

Trees outside forests and their carbon dynamics over Maryland, U.S.A

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Key Research Result

- Trees outside forests (TOF) account for ~23% of statewide tree cover, ~15% of aboveground tree carbon stocks, and ~23% of carbon fluxes
- TOF carbon stocks increased by ~5.15 Tg C (2011–2023), contributing ~24% of the state’s total tree carbon gain
- TOF are shorter, more fragmented, and spatially dispersed than forest trees.

Significance

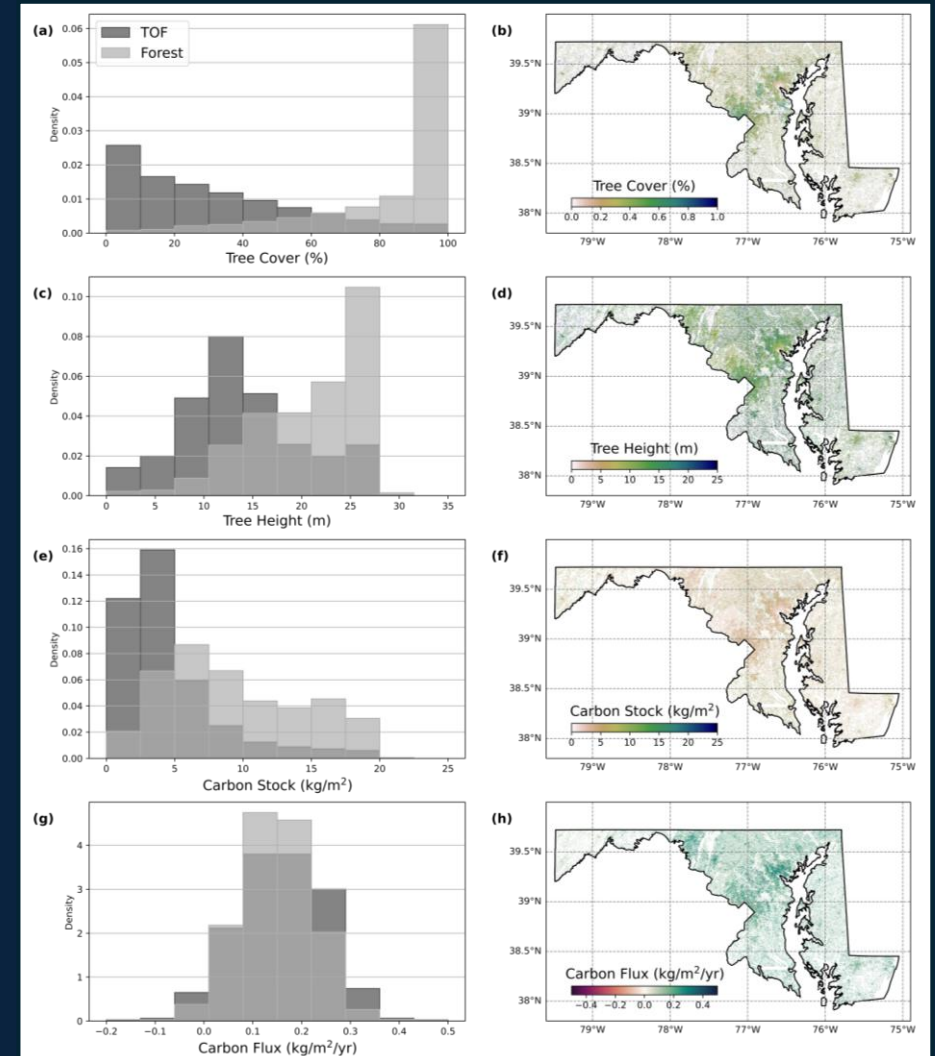
- Highlights a previously underrepresented carbon pool in non-forest landscapes
- Provides a scientific basis for integrating non-forest trees into carbon accounting, climate policy, and tree-planting strategies

NASA assets and data

Maryland Forest Carbon Monitoring System

- Ecosystem Demography model version 3 (EDv3)
- Very-high-resolution airborne LiDAR + optical imagery (≤ 1 m)

Reference publication: Shen, Quan, et al. “Trees Outside Forests and Their Carbon Dynamics over Maryland, U.S.A.” *Environmental Research Letters*, vol. 21, no. 2, Jan. 2026, p. 024010. DOI.org (Crossref), <https://doi.org/10.1088/1748-9326/ae301d>.



Data distribution of (a) tree cover, (c) tree height, (e) carbon stocks, and (g) carbon fluxes for forest and TOF over forest and non-forest land cover classes; spatial distribution of TOF (b) tree cover, (d) tree height, (f) carbon stocks, and (h) carbon fluxes in Maryland, 2011.