

Nitrogen dynamics in land cleared of alien vegetation (*Acacia saligna*) and impacts on groundwater at Riverlands Nature Reserve (Western Cape, South Africa)

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Abstract

Woody invading alien plants, many of which are nitrogen-fixing legumes (Fabaceae family), are currently cleared in South African catchments to reduce water loss and preserve streamflow, and for the restoration of the ecosystem. This study tested the hypothesis that clearing invasive alien vegetation may disturb the vegetation-micro-organism-soil N cycling system by producing a large once-off input of fresh tree litterfall rich in N and by eliminating a large N sink. Three experimental plots were established at the Riverlands Nature Reserve (Western Cape, South Africa): a site invaded by *Acacia saligna* to be used as control; a site cleared of *Acacia saligna*; and a site with natural vegetation to be used as background. Nitrogen concentrations in soil and groundwater, volumetric soil water contents, root density and weather conditions were measured during 2007. Oxidised forms of nitrogen, in particular NO₃⁻, were dominant in the system. Recharge and leachate were simulated with the HYDRUS-2D model and used as inputs into Visual MODFLOW to predict the spatial distribution of nitrate plus nitrite (NOx) in groundwater. NOx levels in soil and groundwater were higher in alien-invaded areas compared to fynbos-covered land. A quick release of NOx into groundwater was observed due to high residual N reserves in the rooting zone, decreased evapotranspiration and increased recharge in the treatment cleared of alien vegetation. In the long run, high NOx concentrations in groundwater underlying cleared land will last only until all the excess nitrogen has been leached from the soil. A decrease in NOx concentration in groundwater can be expected thereafter. Clearing land of alien invasive legumes may therefore have a beneficial effect by reducing groundwater contamination from NOx and reducing water losses in catchments.

Keywords: *Acacia saligna*, forest clearing, groundwater contamination, nitrate leaching, Riverlands Nature Reserve