

KEANEKARAGAMAN FUNGSIONAL POHON DI HUTAN KOTA JOYOBOYO: IMPLIKASINYA TERHADAP SEKUESTRASI KARBON

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INTISARI

Ruang Terbuka Hijau (RTH), termasuk hutan kota, merupakan komponen penting kawasan perkotaan yang menyediakan berbagai jasa ekosistem, salah satunya sekuestrasi karbon, yaitu proses penyerapan dan penyimpanan karbon oleh vegetasi dalam biomassa. Pada kawasan perkotaan, komposisi jenis pohon dapat membentuk karakter fungsional komunitas yang berbeda dan berimplikasi pada kemampuan sekuestrasi karbon. Penelitian ini bertujuan menganalisis hubungan antara karakter fungsional komunitas pohon dan kapasitas sekuestrasi karbon di Hutan Kota Joyoboyo.

Penelitian dilakukan dengan *systematic sampling* pada 15 plot berukuran 20 × 20 m. Data struktur komunitas pohon yang dikumpulkan meliputi jenis, diameter setinggi dada, dan tinggi total pohon. Biomassa di atas permukaan tanah (*above-ground biomass* / AGB) diestimasi menggunakan persamaan alometrik Chave *et al.* (2014), kemudian dikonversi menjadi simpanan karbon dan ekuivalen karbon dioksida. Data karakter fungsional antarspesies berupa *specific leaf area* (SLA), kandungan nitrogen daun (*leaf nitrogen content* / LNC), kerapatan kayu (*wood density* / WD), dan tinggi maksimum (Hmax) diperoleh dari TRY Plant Trait Database. Nilai *community weighted mean* (CWM) untuk setiap plot disusun berdasarkan data karakter fungsional tersebut, lalu dianalisis hubungannya dengan sekuestrasi karbon menggunakan regresi linier sederhana secara terpisah untuk masing-masing karakter fungsional. Selanjutnya, dilakukan pemilihan model menggunakan *Akaike Information Criterion* (AIC) untuk membandingkan keempat model dengan prediktor CWM terhadap model nol (*null model*).

Hasil penelitian menunjukkan bahwa rata-rata biomassa di atas permukaan tanah di Hutan Kota Joyoboyo sebesar 330,82 ± 191,42 ton/ha, simpanan karbon 155,48 ± 89,97 ton C/ha, dan sekuestrasi karbon 570,63 ± 330,18 ton CO₂/ha. Pada luas 2,6 ha, total simpanan karbon diestimasi 404,26 ton C atau setara 1.483,63 ton CO₂. Hasil regresi linier sederhana menunjukkan bahwa nilai karakter leaf nitrogen content komunitas pohon merupakan satu-satunya karakter fungsional yang signifikan terhadap sekuestrasi karbon pada taraf 10%, dengan R² = 0,2147 dan p = 0,082. Pemilihan model menggunakan AIC juga menunjukkan bahwa model dengan prediktor leaf nitrogen content memiliki nilai AIC terendah, sehingga menjadi model terbaik. Temuan ini menunjukkan bahwa 21,47% variasi sekuestrasi karbon dapat dijelaskan oleh kandungan nitrogen daun komunitas pohon, sehingga komunitas dengan rerata kandungan nitrogen daun lebih tinggi cenderung memiliki sekuestrasi karbon lebih besar.

Kata Kunci: Hutan Kota, Sekuestrasi Karbon, Karakter Fungsional, Nitrogen Daun

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FUNCTIONAL DIVERSITY OF TREES IN JOYOBOYO URBAN FOREST: IMPLICATIONS FOR CARBON SEQUESTRATION

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ABSTRACT

Green Open Space (*Ruang Terbuka Hijau* / RTH), including urban forests, is an important component of urban areas that provides various ecosystem services, one of which is carbon sequestration, namely the process of carbon absorption and storage by vegetation in biomass. In urban environments, tree species composition may shape different community functional traits and thereby influence carbon sequestration capacity. This study aimed to analyse the relationship between tree community functional traits and carbon sequestration capacity in Joyoboyo Urban Forest.

The study was conducted using systematic sampling in 15 plots measuring 20 × 20 m. The collected tree community structure data included species, diameter at breast height, and total tree height. Above-ground biomass (AGB) was estimated using the allometric equation of Chave et al. (2014) and then converted to carbon stock and carbon dioxide equivalent. Interspecific functional trait data, including specific leaf area (SLA), leaf nitrogen content (LNC), wood density (WD), and maximum height (Hmax), were obtained from the TRY Plant Trait Database. The community weighted mean (CWM) for each plot was calculated based on these functional trait data and then analysed for its relationship with carbon sequestration using separate simple linear regression models for each functional trait. Model selection was subsequently conducted using the Akaike Information Criterion (AIC) to compare the four CWM-based models with the null model.

The results showed that the average aboveground biomass in Joyoboyo Urban Forest was 330.82 ± 191.42 ton/ha, with a carbon stock of 155.48 ± 89.97 ton C/ha and carbon sequestration of 570.63 ± 330.18 ton CO₂/ha. Across the 2.6 ha area, total carbon stock was estimated at 404.26 ton C, equivalent to 1,483.63 ton CO₂. Simple linear regression analysis showed that community-level leaf nitrogen content was the only functional trait significantly related to carbon sequestration at the 10% significance level, with R² = 0.2147 and p = 0.082. Model selection using AIC also indicated that the model with leaf nitrogen content as a predictor had the lowest AIC, making it the best-supported among the candidate models. These results indicate that about 21.47% of the variation in carbon sequestration could be explained by differences in community leaf nitrogen content, meaning that tree communities with higher mean leaf nitrogen content tended to have greater carbon sequestration capacity.

Keywords: Urban Forest, Carbon Sequestration, Functional Diversity, Leaf Nitrogen

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