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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Water and environment

Assessing the long-term response of wetlands to rehabilitation

A completed WRC-funded project investigated the long-term response of two wetlands in KwaZulu-Natal to rehabilitation.

Background

The importance of wetlands with regards to supplying ecosystem goods and services has been described and highlighted in numerous studies. Wetlands in KwaZulu-Natal have been subjected to high levels of modification and destruction, including two sites identified for this research project, namely the Killarney and Kruisfontein wetlands.

The recognition of benefits associated with wetland ecosystems and the need to reverse ecosystem degradation resulted in the initiation of the Working for Wetlands (WfWet) programme, aimed at protecting, rehabilitating and the sustainable use of South Africa's wetlands.

To date, the monitoring and evaluation of rehabilitated wetlands within the WfWET programme has been severely limited due to budgetary constraints. The need to undertake such evaluations of wetland rehabilitation is considered critical to inform our understanding of system response and future rehabilitation efforts.

The WRC project aimed to assess the integrity and survival of the rehabilitation interventions of the two selected wetlands; to rapidly assess the ecological integrity and ecosystem services supplied; investigate the response of aspects of the system, specifically vegetation, to rehabilitation interventions; and to document lessons learnt in terms of rehabilitation planning and the challenges of the long-term monitoring of wetland rehabilitation efforts.

The study sites

The study sites were of the Killarney wetland, which occupies a tributary valley of the Ntsikeni Vlei in southern KwaZulu-Natal, and the Kruisfontein wetland, which occupies two coalesced tributaries of the Mooi River in the Midlands, east of the town of Mooi River.

Both of the sites had undergone extensive modifications relating to historical land uses, but the overall level of modification at Killarney wetland was lower than at Kruisfontein wetland. Rehabilitation interventions were implemented in 2005 and 2006 for Kruisfontein and 2005 to 2007 for Killarney. The objectives of the rehabilitation for both wetlands were similar; primarily attempting to re-establish near-natural hydrological conditions and promote the re-establishment of native hydric plants.

Monitoring activities

In order to assess the response of the wetlands to the WfWET rehabilitation, pre-rehabilitation monitoring of the above-mentioned wetland systems was undertaken in 2005, and post-rehabilitation in 2011 and 2012 for the Killarney and Kruisfontein wetlands respectively.

The monitoring included three levels of monitoring:

- Level 1 monitoring focused on the outputs of wetland rehabilitation, including the assessment of the structural integrity of the interventions, and identifying structural vulnerability;
- Level 2 monitoring with a rapid assessment of the outcomes of the rehabilitation, focused on the improvements in the functioning and integrity of the wetlands;
- Level 3 monitoring assessed the outcomes of the wetland rehabilitation, based on the stated objectives. Based on the rehabilitation objectives of the sites to re-establish near-natural hydrological conditions and promote the re-establishment of native hydric plants, the species composition of vegetation was monitored using vegetation plots.

The results of the three levels of monitoring identified a number of key trends to be considered in rehabilitation planning and served to document lessons to be applied in future planning.

The assessment of the ecosystem goods and services and ecological integrity of the wetlands before and after rehabilitation served to highlight the changes in functioning and integrity associated primarily with the WfWET rehabilitation. The improvements in the wetlands' levels of ecosystem service delivery were strongly linked to the improvements in regulatory services.

The increase in regulatory services relating to water quality within the Kruisfontein wetland is particularly important if one considers that the area receives effluent from a farm dairy. It should, however, be noted that the poor recovery of the vegetation within the Kruisfontein wetland has reduced provisioning services.

The assessment of the wetlands' integrity, especially with the derivation of hectare equivalents, provided a useful means to evaluate the response of the wetland systems. The improvement in ecosystem integrity was less than the anticipated improvements. This suggests that the rehabilitation of the wetlands has not followed the trajectory of change anticipated during the rehabilitation planning process.

Within the Killarney wetland it is anticipated that vegetation conditions may improve further as the desired state/regime within the wetland is maintained. Within the Kruisfontein wetland, however, both hydrology and vegetation have not responded in accordance with the anticipated response.

The hydrological response within the wetland was inhibited by the ineffectiveness of the spreader canal and the short-cutting of flows along the western edge of the earthen berms. The limited vegetation response in the Kruisfontein wetland is linked to there being reduced area with improved hydrology and the dominance of disturbance-tolerant plant species.

General lessons

The Killarney and Kruisfontein wetlands provide valuable generally applicable lessons relating to understanding the objectives of wetland rehabilitation:

- To re-establish/secure the ecological condition of wetland vegetation it is important to screen the site in terms of its readiness with respect to the establishment of indigenous vegetation.
- To reinstate the regulatory hydrological services supplied by the wetland is probably of little consequence and therefore costly re-planting is unlikely to be justified.
- Planting of wetland vegetation may be justified if biodiversity is an issue at a particular site.
- To offset the impacts of a proposed development, understanding both the thresholds that exist within a system and the lag time that could be applicable to the natural response of the rehabilitated system would be critical.

It is recommended that the following be revised or included in the Wetland Management Series guidelines and assessment frameworks:

Firstly, the criteria for determining the cost-effectiveness of the wetland rehabilitation strategy based on costs per hectare equivalent should be updated to be more sensitive to changes, so as to avoid situations similar to that recorded for the Kruisfontein wetland.

The WET-EcoServices assessment framework should be updated to account for both the size of the wetland and the amount of functional wetland area within the wetland itself, incorporating a means of weighting ecosystem services based on the extent of the wetland and an understanding of the interactions between system integrity and functioning.

Investigate, by means of detailed research, the potential to update the WET-EcoServices framework to inform the valuation of wetland rehabilitation based on resource economics. Refine WET-Health to illustrate the value of the detailed mapping of disturbance units for hydrology, geomorphology and vegetation for each wetland rehabilitated.

Update the Level 1 monitoring to include additional criteria used to assess structural integrity, and incorporate guidance on reviewing the rehabilitation strategy adopted in terms of cost-effectiveness and efficacy in terms of meeting the stated objectives.

Greater guidance, especially in terms of the approaches and 'experimental design' of the wetland rehabilitation monitoring, needs to be provided. Furthermore, it is recommended that WfWET's monitoring and evaluation framework include all levels of monitoring, but with Level 3 monitoring being adopted for large-scale or high-value wetland rehabilitation projects to accommodate budgetary constraints.

Greater emphasis needs to be placed on the collection of a detailed measure of the effect of wetland rehabilitation on the delivery of ecosystem services. More explicit guidance in accounting for ecosystem service delivery should be provided.

Conclusion

The assessment of the long-term response of the two wetlands to WfWET rehabilitation is seen as contributing significantly towards the wetland rehabilitation field of practice as it allows for some reflection on challenges. This reflection assists in 'closing the loop', informing future rehabilitation planning, with recommendations documented for wetland rehabilitation implementation, planning, monitoring and evaluation.

In addition to documenting lessons learnt and refining wetland rehabilitation efforts in SA, this study introduces two indices to objectively and defensibly utilise vegetation to quantify changes in long-term wetness and habitat quality.

This is the first time that these indices have been applied in South Africa, and based on their application in the study it appears that these indices have particular value for measuring wetland ecosystem response to rehabilitation. In addition, the indices are likely to have much broader application, e.g. for wetland delineation and the assessment of current impacts on wetlands.

Further reading:
To order the report, ***Assessment of the long-term response of two wetlands to Working for Wetlands rehabilitation*** (**Report No. 2035/1/13)** contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.