	2369.69	110.32	2259.37	2194.16	102.15	2092.01
5	2393.39	111.43	2281.96	2216.10	103.17	2112.93
6	2417.32	112.54	2304.78	2238.26	104.21	2134.06
7	2441.50	113.67	2327.83	2260.64	105.25	2155.40
8	2465.91	114.80	2351.11	2283.25	106.30	2176.95
9	2490.57	115.95	2374.62	2306.08	107.36	2198.72
10	2515.48	117.11	2398.36	2329.14	108.44	2220.71
11	2540.63	118.28	2422.35	2352.44	109.52	2242.91
12	2566.04	119.47	2446.57	2375.96	110.62	2265.34
13	2591.70	120.66	2471.04	2399.72	111.72	2288.00
14	2617.61	121.87	2495.75	2423.72	112.84	2310.88
15	2643.79	123.09	2520.70	2447.95	113.97	2333.99
16	2670.23	124.32	2545.91	2472.43	115.11	2357.33
17	2696.93	125.56	2571.37	2497.16	116.26	2380.90
18	2723.90	126.82	2597.08	2522.13	117.42	2404.71
19	2751.14	128.08	2623.06	2547.35	118.60	2428.76
20	2778.65	129.36	2649.29	2572.82	119.78	2453.04
21	2806.44	130.66	2675.78	2598.55	120.98	2477.57
22	2834.50	131.96	2702.54	2624.54	122.19	2502.35
23	2862.85	133.28	2729.56	2650.78	123.41	2527.37
24	2891.47	134.62	2756.86	2677.29	124.65	2552.65
25	2920.39	135.96	2784.43	2704.06	125.89	2578.17
26	2949.59	137.32	2812.27	2731.11	127.15	2603.95
27	2979.09	138.70	2840.39	2758.42	128.42	2629.99
28	3008.88	140.08	2868.80	2786.00	129.71	2656.29
29	3038.97	141.48	2897.49	2813.86	131.00	2682.86
30	3069.36	142.90	2926.46	2842.00	132.31	2709.69
31	3100.05	144.33	2955.72	2870.42	133.64	2736.78
32	3131.05	145.77	2985.28	2899.12	134.97	2764.15

33	3162.36	147.23	3015.13	2928.11	136.32	2791.79
34	3193.99	148.70	3045.29	2957.40	137.69	2819.71
35	3225.93	150.19	3075.74	2986.97	139.06	2847.91
36	3258.19	151.69	3106.50	3016.84	140.45	2876.39
37	3290.77	153.21	3137.56	3047.01	141.86	2905.15
38	3323.68	154.74	3168.94	3077.48	143.28	2934.20
39	3356.91	156.29	3200.63	3108.25	144.71	2963.54
40	3390.48	157.85	3232.63	3139.33	146.16	2993.18
			Total	104109.87	33388.66	70721.21
			B/C	**3.118120614**		

δ	0.08	**Citrus Farming**				
r	0.01					
t	**Bt**	**Ct**	**Nt**	**Discounted Bt**	**Discounted Ct**	**Discounted Nt**
0	0.00	64987.50	-64987.50	0.00	60173.61	-60173.61
1	0.00	18716.66	-18716.66	0.00	17330.24	-17330.24
2	0.00	18903.83	-18903.83	0.00	17503.54	-17503.54
3	0.00	19092.86	-19092.86	0.00	17678.58	-17678.58
4	0.00	19283.79	-19283.79	0.00	17855.36	-17855.36
5	0.00	19476.63	-19476.63	0.00	18033.92	-18033.92
6	0.00	19671.40	-19671.40	0.00	18214.26	-18214.26
7	50535.92	19868.11	30667.81	46792.52	18396.40	28396.12
8	51041.28	20066.79	30974.49	47260.44	18580.36	28680.08
9	51551.69	20267.46	31284.23	47733.05	18766.17	28966.88
10	52067.21	20470.14	31597.07	48210.38	18953.83	29256.55
11	52587.88	20674.84	31913.04	48692.48	19143.37	29549.12
12	53113.76	20881.59	32232.17	49179.41	19334.80	29844.61
13	53644.90	21090.40	32554.50	49671.20	19528.15	30143.05
14	54181.35	21301.30	32880.04	50167.91	19723.43	30444.48
15	54723.16	21514.32	33208.84	50669.59	19920.66	30748.93
16	55270.39	21729.46	33540.93	51176.29	20119.87	31056.42
17	55823.10	21946.76	33876.34	51688.05	20321.07	31366.98
18	56381.33	22166.22	34215.10	52204.93	20524.28	31680.65
19	56945.14	22387.89	34557.25	52726.98	20729.52	31997.46
20	57514.59	22611.76	34902.83	53254.25	20936.82	32317.43
21	58089.74	22837.88	35251.85	53786.79	21146.19	32640.61
22	58670.63	23066.26	35604.37	54324.66	21357.65	32967.01
23	59257.34	23296.92	35960.42	54867.91	21571.23	33296.68

24	59849.91	23529.89	36320.02	55416.59	21786.94	33629.65
25	60448.41	23765.19	36683.22	55970.75	22004.81	33965.95
26	61052.90	24002.84	37050.05	56530.46	22224.86	34305.61
27	61663.43	24242.87	37420.55	57095.77	22447.10	34648.66
28	62280.06	24485.30	37794.76	57666.72	22671.57	34995.15
29	62902.86	24730.15	38172.71	58243.39	22898.29	35345.10
30	63531.89	24977.46	38554.43	58825.82	23127.27	35698.55
31	64167.21	25227.23	38939.98	59414.08	23358.55	36055.54
			Total	**1321570.44**	**686362.70**	**635207.73**
			B/C	**1.925469482**		

* Citrus trees take about 6 years to mature and then have a productive life of up to 25 years After 30 years they therefore produce no financial benefit.

Carbon Restoration Projects

δ 0.08

r 0.01

t	Bt	Ct	Nt	Discounted Bt	Discounted Ct	Discounted Nt
0	0.00	8191.31	-8191.31	0.00	7584.55	-7584.55
1	900.00	0.00	900.00	833.33	0.00	833.33
2	909.00	0.00	909.00	841.67	0.00	841.67
3	918.09	0.00	918.09	850.08	0.00	850.08
4	927.27	0.00	927.27	858.58	0.00	858.58
5	936.54	0.00	936.54	867.17	0.00	867.17
6	945.91	0.00	945.91	875.84	0.00	875.84
7	955.37	0.00	955.37	884.60	0.00	884.60
8	964.92	0.00	964.92	893.45	0.00	893.45
9	974.57	0.00	974.57	902.38	0.00	902.38
10	984.32	0.00	984.32	911.40	0.00	911.40
11	994.16	0.00	994.16	920.52	0.00	920.52
12	1004.10	0.00	1004.10	929.72	0.00	929.72
13	1014.14	0.00	1014.14	939.02	0.00	939.02
14	1024.28	0.00	1024.28	948.41	0.00	948.41
15	1034.53	0.00	1034.53	957.90	0.00	957.90
16	1044.87	0.00	1044.87	967.47	0.00	967.47
17	1055.32	0.00	1055.32	977.15	0.00	977.15
18	1065.87	0.00	1065.87	986.92	0.00	986.92
19	1076.53	0.00	1076.53	996.79	0.00	996.79
20	1087.30	0.00	1087.30	1006.76	0.00	1006.76

21	1098.17	0.00	1098.17	1016.83	0.00	1016.83
22	1109.15	0.00	1109.15	1026.99	0.00	1026.99
23	1120.24	0.00	1120.24	1037.26	0.00	1037.26
24	1131.45	0.00	1131.45	1047.64	0.00	1047.64
25	1142.76	0.00	1142.76	1058.11	0.00	1058.11
26	1154.19	0.00	1154.19	1068.69	0.00	1068.69
27	1165.73	0.00	1165.73	1079.38	0.00	1079.38
28	1177.39	0.00	1177.39	1090.17	0.00	1090.17
29	1189.16	0.00	1189.16	1101.08	0.00	1101.08
30	1201.05	0.00	1201.05	1112.09	0.00	1112.09
31	1213.06	0.00	1213.06	1123.21	0.00	1123.21
32	1225.19	0.00	1225.19	1134.44	0.00	1134.44
33	1237.45	0.00	1237.45	1145.78	0.00	1145.78
34	1249.82	0.00	1249.82	1157.24	0.00	1157.24
35	1262.32	0.00	1262.32	1168.81	0.00	1168.81
36	1274.94	0.00	1274.94	1180.50	0.00	1180.50
37	1287.69	0.00	1287.69	1192.31	0.00	1192.31
38	1300.57	0.00	1300.57	1204.23	0.00	1204.23
39	1313.57	0.00	1313.57	1216.27	0.00	1216.27
40	1326.71	0.00	1326.71	1228.44	0.00	1228.44
			Total	40738.64	7584.55	33154.10
			B/C	**5.3712698**		

Appendix 5 – Consumption Diaries to ascertain flow of income to the Communities

The socio-economic impact of parks on the communities surrounding them is a topical issue and one receiving considerable interest world-wide. If conservation management is to be aided by supportive local communities, then it is important to identify and publicize tangible benefits that flow to such communities. Certainly there are conservation areas in South Africa that offer few tangible benefits to surrounding communities, but are important from a biodiversity perspective; fortunately these are not the norm. An aspect of this study was to identify benefits that the Addo Park provides to local communities.

Studies in the past (Saayman & Saayman, 2005 and Connor & Zimmerman, 2008) have looked at whether or not the Greater Addo Elephant National Park (GAENP) impacts on the regional economy. These studies have shown that there is a positive impact. The multiplier effects that they have worked out are certainly significant but no study has looked at exactly **where** the income earned through jobs in the Park flows in the communities. The Eastern Cape is an extremely poor area with high poverty and unemployment levels. If the Park is helping to reduce this poverty and assist people in meeting their basic needs, then it can be said that they are having a positive impact on the surrounding communities, and from a socio-economic perspective it is beneficial for the land to be used for conservation and eco-tourism. If the Park is not fulfilling this role then it could be argued that the land would be better used for an alternative use. This case study is

however only identifying the avenues through which the Park impacts directly through the incomes of its employees. It is beyond the scope of this dissertation to use a regional CGE Model to determine whether or not the benefit is less than that which would come from alternative land uses, e.g. dairy or citrus farming. With each alternative land use there are always going to be opportunity costs and losses that counterbalance the gains from that use, but ideally one would like to find a use that offers the greatest benefit and which is also sustainable and maximizes social welfare. It is also ideal if the income earned through the land use is spent locally, so as to maximize on the multiplier effect and to impact as many local people and businesses as possible, rather than spending the income on products from outside the region, resulting in a large amount of leakage and lower multiplier effects

For the consumption diary analysis a sample of people was chosen from a number of different businesses in and around the GAENP. People were selected from one of the private lodges in the GAENP in order to see if there is any noticeable difference in spending patterns between people employed directly by the Park and those employed by the private sector. Staff employed at the Park were chosen randomly. Also included were staff employed in the Working for Water office at Main Camp, and a local laundry operator that serves all the lodges, B&B's, etc. in the Addo area. All participants, bar one, were from either the Nomathansanqa or the Valencia community. These communities border on the south-western edge of the Main section of the Park and are where most of the staff employed in the Park and in businesses around the Park live.

Table 1: Population figures for the Sundays River Valley from the 2001 Census

African/Black		Coloured		Indian/Asian		White		TOTAL
Male	Female	Male	Female	Male	Female	Male	Female	
14440	15705	3590	3894	5	3	1075	1151	**39863**

Source: www.statssa.gov.za/census01/html/default.asp

As can be seen from Table 1, 76% of the population in the Sundays River Valley is African, and 19% is Coloured. Thus the majority of the population fall into these two population groups, and the sample is therefore representative of the population in the area, as 6 out of the 10 participants were Xhosa, one Sotho and 3 Coloured. The Nomathansanqa community largely comprises Xhosa people, with the Valencia community, seen in the area as the wealthier of the two communities, being largely Coloured, with a growing squatter settlement of Xhosa people to the east of it. During the researcher's four years in the area this squatter development more than doubled in size and is an indication of the inflow of people to the area. Whether this inflow is due to the expansion of the Park, the expanding citrus industry or general population growth is unclear. This case study is not intended as a statistical survey, but rather uses small scale interviews, which are supported by data collected in short period consumption diaries. The process of completing the diaries and through discussions held with the respondents focuses them to think about what they allocate their budget on normally.

The researcher conducting the interviews worked in the area for a number of years and therefore has primary knowledge of conservation and tourism in the area and this provided a useful foundation for the research and the interviews.

All participants selected to take part in the consumption diary analysis were enthusiastic and helpful. The reason for the study was explained to each of them and the process of the diary keeping and questionnaire were also outlined. They were then asked if they would be willing to participate. Privacy and anonymity were ensured and then each participant signed a consent form. The importance of recording every item bought, no matter how small, was emphasized to ensure that every purchase was recorded. The consumption diaries were kept for 7 days. Though this is a short period of time, it is not problematic, as it introduced the interviewees to the kind of thinking that was needed prior to the discussions that were held with them and from which information was taken. This case study therefore does not attempt to generalize these results to get an indicator of the overall impact of the Park, but rather is a starter to the process and is a source of basic information. The survey questions were the basis for the interviews and from there was a flow of general discussion about the respondents views of the Park, their socio-economic situation and their thoughts on the future of the area. Due to time constraints, there were only 10 consumption diaries completed and it would be beneficial in the future to conduct more extensive surveys with greater numbers. 6 of the surveys and diaries done were completed by females, and 4 by males. Employees were asked questions relating to their income, number of dependents, etc. as well as other questions relating to housing, water and electricity. The aim of the survey questions was to determine the amount of income in the household, basic living standards and the level of dependency. This information was then used in the analysis along with the consumption diary results. A copy of the survey questions is attached below, as well as a table showing the breakdown of expenditures for each participant and a number of other relevant facts.

While talking to the participants it was clear that they all felt that the Park was beneficial and that it created jobs in the area and was good for the community. It is interesting to note however that this was the perception of people who are directly employed or directly influenced by the success of the Park. During the author's time working in the Addo area and talking to community members in general, I found that those who did not have jobs in or related to the Park, did not share this perception, and felt that the Park could do more for the community. Even among the survey participants who felt that the Park was beneficial, there was still a feeling that the Park could do more in terms of community engagement. When suggesting that the community should be more involved in the success of the Park they suggested such options as the sale of curios and vegetables, the introduction of community tours and community restaurants. A number of people employed in the citrus industry in the area expressed an interest in being employed in the Park or related B&B's, lodges, etc. Most of these were seasonal workers and wanted more permanent work. There is definitely a perception in the community, picked up by the author from general discussions with community members, that the jobs offered by the eco-tourism/conservation sector are more sought-after and generally viewed as offering better wages, benefits, etc.

Although most interviewees' comments about the GAENP were positive, there were suggestions that more could be done to directly involve and benefit the local communities. One participant who is employed in a skilled position (but is from outside the area) was of the opinion that there is still a large amount of scope for the Park to empower, train and from there employ local people in key positions.

He stated that most of the key positions in the Park were filled by people who were not local to the area and that this appears to undermine the principle of creating employment for the local people. It was interesting to hear this perception, especially from someone who would not have the job if that were Parks' policy. There does seem to be a greater need for empowerment, training and upliftment of local people so that they can, in the future, be employed in key, top-level positions within the Park and from there having a say in the running of the Park on their community's borders. On the other hand, involving local community members in higher level jobs in the Park may make openings for cronyism, corruption, etc.

Using the consumption diaries, calculations were made to determine the percentage of household income spent on different categories of purchases, and also the percentage personal income spent. The average number of dependents for the 10 respondents was 3.1 (ranging between 1 and 5). As expected almost all the participants, except one, had a number of dependents. This appears to be a trend in a number of the communities in Africa and serves to confirm the importance of the 'bread winner' and therefore the importance of any business or activity that creates employment in the area. Other community research conducted by the author in Namibia and Malawi has found the average number of dependents to be 6 and 10 respectively. This highlights the importance of employment creation, particularly in rural areas, as it is not only one person who is affected but usually a number of people and this can assist in improving the living conditions and living standards of a number of people, not only those directly employed. Through discussion feedback, which was prompted by the recordings in the

diaries, it was possible to make rudimentary extrapolations of budgetary behaviour. Due to the short duration of the diary-keeping and the small sample size, this is by no means a thorough analysis that can be used to make any broad statements about the overall impact of the Park, but it can be used as a basis for further studies and offers a basic idea of the situation.

In both the household and personal income percentage spent categories the highest expenditure tended to be on food (ranging from 4% to as much as 73%), followed by monthly accounts (from 17% up to 86% of their monthly income). These accounts comprise clothing stores, furniture stores, etc. 7 out of the 10 respondents paid a large percentage of their income towards monthly account payments. Other than these two major expenditures there were smaller amounts spent on cell phone airtime, electricity, clothes, alcohol, cigarettes, rent, furniture, paraffin, toiletries and transport. A large amount of income is spent on goods that are bought into the Addo area from Port Elizabeth, so there is certainly a leakage effect, with the value not accruing locally. Even though the products are bought in from Port Elizabeth they are sold at a local shop, which reduces the leakage effect to a certain extent. Some produce is grown locally (for example cabbage, spinach, tomatoes) by residents in the communities and sale of these goods to community members ensures that the value is accrued locally. A few community members have started their own small businesses, for example, two staff members from a private lodge that were interviewed were baking cakes, muffins, etc. on their off days and selling them locally for functions, etc. Livelihood diversification strategies of this sort seem to be common in the communities (Lepper, 2006) and other than

allowing community members to earn extra income, they also ensure that there are local benefits and that the value of the business is accrued locally, rather than being sourced from outside the region.

All respondents had electricity in their homes and running water. All, except one respondent, had a flush toilet in their homes. All respondents described their health as either good or excellent. During the interview process it was found that there is quite a large amount of electricity 'theft' in the Nomathansanqa location. This is due to the fact that there are a number of people living in squatter dwellings while waiting for an RDP house. These squatter dwellings have no electricity so the residents are connecting to other sources of electricity illegally.

The consumption diaries were carried out over month end in order to include a number of the monthly expenses, such as rent and accounts. If one takes the first weeks' expenditure and multiplies it by 4 for the month, then all except one household spent more than the household income. One would however assume that the rest of the months' weekly expenditures would be lower as the main accounts are paid over month end. Education is usually paid for on an annual basis, so it is difficult to determine if income is being spent on education. From communications with staff in the private lodges money is spent on education by a large number of the employees as well as giving money to relatives/dependents to assist them in meeting their basic needs.

With respect to safety, it was found from interviewing people in the community at various stages over the period of about 12 months, that none of those interviewed felt safe in their own homes in the community. Though this has nothing to do with the GAENP being rather a government concern, it is interesting to note. Over 3 years working in a private lodge, it was observed that people employed in the private lodges often appear to be the target of robberies, theft, etc. as they are receiving permanent monthly salaries that for the most part are higher than the wages/salaries earned by people in other jobs in the area.

Total household income was calculated and included in the analysis because in 7 out of the 10 cases there was additional income that was included in the household budget and is therefore of importance. Household income ranged between R1900 and R9500 per month. Available total household income per dependent works out to an average of R1496.03 per month. This figure is probably slightly higher than the average due to the fact that there was one participant with a relatively high monthly wage and only one dependent. In some cases this extra income was also Park related as family members were employed in B&Bs in the area (which, to a large extent, depend on the existence of the Park for their success), lodges in the Park or other Park-related businesses. In some cases the extra income was not related to the Park at all, as the family members were employed in the citrus industry in the area, often as seasonal workers.

3 out of the 10 households had some form of monthly saving. Most of the interviews showed people living from month to month with very little planning for

the future. Whether this is due to the fact that there is very little income 'spare' to save each month or to the fact that there is little concern for the future/long term is unclear. My personal observation is that it is a combination of the two and is a common phenomenon among the poor of the area. It may well be a national trend to dissaving, with a large number of people living on credit. (see for example Aron & Muelbauer, 2000 who found that personal saving rates have fallen since 1993).

Over a number of years working in a private lodge in Addo it was clear that a large percentage of the staff from the communities were in debt and faced high monthly account payments. Numerous monthly phone calls from credit bureau and debt collectors, garnishee orders, etc. were evidence of this. It is clear that there is a need for money management advice. Communications with management staff in other lodges showed that there are staff debt issues in most of the businesses. This is possibly an area that employers (whether private or state) can assist community members. If National Parks would like to fulfill their aim of helping to alleviate poverty in the areas around Parks then such guidance and advice is essential and would have long-term benefits.

From the 10 consumption diaries carried out it appears that income is largely spent on necessities such as food, so as such the Park and related businesses are assisting in the process of reducing poverty in the area and assisting in providing for the basic needs of a very poor region. A more extensive study using a greater

sample size and, if possible, completing the consumption diaries for the period of a month, would give an even clearer indication of income flows and would be very useful in analysing the socio-economic impact of the conservation areas directly on the community members and their dependents.

Respondent	A001	A002	A003	A004	A007	A009	A011	A013	A018	A019
Food	R 403.60	R 1 255.00	R 706.94	R 1 666.50	R 622.98	R 316.39	R 602.00	R 1 690.00	R 466.50	R 610.45
Airtime	R 58.00			R 87.00		R 165.00		R 50.00	R 50.00	
Accounts	R 1 570.00	R 2 000.00	R 1 720.00	R 975.00				R 406.00	R 1 300.00	R 600.00
Paraffin/Gas						R 6.50	R 71.90			
Electricity						R 120.00		R 100.00		R 10.00
Clothes	R 269.99					R 242.95		R 45.00	R 260.00	
Toiletries			R 13.00	R 100.00	R 29.98	R 66.98	R 23.00		R 14.95	R 25.00
Alcohol	R 40.00			R 200.00				R 28.00		
Cigarettes			R 154.00	R 100.00						
Transport	R 645.00	R 2 400.00		R 16.00				R 150.00		
Furniture							R 1 200.00			
Rent		R 2 500.00		R 500.00						
Other	R 300.00		R 13.45							
Total	R 3 286.59	R 8 155.00	R 2 607.39	R 3 644.50	R 652.96	R 917.82	R 1 896.90	R 2 469.00	R 2 091.45	R 1 245.45
Expenses x 4	R 13 146.36	R 32 620.00	R 10 429.56	R 14 578.00	R 2 611.84	R 3 671.28	R 7 587.60	R 9 876.00	R 8 365.80	R 4 981.80
Gender	F	M	M	M	F	F	F	M	F	F
Income/mnth	R 6 606.93	R 9 000.00	R 2 700.00	R 4 510.00	R 1 800.00	R 1 900.00	R 2 200.00	R 2 300.00	R 1 500.00	R 1 150.00
Other Household Income	R 2 840.00	R 0.00	R 0.00	R 1 880.00	R 940.00		R 1 300.00	R 3 010.00	R 1 540.00	R 1 200.00
Total	R 9 446.93	R 9 000.00	R 2 700.00	R 6 390.00	R 2 740.00	R 1 900.00	R 3 500.00	R 5 310.00	R 3 040.00	R 2 350.00
Savings	R 3 000.00	R 200.00	R 0.00	R 0.00	R 0.00		R 0.00	R 200.00	R 0.00	R 0.00
Dependents	3	1	4	3	2	5	4	2	5	2
% Household income on										
Food	4.27%	13.94%	26.18%	26.08%	22.74%	16.65%	17.20%	31.83%	15.35%	25.98%
Airtime	0.61%	0.00%	0.00%	1.36%	0.00%	8.68%	0.00%	0.94%	1.64%	0.00%
Accounts	16.62%	22.22%	63.70%	15.26%	0.00%	0.00%	0.00%	7.65%	42.76%	25.53%
Paraffin/Gas	0.00%	0.00%	0.00%	0.00%	0.00%	0.34%	2.05%	0.00%	0.00%	0.00%
Electricity	0.00%	0.00%	0.00%	0.00%	0.00%	6.32%	0.00%	1.88%	0.00%	0.43%
Clothes	2.86%	0.00%	0.00%	0.00%	0.00%	12.79%	0.00%	0.85%	8.55%	0.00%
Toiletries	0.00%	0.00%	0.48%	1.56%	1.09%	3.53%	0.66%	0.00%	0.49%	1.06%
Alcohol	0.42%	0.00%	0.00%	3.13%	0.00%	0.00%	0.00%	0.53%	0.00%	0.00%
Cigarettes	0.00%	0.00%	5.70%	1.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Transport	6.83%	26.67%	0.00%	0.25%	0.00%	0.00%	0.00%	2.82%	0.00%	0.00%
Furniture	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	34.29%	0.00%	0.00%	0.00%
Rent	0.00%	27.78%	0.00%	7.82%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other	3.18%	0.00%	0.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

sample size and, if possible, completing the consumption diaries for the period of a month, would give an even clearer indication of income flows and would be very useful in analysing the socio-economic impact of the conservation areas directly on the community members and their dependents.

Respondent	A001	A002	A003	A004	A007	A009	A011	A013	A018	A019
Food	R 403.60	R 1 255.00	R 706.94	R 1 666.50	R 622.98	R 316.39	R 602.00	R 1 690.00	R 466.50	R 610.45
Airtime	R 58.00			R 87.00		R 165.00		R 50.00	R 50.00	
Accounts	R 1 570.00	R 2 000.00	R 1 720.00	R 975.00				R 406.00	R 1 300.00	R 600.00
Paraffin/Gas						R 6.50	R 71.90			
Electricity						R 120.00		R 100.00		R 10.00
Clothes	R 269.99					R 242.95		R 45.00	R 260.00	
Toiletries			R 13.00	R 100.00	R 29.98	R 66.98	R 23.00		R 14.95	R 25.00
Alcohol	R 40.00			R 200.00				R 28.00		
Cigarettes			R 154.00	R 100.00						
Transport	R 645.00	R 2 400.00		R 16.00				R 150.00		
Furniture							R 1 200.00			
Rent		R 2 500.00		R 500.00						
Other	R 300.00		R 13.45							
Total	**R 3 286.59**	**R 8 155.00**	**R 2 607.39**	**R 3 644.50**	**R 652.96**	**R 917.82**	**R 1 896.90**	**R 2 469.00**	**R 2 091.45**	**R 1 245.45**
Expenses x 4	R 13 146.36	R 32 620.00	R 10 429.56	R 14 578.00	R 2 611.84	R 3 671.28	R 7 587.60	R 9 876.00	R 8 365.80	R 4 981.80
Gender	F	M	M	M	F	F	F	M	F	F
Income/mnth	R 6 606.93	R 9 000.00	R 2 700.00	R 4 510.00	R 1 800.00	R 1 900.00	R 2 200.00	R 2 300.00	R 1 500.00	R 1 150.00
Other Household Income	R 2 840.00	R 0.00	R 0.00	R 1 880.00	R 940.00		R 1 300.00	R 3 010.00	R 1 540.00	R 1 200.00
Total	**R 9 446.93**	**R 9 000.00**	**R 2 700.00**	**R 6 390.00**	**R 2 740.00**	**R 1 900.00**	**R 3 500.00**	**R 5 310.00**	**R 3 040.00**	**R 2 350.00**
Savings	R 3 000.00	R 200.00	R 0.00	R 0.00	R 0.00		R 0.00	R 200.00	R 0.00	R 0.00
Dependents	3	1	4	3	2	5	4	2	5	2
% Household income on										
Food	4.27%	13.94%	26.18%	26.08%	22.74%	16.65%	17.20%	31.83%	15.35%	25.98%
Airtime	0.61%	0.00%	0.00%	1.36%	0.00%	8.68%	0.00%	0.94%	1.64%	0.00%
Accounts	16.62%	22.22%	63.70%	15.26%	0.00%	0.00%	0.00%	7.65%	42.76%	25.53%
Paraffin/Gas	0.00%	0.00%	0.00%	0.00%	0.00%	0.34%	2.05%	0.00%	0.00%	0.00%
Electricity	0.00%	0.00%	0.00%	0.00%	0.00%	6.32%	0.00%	1.88%	0.00%	0.43%
Clothes	2.86%	0.00%	0.00%	0.00%	0.00%	12.79%	0.00%	0.85%	8.55%	0.00%
Toiletries	0.00%	0.00%	0.48%	1.56%	1.09%	3.53%	0.66%	0.00%	0.49%	1.06%
Alcohol	0.42%	0.00%	0.00%	3.13%	0.00%	0.00%	0.00%	0.53%	0.00%	0.00%
Cigarettes	0.00%	0.00%	5.70%	1.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Transport	6.83%	26.67%	0.00%	0.25%	0.00%	0.00%	0.00%	2.82%	0.00%	0.00%
Furniture	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	34.29%	0.00%	0.00%	0.00%
Rent	0.00%	27.78%	0.00%	7.82%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other	3.18%	0.00%	0.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

CONSUMPTION DIARY

DATE : _____

CODE: _____

Name	
Age	
Gender	
Date of Birth	
Marital Status	
Population Group	
Home Language	
No. living in household in 12 mnth period	

Age & Gender of all in household	AGE	GENDER

No. of people employed	
No. of dependents	
Monthly/Weekly Wage	
Other Income (specify type & amount)	_____
Total of all income in household	
Monthly Savings?	
Pension Fund?	

Type of dwelling:

1 : Formal dwelling	
2 : Backyard dwelling	
3 : Squatter dwelling	
4 : Traditional dwelling	
5 : Other (specify)	

Access to electricity in dwelling?	YES	NO
Access to running water in dwelling?	YES	NO
Flush Toilet in dwelling?	YES	NO

Health Status	Excellent	Good	Average	Poor	Very Poor