Fine-scale predictive mapping of the kwongan vegetation of the Eneabba sandplains, Western Australia

Paul D. Macintyre (1), Ladislav Mucina (1,3), Mark P. Dobrowolski (1,2), Adriaan van Niekerk (3), Garth Stephenson (3) & Theo Pauw (3)

1) School of Plant Biology, The University of Western Australia, 35 Stirling Hwy, Crawley WA 6009, Perth, Australia

2) Iluka Resources Limited, 140 St Georges Terrace, Perth WA 6000, Australia

3) Centre for Geographic Analysis, Department of Geography and Environmental Studies, Stellenbosch University, Matieland, 7600, Stellenbosch, South Africa

Correspondence: Paul Macintyre, 20163103@student.uwa.edu.au

Background & Aim: Prediction modelling has been widely used in ecological studies for a variety of purposes. At coarse scales (1:250 000 to 1:1 000,000+) vegetation prediction maps have been successfully created, yet there is currently little data on how these models perform at fine scales (1:10 000 to 1:50 000). Using the protocols developed by Mucina et al. (2013) which have been successfully applied at coarse scales, this project set out to (1) determine whether the existing protocols can be successfully applied at fine scales, (2) examine the vegetation patterns of the sclerophyllous kwongan scrub vegetation of the Eneabba sandplains, and (3) determine whether knowledge of the vegetation-environment relationship can be used to improve the accuracy of the prediction model.

Materials & Methods: The study region was located in the Eneabba sandplains approximately 270 km north of Perth (29°49′ S, 115°16′ E), Western Australia. A total of 200 classified plots were used in the training of a decision tree through the Salford Systems' Classification and Regression Tree (CART) algorithm; for each plot a combination of 109 variables (remotely sensed climatic and topographic variables, and soil/geology variables) were used as predictors. Two decision trees were constructed: one at the level of three large-scale vegetation units ('class') and the other at the level of floristically defined plant community types ('associations') as defined by Tsakalos (2013) and Tsakalos et al. (2014). The mapping region was segmented into image objects using eCognition Developer and the decision trees were applied to the objects to produce a spatial representation of the models.

Main Results: The model used to predict vegetation at the class level resulted in a decision tree with 25 terminal nodes and a total cost of 0.60; the model predicting at the association level resulted in a final tree containing 18 terminal nodes and a total cost of 0.49. Within both models the characteristics of the soil were major factors predicting the classification patterns. The accuracy of the classifications was tested using an additional 343 plots from the region that were excluded from tree construction. The class and association models had an initial accuracy of 33% and 71%, respectively, but when a 30 m buffer was applied to each validation point the accuracy of the models improved to 42% and 76% for the class and association level. Overall it has been shown that the protocols developed by Mucina et al. (2013) can be used at fine scales, but that a much larger number of training points must be used.

Acknowledgments: The authors would like to thank the Centre for Geographic Analysis, Stellenbosch for the use of their facilities throughout this project and Jerry Hruban and Monika Držková for undertaking the collection of the soil data. LM appreciates the logistic support of the Iluka Chair (UWA) and the hospitality of Iluka Resources the staff at the Eneabba mine site.

References

Mucina, L., Daniel, G., Stephenson, G., Boonzaaier, I., van Niekerk, A., Barrett, M., Barrett, R., Tichý, L. & Valachovič, M. 2013. Floristic-ecological mapping in the Northern Kimberley: Field survey methods and mapping protocols. In: Mucina, L. & Daniel, G. (eds.), *Vegetation mapping in Northern Kimberley, Western Australia*, pp. 26–87. Curtin University, Perth, WA.

Tsakalos, J.L. 2013. *Robustness of a regional vegetation classification system: Kwongan vegetation complex of Eneabba*. BSc Hons thesis, School of Plant Biology, The University of Western Australia, Perth, AU.

Tsakalos, J.L., Držková, M., Hruban, J., Mucina, L & Dobrowolski, M.P. 2014. Floristic patterns and drivers of kwongan vegetation patterns in Eneabba region of the Northern Sandplains, Western Australia. In: Mucina, L., Price, J.N & Kalwij, J.M. (eds.), *Biodiversity and vegetation: patterns, processes, conservation*. Kwongan Foundation, Perth, AU.

Macintyre, P.D., Mucina, L., Dobrowolski, M.P., van Niekerk, A., Stephenson, G. & Pauw, T. 2014. Fine-scale predictive mapping of the kwongan vegetation of the Eneabba sandplains, Western Australia. In: Mucina, L., Price, J.N. & Kalwij, J.M. (eds.), *Biodiversity and vegetation: patterns, processes, conservatio*n, p. 141. Kwongan Foundation, Perth, AU.