

Mapping lantana using Landsat to further the National Weeds Strategy

Andrew J. Stewart¹, Grant W. Hodgins¹, Tim J. Danaher¹ and Andrew Clark²

¹ Department of Natural Resources and Water, 80 Meiers Rd, Indooroopilly, Queensland 4068, Australia

² Department of Primary Industries and Fisheries, Locked Bag 40, Coorparoo DC, Queensland 4151, Australia

Email: Andrew.J.Stewart@nrw.qld.gov.au

Summary Identified by the National Weeds Strategy (1997) as one of the twenty Weeds of National Significance, lantana (*Lantana camara* L.) has been documented to exist along the majority of the eastern Australian coast and adjacent inland. A strategic plan was composed in 2000 detailing a requirement to identify high priority areas to target management resources.

Despite being regarded as an understorey species, lantana's biology lends itself to remote sensing mapping due to its preference to grow in monoculture environments in open or disturbed areas readily seen by satellite sensors.

Based on the proven credibility and operational efficiency of utilising Landsat Thematic Mapper (TM) imagery in mapping the vegetation cover of large scale regions by the Statewide Landcover and Trees Study (SLATS) program, a world's first application of remote sensing technology to map a weed species at a national level began in 2006.

A methodology was developed incorporating several remote sensing weed mapping techniques with a predictive model of ideal habitat and disturbance pathways based on Duggin and Gentle's (1998) findings that invasion success of lantana was significantly correlated with the intensity of disturbance. This initially involved a time-series analysis of field spectrometer and satellite-measured spectral response of the weed's varied phenological states. Based on these specifically identified spectral components and a pre-existing lantana classification technique (Stewart *et al.* 2006), a combined process of spectral unmixing and broad classification was able to differentiate densities of lantana at a 25 metre ground resolution. This classification was then generated over 51 Queensland and 17 New South Wales Landsat 5 TM scenes each covering 185 km × 185 km. This initial classification was then extensively field surveyed over the entire coastal and great divide of Queensland and New South Wales with in excess of 50,000 vehicle drive-by observations of presence or absence, and the related GPS position. The observation data was then used to train an Artificial Neural Network comprised of several other environmental

and disturbance-related datasets to generate a superior predictive model to that of pre-existing climate-only based models. The predictive model was then used to refine the initial spectral classification, generating the final mapping product.

Initial results of the drive-by observations indicated an overall accuracy in excess of 82%. Classification errors of commission were largely attributed to spectral confusion with other species of either similar structure to lantana, such as poison peach bush (*Trema tomentosa* var. *viridis* (Planch.) Hewson), or of high foliage reflectance, such as *Terminalia sericocarpa* F.Muell. Errors of omission were predominantly found in areas of either completely defoliated sparse infestation, or in contrast, infestations completely obscured by the forest canopy, such as under mature pine forest plantations. The inclusion of the predictive model in these instances generally improved the spectral classification therefore resulting in an increase to the overall accuracy.

The overall accuracy achieved provided a mapping product of Queensland and New South Wales suitable for assisting in the identification of high priority areas. It is also hoped that with future mapping undertaken using this methodology, a product could be capable of determining the success of applied management techniques.

Keywords Lantana, Landsat TM, predictive model.

REFERENCES

- Duggin, J.A. and Gentle, C.B. (1998). Experimental evidence on the importance of disturbance intensity for invasion of *Lantana camara* L. in dry rainforest-open forest ecotones in north-eastern NSW, Australia. *Forest Ecology and Management*. 109, 279-92.
- Stewart, A.J., Hodgins, G.W., Danaher, T.J. and Scarth, P.F. (2006). Mapping lantana using Landsat to further the National Weed Strategy. Proceedings of the 13th Australasian Remote Sensing and Photogrammetry Conference, Canberra, Australia.