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Automated mapping of urban trees with LiDAR

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Urban trees within our cities and towns form the green infrastructure on which urban residents depend. As our population continues to grow, smart and data-driven decisions regarding urban forest planning and management are crucial. Urban tree mapping and surveys have been traditionally conducted manually, which is expensive and tedious. Moreover, these surveys are often limited in public space (e.g., street trees and parks), missing large portions of urban trees on private properties (e.g., backyard trees). The purpose of this research is to develop an automated approach that utilizes geospatial data and algorithms to identify and map urban trees, and subsequently measure the benefits they provide. To do this, publicly available 3DEP LiDAR data from USGS were used to map urban trees in the City of West Lafayette, Indiana. Building upon a tree canopy height model that was computed through observations between first and last LiDAR returns, a raster layer of tree and ground points was generated and normalized. Then, the normalized raster layer was segmented to identify individual trees by applying a means-shift clustering algorithm. Finally, key biometrics such as tree height and crown area were calculated. Ecological benefits of individual trees can then be estimated based on existing biometric equations. The proposed work has the potential for automated accurate mapping and measurement of urban trees to enhance their management allowing greater ecosystem services.

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