POLICY BRIEF

January 2022
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.

The role of ecological infrastructure in mitigating drought

Anthropogenic activities (man driven modifications) have modified catchment landcover, particularly the vegetation, to provide grazing for livestock, for cultivation, and plantations in order to secure food, firewood, timber and space for human settlements. These modifications are necessary to meet human needs, but typically they alter how the rainwater is partitioned, often reducing river flows or increasing the volume of floods, or both. Changes in water flows are also closely linked to sediment flows, and the reduced vegetation cover in heavily- or over-grazed lands or poorly planned cultivation may result in increases in soil erosion. Typically, this triggers a negative spiral with further, more rapid erosion, sedimentation of dams and non-potable water. Thus, it is crucial for people, business and policy to recognise the early stages of such degradation and alter their land-use practices to halt further damage and restore the ecosystems that protect their livelihoods. Restoration is the key word in the current decade of the SDG:2030 where reversal of ecosystem degradation is being correctly profiled since productive land is so important in almost all forms of human livelihood. A Water Research Commission (WRC-funded study investigated the role of healthy landscapes or ecological infrastructure as a mitigatory mechanism to the impact of climate change and drought. Ecological Infrastructure (EI) refers to naturally functioning ecosystems that deliver valuable services or benefits to the society.

Background

South Africa is currently and continuously experiencing severe droughts (others prefer to refer to these as Day-Zero, Gqeberha is the case at hand), which began in 2015, and this has resulted in crop losses, imposition of water restrictions and significant impacts on water and food security.

Climate experts project that droughts are likely to become more intense and more frequent in the future due to changing climatic regimes with little or failure to implement practical interventions as noted in COP:26 as well as World Economic Forum Global risk list of 2021. The COP:26 report (November 2021) further notes that "the need to mitigate climate change, and the role that nature (ecological infrastructure) can play in doing so, are recognised under multilateral agreements, including the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD).

However, the member states are collectively on a path towards failing to meet the UNFCCC's Paris Agreement commitment to limit warming to well below 2°C, preferably 1.5°C". This is mainly because energy, land and water demands are expected to increase globally. This has implications for associated impacts on the availability of grasses for livestock, and water and food security (due to crop losses and water availability). It is clear that society needs to respond more appropriately to droughts through timeous and transformative interventions, moving away from responses that do not yield long-term gains, to those that optimise the sustainability of water resources, i.e., green and renewable approaches.

In the past, the normal go-to response for water security in many countries, including South Africa, has been to build dams and institute inter-basin transfers. This approach is still valid, but it should be complemented with the (long-term) approach of rehabilitation and maintenance of the degraded landscapes that not only serves the purpose of water security, but provides additional benefits that healthy functioning ecosystems are capable of, such as hydrological flow control, water purification, biodiversity, cultural values, etc.

The approaches for investing in EI are also in line with the National Water Resource Strategy (NWRS2) which promotes rehabilitating strategic water ecosystems and protecting and maintaining freshwater ecosystem priority areas.

The objectives of this study were to:

- explain how well-managed ecological infrastructure can help to mitigate the impacts of droughts on human livelihoods and well-being and to propose strategic responses that will maintain and enhance the value of this service that people will embrace and implement.
- assess ecological infrastructure presence, current state and prioritisation in three focal catchments.
- rovide an assessment of how the ecological infrastructure facilitates drought mitigation

Methodology

In South Africa, ongoing land degradation of catchment areas is on the increase. The natural resource base, particularly in communal areas, is in decline.

It is estimated that close to 18 percent of the natural land cover in the country has already been transformed (DEAT, 2008) and environmental degradation is visible in some areas impacting negatively on water resources (WRC Project no. K5/2432). In an attempt to appeal for increased water resources management, the WRC and its research partners listed 23-strategic water source areas that should be prioritised if economic development is not going to be further constrained by water security, which is already under serious pressure (see Fig.1 and study catchments).
The study evaluated the EI using various national databases in three focal catchments: White Kei, Tsitsa and Upper Crocodile catchments. The study conducted the degradation analysis in these three focal catchments using Trends-Earth platform, which to monitor for the proportion of land that is degraded over the total land area (also used in SDG:15, extent of rehabilitation). The datasets used in the study were under three main criteria: ecosystem health status, hydrological functionality and social benefits.

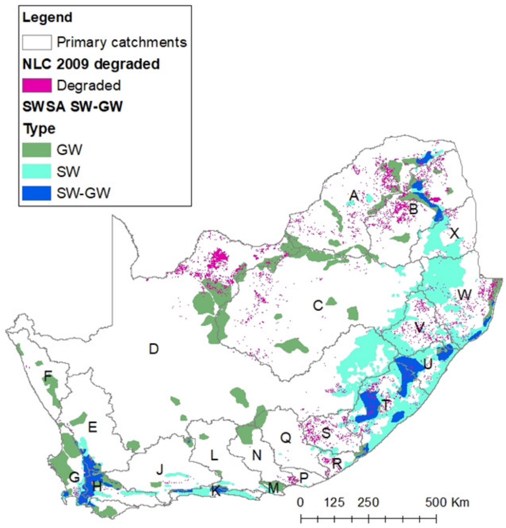

Fig.1 Study locations, the White Kei, Tsitsa-uMzimvubu and upper Crocodile catchments within the strategic water resource areas spread.

To demonstrate the value of EI in facilitating drought mitigation, the hydrological modelling was conducted for selected catchments. The Pitman Model (Pitman GWv3 Model) was selected to represent the runoff regime in natural vs modified catchment areas.

Main results

The results found that a large proportion of the pixels are in stable state in Cacadu (White Kei) catchment and <17% has degraded over the assessment period of 2000 to 2015. In comparison, approximately 41% of the land is degraded in Tsitsa catchment, particularly the lower parts, and 34% in the Upper Crocodile catchment.

This degradation information along with other spatial datasets (associated with ecosystem health and hydrological function criteria) and feedback from stakeholders (social benefit criteria) was used as input towards prioritisation for rehabilitation. The Pitman hydrological model was applied and the simulated impacts of land use covers were evaluated. The results clearly demonstrated that land modification in these environments reduces the catchment's capacity to retain as much rainfall from quickly reaching streams during the wet season.

Water flow regulation consists of processes by which rainwater is captured by the soils and underlying geological materials, stored as moisture or groundwater, and released slowly into springs and streams. The structure and state of the vegetation plays a critical role in flow regulation because interactions between vegetation, animals and soils play a critical role in determining soil porosity and, thus, its ability to absorb rainwater and minimise surface runoff during rainfall events.

Thus, identifying the location of degraded ecosystems and prioritising these for rehabilitation. It should be noted that modelling was the only option to evaluate EI role, otherwise using a rehabilitated site would need at most 20 years to yield benefits. Limited data is continuing to perturb research, particularly modelling.

Conclusions and recommendations

The studies from three catchments collectively agree that land cover alterations such as those in the White Kei and the Tsitsa catchments combined with climate change impacts intensify surface runoff and result in less resilient catchments regarding drought. In fact, in the Olifants catchment where a significant reduction in rangelands and increase in croplands led to nearly 50% more surface runoff. Such dramatic changes on vegetation land cover are characterised by high loads of sediment, which result in dam siltation, habitat los paralleled by biodiversity loses, eco-tourism and many other negative consequences of ecosystem degradation. Restoration gets more expensive as the start of implementation is delayed.

Recommendations for policy

The findings are supporting the argument that investment in ecological infrastructure enhances catchment water security through promotion of strong flow regulation.

- The rehabilitation work must include the community at a village level to identify priorities and develop a village scale catchment management plan
- The policy (DFFE, Agric, SANBI, DWS) has an objective tool to use in prioritization of restoration in the light of competing needs based on extensive degradation across the country
- Monitoring must be emphasised and built into the entire EI restoration efforts

Further reading:

To access the report, *The role of ecological infrastructure (EI) in mitigating the impacts of droughts,* (**WRC report No. 2928/1/21**), Visit: www.wrc.org.za or Email: orders@wrc.org.za