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The impact of riparian alien plant removal on aquatic invertebrate communities in the upper reaches of Luvuvu River catchment, Limpopo Province

by

Rifilwe Victor Modiba

Student number: 11564558

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Department of Zoology

School of Mathematical and Natural Sciences

University of Venda, Thohoyandou

South Africa

Supervisor: Prof SH Foord

Co-Supervisor: Prof: PSO Fouché

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ABSTRACT

Invasive Alien plants (IAPs) have considerable negative impacts on freshwater habitats. South Africa has implemented an innovative Working for Water (WfW) programme for the systematic removal of these plants aimed at, amongst other objectives, restoring biodiversity and ecosystem services in these threatened habitats. These restoration processes are expensive and thus should be evidence-based. Few studies include invertebrates as indicators of efficacy of these interventions. In this study in-stream macroinvertebrate and adult Odonata assemblages were used as indicators of restoration success by quantifying the response of biodiversity metrics for these two groups to the removal of IAP's in a strategic water resource of South Africa that is extensively invaded by invasive alien plants which are dominated by but not limited to *Solanum mauritianum*, *Acacia mearnsii*, *Pinus patula*, *Caesalpinia decapetala* and *Eucalyptus gomphocephala*.

The study consisted of a replicated design that included 45 sampling units (SU), viz. 15 invaded, 15 uninvaded and 15 cleared sites stratified across the upper reaches of six sub-catchments of the Luvuvhu river catchment, Limpopo Province. Cleared sites were only considered if they had received at least two WfW treatments in the last 3 years. The benthic macroinvertebrate and adult Odonata assemblages in each of these sampling sites were surveyed from November to March, 2013/2014 and 2014/2015 respectively. Generalized Linear Models (GLM) with a log link function and Poisson error distribution were done for metrics (invaded, cleared, and uninvaded) whose residuals were not normally distributed or had unequal variance and for abundance. RDA was done for EPTO genera (Ephemeroptera, Plecoptera, Trichoptera and Odonata) and adult Odonata species abundance. GLM was done to for the abundance of genera and odonates that had association with the RDA environmental factors.

Sixty four benthic macroinvertebrate families and 57 EPTO genera from SASS5 surveys, and 45 adult Odonata species were recorded across all 45 sampling units. Distribution records for *Hemicordulia* and *Lestiniogomphus* and for the dragonfly species *Notiothemis jonesi* and *Notogomphus praetorius* were new. There was no significant difference between the SASS5 total score, ASPT, and family richness of the three invasion classes. Although clearing only had a weak positive effect on the adult odonate species richness it had a positive impact on total DBI per site scores. These differences were mainly the result of significantly larger total DBI per site scores in the cleared sites as compared to the invaded sites. Average DBI per site did not differ significantly between invasion classes. Results suggest that water quality is significantly positively impacted by repeated clearing pointing to the importance of follow up treatments after initial clearing. Adult

odonate diversity as measured by richness, endemism, threat and distribution respond positively to all forms of clearing. Clearing had a significant impact on odonate assemblage structure but did not affect EPTO structure. Variation partitioning showed that 21.8% of the variation in EPTO assemblage could be explained by spatial and environmental variables while 16% of the variation in odonate structure was explained.

The response of the diversity metrics to clearing increased in significance at finer taxonomic resolutions, particularly of adult odonates whose metrics significantly improved with clearing and whose structure responded to both invasion and clearing. The study recommends the use of total DBI per site for surveying river health when hydraulic biotopes are poor.

Key words: Restoration, evidence-based conservation, benthic macroinvertebrates, Soutpansberg mountains, DBI, SASS, River