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Forest biodiversity mapping using airborne LiDAR and hyperspectral data

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Monitoring forest biodiversity is essential to the conservation and management of forest resource. A new method called "Spectranomics" that map forest species richness based on leaf biochemical and spectroscopic traits using imaging spectroscopy has been developed. In this study, we use this method combined with the airborne imaging spectroscopy (PHI-3 with 1 m spatial resolution) data to detect the relationship among the spectral, biochemical and taxonomic diversity of tree species based on 20 dominant canopy species collected in the Longmenhe Forest Nature Reserve of China. Seven optimal biochemical components (chlorophyll, carotenoid, water, specific leaf area, nitrogen, cellulose and lignin) were selected ($R2>0.58$, $P<0.01$) to indicate the forest biodiversity, and the max species number detected by the 7 biochemical combination was 14. Then, 7 vegetation indices were derived to represent the corresponding biochemical components, and scaled from the canopy to leaf scale by divided leaf area index. In addition, we used the morphological crown control method based on watershed algorithm to isolate individual tree crown by LiDAR (>4 points/m2). Finally, a self-adaptive Fuzzy C-Means (FCM) clustering algorithm was applied to determine the optimal clustering numbers (i.e. species richness) and Shannon-Wiener for each 30x30 m window based on the isolated individual tree height and 7 biochemical indices. According to total 22 sample plots, the mapping results show that the predicted species richness is close to the field measurements ($R2=0.6482$, $P<0.01$) and the predicted Shannon–Wiener index provides higher estimated accuracy ($R2=0.8252$, $P<0.01$) than the species richness.

Biography

Yuan Zeng is an Associate Professor in RADI. She completed her PhD in 2008 from Wageningen University in the Netherlands. Her research interests include hyperspectral remote sensing, forest canopy variable retrieval and modeling, remote sensing applications in forests and ecology. She has published more than 50 papers in journals. Currently, her on-going projects are related to the forest above ground biomass mapping and plant biodiversity estimation using LiDAR and hyperspectral data.

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