The 36th International Symposium on Remote Sensing of Environment,
11 – 15 May 2015, Berlin, Germany, ISRSE36-598

Monitoring *Pinus Radiata* plantations using multitemporal RapidEye images –A case Study from New South Wales, Australia–

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THEME: Forests, biodiversity and terrestrial ecosystems (BIOD).

KEY WORDS: RapidEye, nonlinear logistic models, estimation, softwood plantations

ABSTRACT:

Softwood plantations are of profound importance for satisfying the increasing global demand on wood and fibre for construction, paper and energy needs. There are approximately 296,000 ha of softwood plantation forests in New South Wales (NSW), Australia and *Pinus radiata* is the dominant species. Forests New South Wales (FNSW) manages the majority of these plantations which are characterized by relatively short rotation periods and are thus subjected to constant harvesting, thinning and replanting operations. As a consequence, maintaining stand information up to date is challenging. The current approach is based on an integrated method where field observations are combined with aerial photographic interpretation. The latter is a labour intensive process and accuracy depends largely on the skills and experience of the image interpreter. Therefore, Australian softwood companies are keen to identify alternative approaches that comply with their precision and cost expectations. The unique constellation of the RapidEye satellite system with a high temporal and spectral resolution as well as the low acquisition costs compared to airborne data makes it a potential alternative data source.

In the present study we evaluate the potential of RapidEye for monitoring *Pinus Radiata* plantations in the Nundle State Forest (7245ha). We are particularly interested in predicting the two target variables: *basal area* and *stem density* as both variables are fundamental for the planning of forest management operations.

RapidEye images, acquired in 2011 and 2014, as well as forest inventory plots collected in the same reference years were used to construct nonlinear logistic regression models. Using these prediction models, maps of both target variables were produced which depict the spatial distribution of the target variables. Validation of these maps resulted in a RMSE: 10.09 m²/ha for the basal area and 186.23 N/ha for the stem density map, respectively.

From our results we conclude that RapidEye imagery is in fact a suitable data source – both in terms of precision and cost - to support forest management planning in *Pinus Radiata* plantations by providing sufficiently precise estimates of basal area and stem density and maps of their spatial distributions.

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