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| Developing an individual tree model to quantify crown damage of Coastal Grey Box (*Eucalyptus bosistoana* F. Muell.*)* using UAV in New Zealand |
| In recent years, Eucalyptus plantations have been expanding to produce a naturally durable timber in drylands of New Zealand. These plantations are highly vulnerable to insect herbivory, leading to severe crown damage. For effective pest management, accurate and timely detection, quantification, and monitoring of crown damage at the individual tree level are crucial. However, current assessment methods rely on subjective ground-based visual evaluations, which are labour-intensive, time-consuming, costly, and impractical in inaccessible areas. This study aimed to develop a species-specific model for precise estimation of Eucalyptus crown damage using remote sensing techniques. The study was conducted in *Eucalyptus bosistoana* F. Muell. breeding trials in Sefton, New Zealand. We purposively selected 170 individual trees with varying degrees of crown damage (ranging from 0 to 100% at 5% intervals). For each tree, we collected four leaf samples from four vertical heights of a live crown, each height facing different orientations. We photographed the leaf samples and assessed tree-level quantitative crown damage index (CDI) using an image processing program (ImageJ). Additionally, we captured unpiloted aerial vehicle (UAV) LiDAR and RGB imagery using DJI Matrice 300. Spectral, structural, and textural metrics related to greenness, crown width, crown length and crown density of individual trees were extracted and used as predictor variables, while the CDI served as the response variable. We evaluate three models - Partial Least Square Regression, Random Forest, and Support Vector Regression, to quantify crown damage. Based on the preliminary results, we anticipate that this study will provide a best fit model to estimate individual tree-level crown damage with higher accuracies of R2, RMSE and MAE. This alternative method could offer an accurate, reliable, objective, and unbiased approach for quantifying eucalyptus crown damage using UAV remote sensing, thereby surpassing the limitations of ground-based assessments. The developed model will facilitate the detection, monitoring, and management of eucalyptus forest health for growers and planners in New Zealand and beyond. **Keywords:** Crown damage, LiDAR, Machine learning, RGB image, UAV |