

# **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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## 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.*