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Unmanned?erial?ehicles (UAV)-based canopy height modeling under leaf-on and leaf-off conditions for determining tree height and crown diameter (case study: Hyrcanian mixed?forest)

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关键词	canopy height model ; digital elevation model ; forest inventory ; unmanned aerial vehicles (UAVs) ; tree crown architecture ;
摘要	Tree height and crown diameter are two common individual tree attributes that can be estimated from unmanned aerial vehicle (UAV) images thanks to photogrammetry and structure from motion. This research investigates the potential of low-cost UAV aerial images to estimate tree height and crown diameter. Two successful flights were carried out in two different seasons corresponding to leaf-off and leaf-on conditions to generate a digital terrain model and a digital surface model, which were further employed in calculation of a canopy height model (CHM). The CHM was used to estimate tree height using low pass and local maximum filters, and crown diameter was estimated based on an inverse watershed segmentation algorithm. UAV-based tree height and crown diameter estimates were validated against field measurements and resulted in 3.22 m (10.1%) and 0.81 m (7.02%) root mean square errors, respectively. The results showed high agreement between our estimates and field measurements, with an R-2 of 0.808 for tree height and an R-2 of 0.923 for crown diameter. Generally, the accuracy of the results was considered acceptable and confirmed the usefulness of this approach for estimating tree heights and crown diameter.
服务人员	付贺龙
服务院士	唐守正
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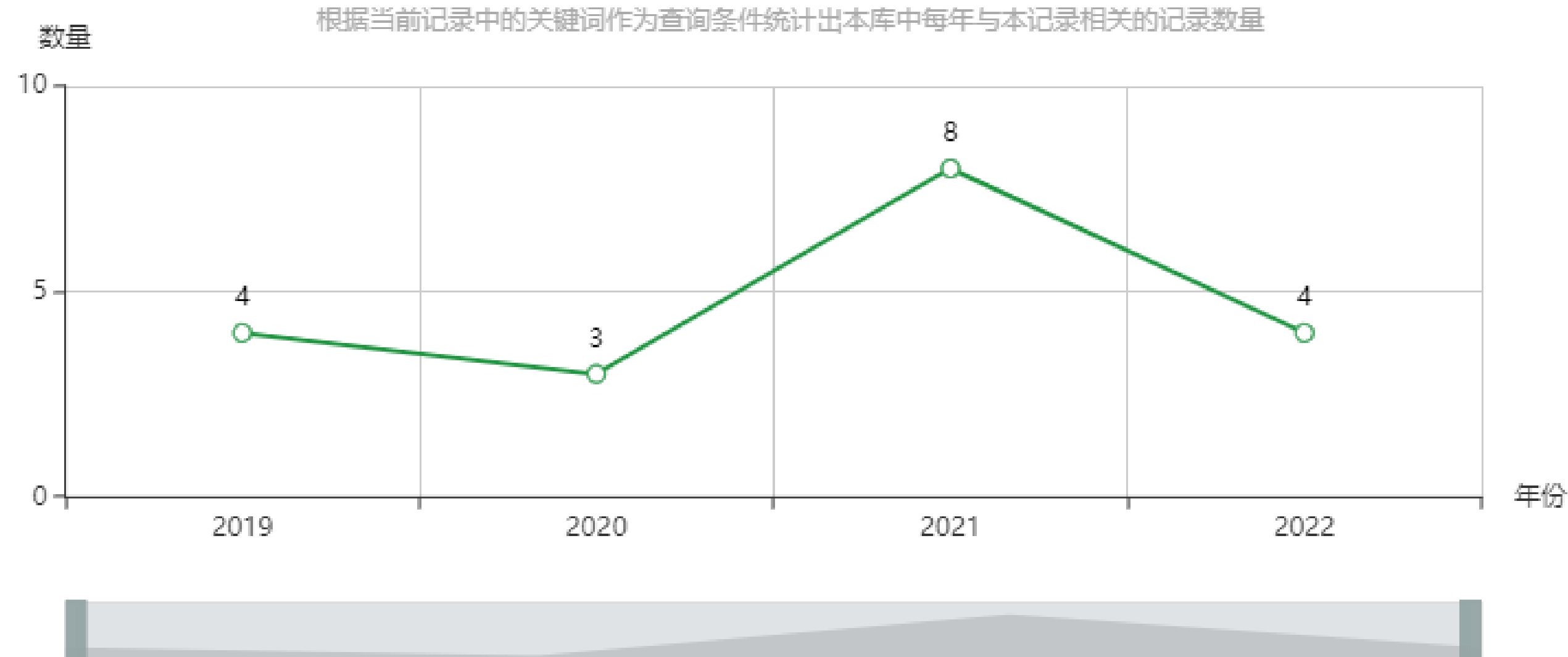
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