

Case Study: Weed identification and mapping from high resolution aerial photography

COUNCIL NAME

Queanbeyan-Palerang
Regional Council

WEBSITE

www.qcc.nsw.gov.au

SIZE

5,319 square
kilometres

POPULATION

56,368

Overview

This project successfully trialled the ability to identify and map noxious weeds from high resolution natural colour aerial imagery. Imagery was obtained from low-flying remote pilot aircraft with 2-5cm pixel resolution. Most tree and shrub species were readily identified, with many grass and forb species also able to be confidently mapped. Suitable imagery obtained across larger areas can potentially replace on-ground inspections, improving the safety, efficiency and effectiveness of council weed inspection programs.

Background

Councils are often the local control authority under the *Noxious Weeds Act 1993*, with obligations to routinely inspect properties outside of urban areas. The benchmark five-year reinspection period is difficult to achieve effectively. Locked gates and other access restrictions reduce the efficiency of on-ground inspections. Control requirements for weeds involve preventing their spread, which is difficult to prove without accurate comparative mapping.

Aerial survey imagery from remote pilot aircraft offered the potential to systematically and safely survey large areas more rapidly than on-ground inspections, and objectively document the extent of weeds for future comparison. An alternative, multi-spectral imagery modelling, may enable automatic species detection, but it has limited success when transferring models to different environments and seasonal conditions. The broader use of the natural colour imagery for other applications adds value, thus helping to offset acquisition costs.



Aside from improved efficiency, consistency and more frequent weed inspections, improved identification and mapping of weeds from aerial imagery can assist Council in a range of disciplines including planning, enforcement and bushland management.

The objective of this project was to:

1. Determine the resolution and quality of aerial photos required to identify common noxious weeds by expert visual interpretation.
2. Determine the resources required to comprehensively survey and map weeds across large areas using high resolution imagery from remote pilot aircraft.

Implementation

This project was part of a broader program by Palerang Council to trial aerial imagery from remote pilot aircraft. To legally obtain imagery a basic aerial survey remote pilot aircraft system was purchased (\approx \$5,000), staff qualified as remote pilots (\approx \$4,000 each) and a CASA Operator's Certificate (\approx \$3,000) obtained. A range of sites were flown including Crown, State and private land sites for which Council had been granted funding for weed management projects.

The trial obtained imagery at different resolutions and using cameras with different size sensors to compare the ability to detect various weed species and determine the time required to fly a specific area to obtain a specific desired image resolution.

Outcomes

Outside of urban areas, poor aerial imagery resolution means most weed species cannot be identified. Over urban areas where 10 cm imagery is common, larger plants become discernible but most grass and forb weeds cannot be identified unless they form part of a larger known infestation and their visual pattern contrasts to the surrounding vegetation.

Imagery in the 3-4 cm range enables the confident identification of Serrated tussock, compared to nearby native grasses, by an experienced weeds inspector. It is anticipated that 1cm resolution imagery will enable the identification of most plant species except for isolated smaller plants, plants amongst similar-looking species, and those located under tree canopy. However on-ground inspection has similar limitations to the quality of the survey.

The imagery can be obtained at a rate of several km^2 per day by one operator, potentially 5-6 km^2 by a pair of operators working concurrently. Even after visually scanning that imagery back in the office to detect weeds and assign properties that require inspection, the efficiency for peri-urban areas is greater than for ground inspections alone. The imagery provides an objective record of inspection and can be used for a range of other applications including provision to the landholder for weed management planning.

An aerial photography plant identification guide at resolutions typically available from remote pilot aircraft imagery will be developed in the future.

Key Learnings

The benefits are clear and will be ongoing as future aerial inspections are compared to the past to assess change in weed extent. Initial cost-benefit analysis shows that obtaining detailed imagery, mapping weeds, identifying the limited number of properties requiring on-ground

inspection, and undertaking those inspections will be much more efficient than ground surveys alone.

A range of additional applications have been determined suitable for this technology with potential for broader compliance monitoring (e.g. failing septics, unregistered pools, unapproved development, pollution incidents), asset management (e.g. road infrastructure, roadside vegetation, community halls, bushland, rural waste transfer stations) and vegetation mapping. Site-specific projects such as compliance, roadworks survey, real-time flood mapping, community land management plans may also employ the technology.

As the remote pilot technology and industry advances, the cost-effectiveness and relative ease will improve, perhaps triggering other councils to adopt the same technology.

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This project was the 2016 winner of the Invasive Species Management Award at the LGNSW Excellence in the Environment Awards