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| **Detecting and measuring urban tree loss at the property scale with remote sensing data** |
| **Introduction:**  Urban trees provide a multitude of environmental and amenity benefits for city occupants yet face the constant risk of removal due to urban pressures and the preferences of private landowners. Understanding the patterns and drivers of tree loss on private land is critical for the effective management of urban forests. Although city-scale assessments of urban forest canopy cover are common, the accurate identification of urban tree loss at the property scale remains challenging. Evaluating change at the property scale is of particular importance given the localised benefits of urban trees and the scale at which tree removal decisions are made.  **Aim / Methods:**  The objective of this research is to detect and quantify the city-wide loss of tree canopy (minimum 3m height and 3m² area) at the scale of individual properties using publicly available remote sensing data. The study area is the city of Christchurch, New Zealand, with the study focussed on tree loss that occurred between 2016 and 2020. Due to the variable quality and alignment of available remote sensing data, a variety of methods have been utilised to create accurate canopy maps for these two dates. For 2016, a semantic segmentation deep learning model (DeepLabv3plus) was trained using high resolution aerial imagery (RGB, 7.5 cm) and used to predict city wide canopy cover. Although similar aerial imagery was available for 2020, it was poorly aligned with the 2016 imagery, which precluded its use for accurate change detection. A 2020 canopy map was therefore prepared utilising classified LiDAR point cloud data (25 pts / m²), which was better aligned for comparison with the 2016 canopy map to identify tree loss over time. Tree loss predictions were ground-truthed using a visual comparison of aerial imagery for several test areas throughout the city (45 image tiles of 57.6 m² each), with the tree loss quantified by canopy area and volume for each property within the study area.  **Results / Conclusion:**  At the date of writing, the deep learning model has produced an accurate canopy map for 2016 (mean IoU >90%; overall accuracy >97%). Preliminary comparisons with the LiDAR based canopy map for 2020 have produced promising results for property scale identification of tree loss (mean IoU >78%, overall accuracy >98), with further refinements currently being explored. This research provides a geospatial method for evaluating fine-scale city-wide tree dynamics in urban areas using a variety of remote sensing data. This creates the opportunity for detailed evaluation of the drivers of urban tree loss on private properties to enable better management of existing urban forests. |