

# **Ecosystem Services in the Gariep Basin**

A contribution to the Millennium Ecosystem Assessment,  
prepared by the Gariep basin team of SAfMA,  
the Southern African Millennium Ecosystem Assessment

*Ecosystem Services in the Gariep Basin*

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# Ecosystem Services in the Gariep Basin

## TABLE OF CONTENTS

List of Tables .....	i
List of Figures .....	ii
List of Boxes .....	v
Acknowledgements .....	vii
<b>Executive Summary .....</b>	<b>xi</b>
<b>Chapter 1 Introduction .....</b>	<b>1</b>
1.1 An Ecosystem Services Approach .....	1
1.2 The Southern African Millennium Ecosystem Assessment (SAfMA) .....	3
1.3 The Gariep Basin Assessment .....	4
1.4 The Gariep Local Assessments .....	4
1.5 Ecosystems and Livelihoods .....	6
<b>Chapter 2 Condition and Trends of Ecosystem Services and Human Well-Being .....</b>	<b>15</b>
2.1 Approach .....	15
2.2 Human Well-Being .....	17
2.3 Freshwater Services .....	24
2.4 Food Services .....	44
2.5 Energy Services .....	53
2.6 Mineral Services .....	61
2.7 Air Quality .....	67
2.8 Cultural Services .....	70
2.9 Ecosystem Integrity .....	73
2.10 Ecosystem Services in an Urbanising World: Gauteng Province .....	94
<b>Chapter 3 Trade-offs and Decision-Making .....</b>	<b>103</b>
3.1 Trade-offs between Services: Water and Food Production .....	103
3.2 Trade-offs between Utilisation and Protection of Water Services .....	106
3.3 Trade-offs between Land Use and Biodiversity .....	109
3.4 Summary: Assessing Trade-offs .....	112
<b>Chapter 4 Looking Ahead: Drivers, Scenarios, and Responses .....</b>	<b>115</b>
4.1 Drivers of Change in Ecosystems and their Services .....	115
4.2 The Gariep Basin in 2030: Envisioning the Future with Scenarios .....	119
4.3 Scenario Storylines .....	122
4.4 Response Options in Alternative Futures .....	129
<b>Chapter 5 Adding it Up: A Synthesis .....</b>	<b>133</b>
5.1 The Big Picture .....	133
5.2 Epilogue: Lessons Learned from a Multi-Scale Integrated Assessment Approach .....	138
5.3 Conclusion: Decisions for the Future .....	138
<b>Literature Cited .....</b>	<b>139</b>

## LIST OF TABLES

<b>Table 1.1</b>	Land area, population, and economic characteristics of Lesotho and the eight South African provinces in the Gariep basin.
<b>Table 1.2</b>	Threats to ecosystem services and examples identified by the Gariep Basin User Advisory Group at the onset of the assessment process.
<b>Table 1.3</b>	Gross Geographic Product (GGP) per province supported by inter-basin transfers (IBTs).
<b>Table 2.1</b>	Mean values and 95% confidence limits of HIV prevalence per province in antenatal clinic attendees in South Africa, 2000 - 2002.
<b>Table 2.2</b>	Groundwater use per sector in the South African catchments of the Gariep basin.
<b>Table 2.3</b>	Contribution of return flows to the Gariep basin from irrigation, urban developments, and mining.
<b>Table 2.4</b>	Water requirements in the Gariep basin.
<b>Table 2.5</b>	Description of the species data used in the study, including number of species, as well as the numbers of endemic and listed Red Data species per taxon.
<b>Table 2.6</b>	Water balance for Gauteng Province.
<b>Table 2.7</b>	Average levels of heavy metal concentrations found in the Upper Klip River, 1995-1999.
<b>Table 2.8</b>	Reduction of faecal coli and ammonia due to wetland filtering.
<b>Table 3.1</b>	PODIUM Results: Implications of Population Growth on Water and Food Demands (2025).
<b>Table 3.2</b>	PODIUM Results: Implications of Increasing Irrigated Area for Water and Food Situation (2025).
<b>Table 3.3</b>	PODIUM Results: Irrigation Efficiency and Water Resources Development.
<b>Table 3.4</b>	Proposed framework for setting ecological resource quality objectives on the basis of a classification system.
<b>Table 3.5</b>	Area of Gariep basin (in square kilometres and as a percentage of total area) in each ecological management class under present and attainable configurations shown in Figure 3.1.
<b>Table 3.6</b>	Total calories and protein produced by cereals and meat in the basin.
<b>Table 3.7</b>	Per capita amount of calories and protein for upper and lower targets for males and females.
<b>Table 4.1</b>	Indirect (primary) drivers of change in the Gariep basin.
<b>Table 4.2</b>	Generic local-scale drivers, common to the three sites, but with varying degrees of change.
<b>Table 4.3</b>	Local-scale drivers that are specific to each site.
<b>Table 4.4</b>	Classification of the MA global scenarios, the SAfMA regional scenarios, the Gariep basin scenarios, and the Gariep local assessment scenarios into five scenario archetypes.
<b>Table 4.5</b>	Bifurcations of key uncertainties and their demographic consequences under four scenarios.
<b>Table 4.6</b>	Which responses in which future?
<b>Table 5.1</b>	Ability of provisioning services to meet human well-being requirements.

## LIST OF FIGURES

- Figure 1.1** Conceptual Framework of the Millennium Ecosystem Assessment.
- Figure 1.2** The location of assessment sites in the Southern African Millennium Ecosystem Assessment.
- Figure 1.3** The location of the Gariep basin.
- Figure 1.4** The face of the Gariep. (a) Ethnic and (b) linguistic profiles of the Gariep basin population.
- Figure 1.5** (a) Population density per municipality; (b) Mean annual precipitation.
- Figure 1.6** Land tenure systems within the Gariep basin.
- Figure 2.1** Ecosystem services and constituents of human well-being.
- Figure 2.2** (a) Average annual income per capita; (b) Percent of the economically active population that is unemployed.
- Figure 2.3** (a) The Gini index as indication of the equality of income distribution in the economically active populations; (b) An example of the share of incomes for Lesotho, Johannesburg and Sengonyana.
- Figure 2.4** (a) Percentage of the population of 15 years and older that is literate, per municipality; (b) Life expectancy at birth, per province.
- Figure 2.5** The number of dependents (persons younger than 19 or older than 65) per person of economically active age (between 20 and 65).
- Figure 2.6** Measures of available surface water supply in the Gariep basin. (a) Natural mean annual runoff per quaternary catchment in millions of cubic metres; (b) Water availability per capita per quaternary catchment in cubic meters per person per year.
- Figure 2.7** (a) The distribution of exploitable groundwater potential and (b) groundwater use in the Gariep basin.
- Figure 2.8** The Gariep basin's (a) groundwater balance and (b) effect of groundwater abstraction on surface water.
- Figure 2.9** Proportion of sectoral water requirements in South Africa and the Gariep basin, 1980-2000.
- Figure 2.10** Distribution of water requirements in the Gariep basin by (a) irrigated agriculture and (b) the urban sector.
- Figure 2.11** (a) Spatial distribution of ecological reserve requirements in the Gariep basin; (b) Quaternary catchments in which the provisional ecological reserve estimates are able or unable to be met with current yield.
- Figure 2.12** Relative distribution of demand and supply of surface water resources in the Gariep basin. (a) Water requirements as a percentage of mean annual runoff; (b) Major interbasin transfers and dams.
- Figure 2.13** Percentage of urban population per quaternary catchment with (a) no service from any water distribution system; (b) informal houses or shanties serviced only by communal taps and no water-borne sewage; (c) small houses or shanties with water connection, but no or minimal sewage service.
- Figure 2.14** Median TDS concentrations (mg/l) at national sampling sites and median values per water management area in 1996 and 2001.
- Figure 2.15** Trophic status of dams with eutrophication problems in the Gariep basin, October 2002 to September 2003.

- Figure 2.16** Groundwater quality in the Gariep basin, as indicated by (a) salinity (TDS); (b) fluoride; and (c) nitrate.
- Figure 2.17** (a) Mean annual cereal production per capita per district; (b) Potential annual meat production per capita estimated from livestock biomass (in large stock units).
- Figure 2.18** (a) Daily calorie supply estimated from cereal and meat production as a ratio of the recommended dietary allowance (RDA) of 2250 calories per capita per day; (b) Protein relative to energy production from cereal crops and meat production.
- Figure 2.19** Combined index of soil and vegetation degradation per municipality in the Gariep basin
- Figure 2.20** (a) Percentage of households with electricity supplied by the parastatal company Eskom and b) alternative electricity sources within the Gariep basin.
- Figure 2.21** (a) The percentage of households using gas and (b) paraffin within the Gariep basin (MDB, 2001).
- Figure 2.22** Number of actively producing mines per district.
- Figure 2.23** (a) Gross geographic product (GGP) per municipality earned by mining, in South African rands; (b) Population employed in mining industry as a percentage of the Gariep basin's total population.
- Figure 2.24** Number of unexploited deposits per municipality.
- Figure 2.25** (a) Carbon dioxide emissions, in Gg CO<sub>2</sub> per 20 km<sup>2</sup> for the year 2000; (b) Sulphur dioxide emissions, in Gg SO<sub>2</sub> per 20 km<sup>2</sup> for the year 2000.
- Figure 2.26** The nested hierarchy of biodiversity.
- Figure 2.27** Collection localities for scarab beetles in South Africa illustrating congruence with national road network.
- Figure 2.28** Numbers of species of each taxon per quarter-degree square (QDS) in the Gariep basin.
- Figure 2.29** Numbers of endemic species of each taxon per quarter-degree square (QDS).
- Figure 2.30** Number of threatened species of each taxon per quarter-degree square (QDS).
- Figure 2.31** Irreplaceability values per quarter-degree grid square (QDS).
- Figure 2.32** (a) Vegetation types of the Gariep basin based on the definition and delineation of Low and Rebelo; (b) broad land cover categories in the Gariep; (c) location of threatened vegetation types.
- Figure 2.33** Landtypes of the Gariep basin as defined by the Institute for Soil, Climate and Water, Agricultural Research Council.
- Figure 2.34** Conservation status of the landtypes of the Gariep: (a) Pie chart depicting percentage of ecosystems falling into each conservation status class and (b) spatial display of the ecosystems and their conservation status.
- Figure 2.35** Gap analysis of the landtypes of the Gariep.
- Figure 2.36** Draft priority areas of South Africa identified by the National Spatial Biodiversity Assessment.
- Figure 2.37** Ratio of Gauteng's consumption to its production of six food types.
- Figure 2.38** Location of urban development, mines, major rivers, and municipalities in Gauteng Province.
- Figure 2.39** Extent of Gauteng's urbanisation and urban edge.

- Figure 2.40** Biodiversity in Gauteng. (a) Distribution of wetlands illustrating provincial (red) and private nature reserves (pink); (b) Total number of threatened species per quarter degree grid square; (c) Areas (in green) that are invaded by alien plant species.
- Figure 2.41** Land cover in Gauteng Province showing (a) the percentage cover of various land uses within the province and within the urban edge; (b) road effects on the province and the urban edge.
- Figure 2.42** Number of species per taxonomic group occurring in Gauteng which are (a) threatened by urbanisation and (b) invasive species.
- Figure 3.1** (a) Present and (b) attainable ecological management classes.
- Figure 3.2** Production possibilities frontier (PPF) for water resources in an ecosystem.
- Figure 3.3** Irreplaceability maps for the Gariep basin based on upper targets for (a) proteins and calories and (b) biodiversity.
- Figure 3.4** Grid cells with irreplaceability values of more than 0.4 illustrating areas of importance to the provision of (a) food and (b) biodiversity conservation.
- Figure 3.5** Hypothetical trade-offs in a policy decision to expand cropland in a forested area.
- Figure 4.1** Indirect driver: Demographic change in the Gariep basin. Estimated historical population density of the basin and surrounding regions, 1900 - 1990.
- Figure 5.1** Ecosystem service and human well-being "hotspots".

## LIST OF BOXES

- Box 1.1** Ecosystem Services in Rural Livelihoods
- Box 1.2** Community Sketch of Sehlabathebe, Lesotho (upper catchment)
- Box 1.3** Community Sketch of the Great Fish River (mid-catchment)
- Box 1.4** Community Sketch of the Richtersveld (lower catchment)
- Box 2.1** Wealth, Income, and Unemployment: Local-scale Perspectives
- Box 2.2** Literacy and Education in Sehlabathebe
- Box 2.3** Making up the Shortfall: The Lesotho Highlands Water Project
- Box 2.4** Resilience of Freshwater Systems
- Box 2.5** Some, for All, Forever: South Africa's National Water Act
- Box 2.6** Water Pricing
- Box 2.7** Water and Communities
- Box 2.8** Food Security and Human Well-Being
- Box 2.9** Subsidies and the Food-water Link
- Box 2.10** Food and Communities
- Box 2.11** The Role of Eskom
- Box 2.12** Energy Services and Human Well-Being
- Box 2.13** The Nuclear Energy Debate
- Box 2.14** Energy and Communities
- Box 2.15** Legislation Promoting Change in the South African Mining Industry
- Box 2.16** Mining and Human Well-Being
- Box 2.17** How do South Africa's Air Quality Guidelines Measure up to the WHO's?
- Box 2.18** The Cultural Importance of Ecosystem Services to the amaXhosa People of the Eastern Cape
- Box 2.19** Biodiversity of the Gariep in Summary
- Box 2.20** Key Definitions
- Box 2.21** Conservation Targets for Species
- Box 2.22** Land Cover in the Gariep
- Box 2.23** Areas of Biodiversity Interest in the Gariep
- Box 2.24** Drivers of Land Cover Change
- Box 2.25** Invasive Alien Species in South Africa
- Box 2.26** Biodiversity and Communities
- Box 2.27** A Survey of Urban Backyards
- Box 4.1** Direct Drivers: A Timeline of Transformation of Gariep Basin Rivers
- Box 4.2** What will South Africa be like in 2002?
- Box 4.3** What Role for Climate Change and HIV/AIDS in an Uncertain Future?
- Box 4.4** Scenarios Across Scales
- Box 4.5** Local Responses to Ecosystem Change

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## EXECUTIVE SUMMARY

- *The Millennium Ecosystem Assessment (MA)* is a four-year international initiative to evaluate the state of Earth's ecosystems across multiple scales and the current capacity and future potential of ecosystems to deliver services of value to people. Central to the MA is a conceptual framework that describes the relationships between ecosystems, their services, and human well-being, and their drivers of change. The MA is being conducted in a suite of sub-global assessments around the world. The Gariep Basin Millennium Ecosystem Assessment is a component of the southern Africa sub-global assessment (SAfMA).
- *The Gariep Basin Millennium Ecosystem Assessment investigated the condition and trends of ecosystem services and human well-being in the Gariep basin from 1993 to 2003.* The assessment features highlights from four local-scale assessments nested within the basin: Sehlabatebe, Great Fish River, Richtersveld, and Gauteng Province. Scenarios were constructed at both basin and local scales to depict possible alternative futures of ecosystem service supply and demand in 2030. Past, present, and possible future responses to change in ecosystem services were considered. Conducted with input and technical support from a User Advisory Group (UAG) comprising basin stakeholders, the assessment is aimed primarily at the international assessment community, decision-makers at national and provincial levels of government, research institutions, as well as the private sector and the general public.
- *We define the Gariep basin for the purposes of this assessment as the area of South Africa and Lesotho drained by the Senqu-Gariep-Vaal River system, as well as two primary catchments connected to this system by major water transfer schemes.* Extending over 665,000 square kilometers across south-central southern Africa, the catchment encompasses the entire mountain nation of Lesotho, the urban-industrial complex of Gauteng Province, the "grain basket" of the central plateau, the extremely arid western regions of South Africa, and two international biodiversity hotspots.
- *Human well-being in the basin is highly variable.* The basin's population is characterised by diverse ethnic and cultural backgrounds, a multitude of languages, and high socio-economic inequity. The majority of people live in the higher-rainfall areas in the east, with significantly lower population densities in the arid west. High unemployment, low rural literacy, and high HIV/AIDS incidences have significant consequences for the livelihood options available to people across the basin.
- *The Gariep is a water-scarce basin, with runoff distributed disproportionately across the landscape.* It is the region's most regulated basin, with large dams and extensive transfer schemes, most notably from the Lesotho highlands to the growing urban-industrial complex of Gauteng. Transformation of freshwater and groundwater systems have resulted in biodiversity loss and water quality problems, causing a range of ecological, economic, and human health impacts. The water sector is currently being decentralised and new pricing policies are aimed at full cost recovery of water services. The South African National Water Act of 1998 prioritises the allocation of water to ecosystems and basic human needs, but ecological requirements have yet to be clearly defined. Infrastructure to deliver water is lacking in some rural areas and some households cannot afford to pay for water services.
- *Food production in the Gariep contributes to livelihoods, markets, raw materials, foreign exchange, and surplus or "savings."* Agriculture is a source of water and air pollution and mismanagement has resulted in significant land degradation. Fertilizers and pesticides can have negative effects on health, while GMOs are controversial but can boost agricultural productivity. Subsistence farming, food gardens, wild foods, game farming, and bushmeat are important food sources not usually reflected on national balance sheets. Biodiversity contributes substantially to local livelihoods, both in terms of its direct nutritional value in the form of bushmeat and wild fruit, but also indirectly as a buffer during periods of acute food shortage. Food security is being compromised by declining household incomes, changes in land tenure and market access, and HIV/AIDS. Contemporary and historical national and international political events and policies also affect the types and amounts of food produced and determine local access to food.

- *In rural areas and the informal economic sector, biofuels remain an important energy source, while electricity or fossil alternatives supply urban households.* About 70 percent of South Africa is electrified, dropping to 50 percent in rural areas and 3 percent in Lesotho. Local fuelwood depletion occurs in some rural areas, while in others fuelwood supply is adequate and exceeds the demand. The sustainability of fuelwood use is a function of human population density, primary production, and intrinsic plant properties. Burning of coal, though abundant, produces high carbon dioxide and sulphur dioxide emissions, affecting air quality and contributing to greenhouse gas emissions. Potential for solar power is very high in the Gariep, but investment in alternative energy technologies remains limited.
- *Minerals are of special interest in the Gariep basin because of their contribution to the economy and employment.* However, mineral extraction also creates ecological disturbance that interferes with ecosystem functions and biodiversity. Furthermore, by-products of mining affect air and especially groundwater quality. Mining legislation passed in recent years has required the sector to implement more sustainable and equitable practices, though in general, the benefit flows from minerals are still captured by a narrow margin of society.
- *Cultural services* such as sacred pools and forests, taboos, rituals, religion, language, and ecological knowledge systems exist across the landscape but are often specific to fine-grained landscape patches or individual species in communal areas. Cultural services in some areas are threatened by land use pressures, increasing urban contact, modernisation, and influences of other cultures. Some cultural services in the Gariep basin are formally recognised by South Africa's Natural Heritage Act and the World Heritage Convention.
- *The ecological integrity of the Gariep basin is in reasonably good condition,* with 84 percent of the basin in its natural state, while the rest is transformed by cultivation (93 percent), urbanisation (four percent), and overgrazing and fuelwood removal (four percent). In addition to land cover change, climate change and alien invasions are major drivers of changes in integrity. The basin is less well protected than South Africa on average, despite the occurrence of two important biodiversity areas within its boundaries. The grasslands, nearly 30 percent transformed, is the most threatened biome and most poorly protected, but contains many of the region's areas of biodiversity value, making it a conservation priority.
- *Fine-scale ecological integrity in the Gariep basin is variable in its condition.* At the local level, key resource areas that may appear insignificant in size enable communities to survive or even thrive in areas that, at a coarser scale, appear to be severely degraded or unproductive.
- *While total protected area is increasing and several large transboundary parks have been or will soon be established,* conservation in the region is moving away from a sole focus on protected areas and is embracing other approaches, such as economic incentives for promoting conservation on private or communal land.
- *Gauteng Province, the urban hub of the southern African region, is highly dependent on ecosystem services from outside the province, especially water and food.* Gauteng's entire water supply is delivered by inter-basin transfers from other catchments, and it consumes nearly 30 times the amount of wheat produced within the province. The effects of urbanisation on biodiversity can be radically different from those posed by other forms of land use. Gauteng lies mostly within the Grasslands biome, and contains many endemic and severely threatened species, as well as numerous wetlands which filter pollutants.
- *In the Gariep basin, the challenge of making trade-offs between different ecosystem services and biodiversity* is intensified by the need to reverse past discrimination in South Africa that prevented the majority of the population from fully realising or gaining access to the benefits provided by ecosystem services. We use various techniques to explore trade-offs between food and water, between the utilisation and protection of water, and between food and biodiversity. These approaches show promise, but this is clearly an area where additional research will be required in the future.

- *The major indirect drivers of change in ecosystems and their services are (1) governance change, (2) demographic change, (3) economic change, (4) climate change, (5) social/cultural change, and (6) large-scale interventions on behalf of government, the private sector, or other institutions. Indirect drivers in turn affect direct drivers of change such as land and water use. Local-scale drivers were identified as generic (common to all sites), such as large-scale interventions, or site-specific, such as access to key resource areas (Richtersveld), international donor priorities and sentiments (Sehlabathebe), and exceptionally high levels of HIV/AIDS (Great Fish River).*
- *Alternative scenario storylines for the Gariep basin were explored around the key uncertainty of governance. Fortress World depicts a situation with weak national and local governance, while Local Learning reflects a situation in which national governance is weak but civil society networks are strong. Market Forces represents an active economy but with limited distribution of wealth and an absence of effective social and environmental policies. In the Policy Reform scenario, both national and local governance are strong, and social and environmental policy interventions succeed. Scenarios are intended to stimulate thinking about plausible future events and trends rather than project the future, but they can help to identify types of responses that may be possible under these alternative conditions.*
- *Response options to improve flows from ecosystem services include those that target the management of the condition of the ecosystem; technological interventions; legal, institutional, and economic policies; and social, behavioural, and cognitive responses, including improvements in knowledge and education. Responses are most likely to succeed when they are scale-appropriate and integrated, and when they are made through a participatory process. Among the more promising or novel responses in the basin are the water legislation in South Africa, the privatisation of conservation, and the Working for Water Programme for poverty reduction and eradication of invasive alien vegetation. The local-scale assessments focused on coping strategies adopted by people to deal with change. These include diversification of livelihoods, entry into the wage economy, building social capital, and risk avoidance strategies.*
- *Ecosystem service and human well-being "hotspots" exist at both basin and local scales. These include areas of high service production, high irreplaceability (uniqueness), or sources or locations of conflict or potential conflict in the near future. The overlap of areas with high levels of service production or irreplaceability does not imply conflict, but the management of such areas will require an integrated, multiple-use approach in which different stakeholders are represented. True "hotspots" may exist where technical, institutional, or ideological barriers constrain the implementation of such an approach.*
- *In conclusion, this assessment emphasises the crucial need to incorporate ecosystem services into future decision-making processes related to environment and development issues in the basin. The Gariep basin is an information- and data-rich region of southern Africa, but major knowledge gaps remain. The significance of ecosystem services and their intimate relationship with human well-being is likely to increase in coming years and must be made tangible to a wider audience. Building capacity to understand, manage, and communicate the value of ecosystem services in the Gariep basin must target both new and established managers and scientists from all backgrounds to think in inter-disciplinary, multi-sectoral, multi-cultural, and cross-scale terms.*