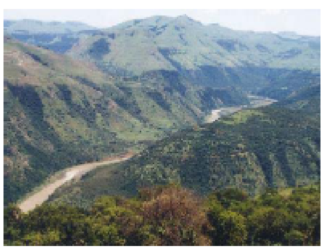

South African National Spatial Biodiversity Assessment 2004

Technical Report

Volume 2: River Component

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Executive Summary

This study provides a starting point for systematic planning for river biodiversity conservation. The approach and results presented here are expected to be refined as our knowledge and understanding in the field of systematic conservation planning for freshwater biodiversity expands.

Systematic conservation planning

The aim of conservation planning is to identify which areas of land, water and sea are crucial for ensuring living landscapes, waters and seascapes, and to focus conservation action on those priority areas. Living landscapes, waters and seascapes are ones that are able to support all forms of life, now and in the future. Systematic conservation planning is founded upon three fundamental principles: the principle of representation, persistence and quantitative target setting. The first principle requires conservation of a representative sample of all species, and of the habitats in which they occur (as opposed to focussing only on the ones experts know). However, conserving species and habitats, often referred to as **biodiversity pattern**, is not enough. It simply provides a snapshot of the biodiversity that currently exists. The principle of persistence requires the conservation of the **biodiversity processes** responsible for maintaining and generating biodiversity over time. Finally, the principle of quantitative target setting requires that explicit and quantitative targets be set for biodiversity features (e.g. length of river, area of vegetation type).

Biodiversity surrogates

Planning for the conservation of a representative sample of biodiversity requires that biodiversity be mapped consistently across the planning region in some operationally feasible manner. This usually depends on developing **biodiversity surrogates**, often based on physically-defined descriptors which are known to influence the distribution of biota in space and time. River heterogeneity signatures were used in this study as surrogates of biodiversity, defined according to two physical descriptors: geomorphic provinces (Level 1 descriptor) and hydrological index (Level 2 descriptor). One hundred and twenty river heterogeneity signatures were thus derived, using unique combinations of geomorphic province and hydrological index. Future improvements to these broad-scale national river heterogeneity signatures include:

- Extending the Level 2 hydrological descriptor to include a measure of the effectiveness potential of flood flows on the surrounding landscape.
- Extending the river heterogeneity signatures to include a measure of the ability of a river to store/transport sediment.
- Supplementing the river heterogeneity signatures with good national species datasets, such as fish.
- Expert review to test validity of each signature, once the above refinements have been made.
- Rigorous testing of the adequacy of river heterogeneity signatures as surrogates for riverine biodiversity pattern.

River integrity

In order to assess how severely river ecosystems have been impacted and to design a conservation plan that selects the most suitable rivers for conservation, it is important to map river integrity across the planning region (here, South Africa). Rivers that are largely natural should be the first choice for meeting biodiversity targets. If the targets cannot be met in rivers with a high ecological integrity, then rivers with a moderate integrity (i.e. those with relatively inexpensive rehabilitation costs) would be the next best option. River integrity was mapped based on the present ecological status category (PESC) desktop estimates from the national Water Situation Assessment Model. These data focus on instream and riparian habitat integrity for **mainstem** rivers in quaternary catchments (tributaries are not assessed). The results show that 29% of the mainstem rivers are intact and suitable for conservation purposes, 45% of are moderately modified, and 26% are transformed. Data availability of river integrity at a national scale is a major limitation to this assessment, since the current data focus only on mainstem rivers and ignores the substantial contribution that healthy tributaries could make to achieving conservation targets. To improve future river biodiversity assessments, it is important to bring catchment-based state-of-rivers reporting together to form a national state of rivers report, which can accurately reflect the condition of at least the 1:500 000 rivers in South Africa.

Biodiversity targets

A uniform target of at least 10% of the total length of each river heterogeneity signature was used for these analyses. Any heterogeneity signature whose intact length dropped below 10% was considered critically endangered. It is well-recognised that this percentage is **arbitrary** and not based on biologically meaningful science. It is also recognised that uniform targets undermine the relative needs of different biodiversity features. The joint DWAF-CSIR-WRC initiative will be giving attention to the development of differential targets, grounding these in a firmer scientific understanding of river ecosystem functioning.

Conservation status

Conservation status aims at identifying threatened ecosystems (**here river heterogeneity signatures**). It is based on the classification scheme developed by IUCN to categorise species into critically endangered, endangered, vulnerable and least threatened species. Of South Africa’s 120 river heterogeneity signatures, 44% are critically endangered, 27% are endangered, 11% are vulnerable, and 18% are least threatened. This is based on an assessment of mainstem rivers only, and ignores the conservation potential of numerous tributaries within catchments where the mainstem is not intact. In South Africa, mainstem rivers are heavily utilised, and we depend quite substantially on intact tributaries for conserving biodiversity pattern. In many instances, these tributaries could be viewed as refugia for aquatic biodiversity. It is important to emphasize that achievement of biodiversity pattern targets using intact tributaries is only one component of achieving biodiversity conservation. Several biodiversity process, for example nutrient cycling, biological community dynamics such as predation and migration, and hydrological regimes, are dependent on connectivity between tributaries through the mainstem. Thus, the mainstem often needs to be in a healthy enough condition to facilitate connectivity between important tributaries. In management terms, a “moderately modified” mainstem connecting “intact” tributaries may be a good compromise. Future improvements to conservation status outputs include:

- An attempt to match the threatened ecosystem classes (critically endangered, endangered, vulnerable and least threatened) used primarily by DEAT through the Biodiversity Act (Act 10 of 2004) with the water classification classes (e.g. natural, moderately impacted, heavily impacted and unacceptably degraded) used by DWAF. This will facilitate the integrated management of South Africa's threatened terrestrial and aquatic natural resources.
- Gaining a better scientific understanding of the thresholds that define the conservation status categories (in this case, 60%, 40% and 10%). Refinement of these thresholds should consider the scientific insight gained through the numerous Ecological Reserve studies currently underway in South African river ecosystems.

Protected area gap analysis

There has been very little emphasis on proclaiming protected areas for the primary purpose of conserving entire river lengths, mostly because this is not a practical management option for rivers, which generally traverse great distances in the landscape. It is therefore not surprising that most river ecosystems are not adequately conserved in protected areas. Moreover, approximately **one third** of South African rivers form the boundary of protected areas, and cannot be considered as protected. Rivers that are protected, however, show a significant recovery in condition downstream of a protected area. This highlights the positive impact that good land management of the surrounding landscape can have on river condition – emphasizing the importance of taking an integrated resource management approach to biodiversity conservation which considers the combined needs of both terrestrial and aquatic biodiversity.

Water Management Area context layer

The mainstem rivers of the Berg, Breede, Gouritz, Middle Vaal, and Upper Vaal Water Management Areas are the most severely threatened in South Africa, followed by the Olifants/Dooring, Fish to Tsitsikamma, Crocodile/Marico, and Olifants. These Water Management Areas all have over 75% of their mainstem rivers in a Critically Endangered or Endangered state. Trying to cater for biodiversity, particularly biodiversity processes that depend on connectivity, in these Water Management Areas will already be difficult, since there are very few moderately intact mainstem rivers. From a biodiversity point of view, these Water Management Areas should receive top priority in terms of the development and implementation of Catchment Management Strategies, in order to prevent further loss of biodiversity. Future improvements to this context layer should focus on basing this context layer on a combination of conservation status of biodiversity (as depicted here) and an assessment of **future vulnerability to degradation**.