Mapping weed infestations using satellite imagery

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Introduction

Weed mapping on a broad scale is essential to evaluate the effectiveness of control strategies and to monitor change in infestations. However, conventional mapping is expensive and time-consuming. Improvements in global positioning system (GPS) accuracy have allowed real-time weed mapping by GPS and tracking software, but such mapping is still extremely time-consuming and therefore limited to restricted areas.

Remote sensing is a viable alternative for mapping some weed species. The availability of imagery with better spatial (ground) resolution and/or spectral (number of bands) resolution will improve the capability for mapping infestations. Currently, the potential for mapping is constrained by the limited number of broad spectral bands on most sensors. This means a weed must be dramatically different in its spectral reflectance from other plants, soil, and stubble to be able to be identified.

In this project, serrated tussock (*Nassella trichotoma*) and Scotch thistle (*Onopordum* spp.) were chosen as target weeds due to their importance and distinct differences from other vegetation. The project proved successful in mapping infestations of more than 20% to 30% ground cover using Landsat Thematic Mapper multispectral (many bands) imagery.

Methods

After field studies to identify key weed growth and recognition stages, Landsat imagery was obtained at three key stages for each weed. In each case, the three images were combined for analysis in an image-processing system. Field sites of various weed infestation levels and other major land-cover types were used to 'train' the analysis. The results were verified by checking against validation sites that had not been used in the 'training' process.

Results

Serrated tussock and Scotch thistle were successfully mapped, although attempts to map different infestation classes met with poor results. This was due to confusion between the different infestation classes. These classes were combined for the final analysis to provide a weed/non-weed map.

Scotch thistle was most successfully mapped, with 86% of infestations identified at a high degree of reliability. Infestations could be detected down to 20% ground cover. Mapping of serrated tussock was less successful, with 82% of infestations identified at down to 30% to 40% ground cover but at a lower reliability. The difficulty in identifying the serrated tussock was due to very dry conditions at one of the key growth stages.

Conclusions

Broad-scale weed mapping is possible using current multispectral satellite and airborne systems, provided the weed is sufficiently different from other vegetation throughout the year or at certain times of year. However, light infestations are difficult to map due to the spatial and spectral limitations of these sensors. This is problematic, as the critical infestations for weed spread is from such infestations. The ability to detect a range of weeds at lower infestation levels will improve as better spatial and spectral resolution imagery becomes more readily available and affordable.

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