

Glyphosate facilitates native sedgeland recovery in Whangamarino wetland following willow invasion

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Aerial glyphosate application is an economic method to deal with large areas of invasive plants. However, there are few studies investigating non-target effects or rates of reinvasion, particularly over multi-year timeframes.

A before-after control-impact (BACI) experiment was conducted in Whangamarino wetland (Waikato, 7,100 ha) to evaluate the effectiveness of the aerial application of glyphosate for control of dense stands of the invasive willow *Salix cinerea*, and determine the vegetation trajectory over the subsequent 2 years. *Salix cinerea* had increased from 1% cover in the wetland in 1942 to 22% in 2014, displacing native *Carex* communities.

Vegetation and abiotic surveys were conducted prior to spray and for two years thereafter. We used multivariate and univariate statistical analyses to quantify the response to glyphosate of *Salix* and the vegetation community at the site. Glyphosate application to an established willow canopy was effective in reducing willow cover to < 5% for up to two years post-spray when assessed using 10 m² plots. Smaller 1 m² plots were more sensitive to detecting willow regrowth, which began one year post-spray. Collateral damage to non-target sub-canopy species was generally minimal, except for the common native tree-fern species *Dicksonia squarrosa* and the invasive exotic fern *Osmunda regalis*, which both showed marked reductions in cover and little or no recovery over the study period. Species richness was higher in sprayed plots post-spray and a shift towards a native *Carex*-dominated vegetation community was detected. *Salix* is a highly successful invasive species and is likely to re-establish in the wetland due to surrounding seed sources. Management options for long-term restoration, including alternative selective herbicides, establishment of a native forest canopy to shade out *Salix*, and repeated glyphosate application will be discussed.