

## **ABSTRACT**

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### **Ecosystem service supply of urban green space: effects of land cover, land-use history, within-land-cover variability on soil-based services**

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Urban landscapes are increasingly recognized as providing important ecosystem services (ES) to their occupants. However, most urban ES studies measure only a single service, and often ignore the complex spatial heterogeneity and land-use history of cities. Soil-based services may be particularly susceptible to legacy effects and time lags in service provision; whereby past land use alters present-day service provision, perhaps superseding current land-cover patterns and management practices. We measured soil properties and nutrient pools (soil organic carbon (SOC), available phosphorus (P), saturated hydraulic conductivity (Ksat)) indicative of multiple ES in 100 sites across the city of Madison, WI. Sites encompassed 5 land-cover classes (forest, grassland, open space, low- and medium-density residential) and spanned a historical development gradient of ~125 years, representing transition from agricultural to urban land. Sites included private and public greenspaces, including both semi-natural and developed land. We asked: how do current land cover, land-use history, and within-land-cover variability affect ES provision? Service provision differed significantly with land cover for all three ES, but was highly variable both among and within sites. Less-developed sites with semi-natural land cover supported higher water quality and runoff regulation services (lower P, higher Ksat), while developed sites had the highest carbon storage. Results also indicate significant land cover-time interactions, which are particularly pronounced in more developed sites. In residential sites, both SOC and P increased significantly with time since development. Soil-based urban ES depend on both past and current land use, with implications for urban landscape management and green infrastructure.