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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

Invasive alien species

Assessing the impact of alien plant infestations in the Southern Cape

A completed Water Research Commission (WRC) study used cost-benefit analysis to determine the impact of alien plant infestations on river systems in the Southern Cape.

Background

Ecosystem resilience is key to the provision of dependable ecosystem goods and services. It is generally accepted that ecosystem diversity helps to maintain system resilience.

It is therefore reasonable to postulate that changes to the variables that drive species patterns will results in changes to ecosystem community structure and consequently negatively impact on system resilience. Alien vegetation in the riparian zone can impact on water temperatures, flow patterns, degree of shading, channel modification and changes to natural sediment loads.

Climate change is likely to exacerbate the problem both directly through its amplication of thermal extremes in aquatic systems, and indirectly through its impacts on dispersal patterns of alien invasive vegetation.

Freshwater systems in the Garden Route Initiative planning domain area – George, Knysna and Plettenberg Bay – are of particular conservation value because of their rich Gondwanaland relic aquatic macroinvertebrate fauna found in these rivers, which are vulnerable to thermal changes. Clearing of riparian vegetation, and restoring riparian zones to either a desired future state or a natural state, will theoretically restore flow and water temperature regimes underpinning community patterns.

Different clearing techniques will have different associated costs and potentially achieve different levels of ecosystem restoration, although what these costs and benefits are remains to be quantified.

This WRC project examined information on the costs of clearing alien riparian vegetation relative to the ecological benefits, as assessed by convergence of water temperatures to target values. This was achieved by:

- Defining relationships between alien plant densities in the riparian zone and changes to water temperature regime;
- Defining relationships between alien plant densities in the riparian zone and changes to the structure of aquatic macroinvertebrate communities;
- Establishing the effect of different clearing techniques/ approaches in the riparian zone on water temperatures and associated aquatic habitat integrity and community response;
- To estimate the most cost-effective clearing techniques in terms of financial efficiency and ecological returns.

Methods

A range of data were collected at a total of 19 sites on seven river systems in the Garden Route Initiative area of the southern Cape. These included 12 months of hourly water temperatures at all sites and quantitative sampling of aquatic macroinvertebrates at ten of these sites.

Each site was also characterised in terms of water quality and general characteristics, including impacts such as density of alien riparian trees. Biotic responses were based on exceedances of thermal thresholds, which were in turn linked to clearing costs extracted from the national Working for Water database.

Key findings

1. Relationships between alien plant densities in the riparian zone and changes to water temperature regime

Thermal regimes were relatively consistent across rivers, irrespective of densities of alien riparian vegetation. However, exceedances of biological thermal thresholds were higher at downstream sites, with relatively higher densities of alien invasive riparian vegetation. Such densities are likely to act as surrogates for overall contributing upstream catchment degradation.

It is likely that groundwater inputs buffer thermal regimes to some extent in the rivers. Thermal differences appear to be more a function of upstream versus downstream influences than direct impacts of alien riparian vegetation.

2. Relationships between alien plant densities in the riparian zone and changes to the structure of aquatic macroinvertebrate communities

Aquatic macroinvertebrate communities at the family level showed variation between sites and seasons. However, these differences appeared to be more pronounced on the basis of natural land cover type (fynbos versus indigenous forest) than densities of alien invasive riparian vegetation.

The same species of aquatic macroinvertebrates showed different levels of thermal tolerances between different river systems.

3. Estimation of the most cost-effective clearing techniques in terms of financial efficiency and ecological returns

The Working for Water database of clearing costs (person days per hectare) at different densities of different species was a key resource for developing cost-benefit models. Person days per hectare were directly used as costs for clearing of alien vegetation at a catchment-scale, with benefits to the ecosystem also reflected as person days per hectare.

Using these values, it was possible to successfully compare different management approaches (e.g. once-off clearing versus multiple follow-ups) at current prices using a spreadsheet-based Net Present Value economic model.

Best value per percentage gain towards a thermal reference condition provided the link between financial efficiency and ecological returns. The long-term benefits of such actions would be reflected by increased resilience to warming water temperatures in response to global climate change.

Based on the findings of the study, there is promise towards developing cost-benefit models incorporating targets for thermal reference conditions. This is a key step towards prioritising areas for clearing of alien invasive vegetation. These findings could be applied not only in the Garden Route area, but also at a national scale.

Further reading:
To order the report, *Towards assessing impacts of alien plant infestations on river systems in the Southern Cape using cost-benefit analyses* (**Report No. 2264/1/15**) contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.