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| **Assessing urban green spaces connectivity using Copernicus data** |
| **Introduction:** With the world’s population expected to reach about 10 billion in 2050, the growing trend of unregulated urbanization poses a significant threat to ecosystems and biodiversity, especially within cities. Hence, urban vegetation plays a pivotal role in maintaining not only human well-being but also ecosystem functionality against climate change and habitat degradation effects. Remote sensing is crucial for monitoring urban green spaces (UGS), with high-resolution urban vegetation cover maps supporting effective vegetation management in densely populated landscapes, where fragmentation represents a severe threat to biodiversity. Here, the spatial information provided by the European Earth Observation Programme - Copernicus - for the year 2018 was used to provide a standardized and comparable assessment of UGS and landscape connectivity at the European capital level.  **Methods:** First, the European Urban Vegetation Map (EUVM) was developed by implementing five Copernicus datasets (Urban Atlas, Street Tree Layer, Tree Cover Density, Grassland, Small Woody Features) in Google Earth Engine, and categorizing urban vegetation into trees, shrubs, and herbaceous types at a 10m spatial resolution for the year 2018. Utilizing EUVM data, validated against field surveys from the Land Use and Coverage Area Frame Survey (LUCAS), an ecological network model was implemented using a graph theory-based approach. Then, three global landscape connectivity metrics - Probability of Connectivity (PC), Equivalent Connected Area (ECA), and Integral Index of Connectivity (IIC) - were computed for each city. Finally, European capital cities were ranked based on relative vegetation percentage and overall landscape connectivity metrics.  **Results:** Validation against LUCAS showed an average overall accuracy of 83.57%. Among the cities considered, Ljubljana and Stockholm exhibited the highest proportion of vegetation within their urban cores (over 75%, primarily consisting of trees) and reported the highest overall landscape connectivity. Notably, Ljubljana recorded the highest PC (0.131) and IIC (0.098). On the other hand, Stockholm had the lowest mean distance between patches (55.12m), highest mean patch capacity (10.55 ha), and largest ECA (61269.18 ha), with a scattered patch capacity distribution (0.11 patches/ha) and a large Gini coefficient (0.96). In contrast, Valletta and Nicosia displayed the overall lowest UGS coverage and global landscape connectivity metrics.  **Conclusion**: The study highlights the role of Copernicus data for assessing UGS in European cities, especially due to regular updates that can be implemented for trend analysis. Also, network connectivity analysis offers relevant insights into UGS distribution, which can guide urban planning strategies to maximize ecological connectivity and halt biodiversity loss in highly anthropic landscapes such as cities. The proposed methodology supports standardized assessment at the European level, which is crucial for ensuring comparability and addressing urban sustainability and biodiversity challenges efficiently. This methodology can be also applied in different contexts and scenarios for a broader range of datasets. While this study represents an initial effort to align the understanding of UGS and their connectivity at the European level, forthcoming research should focus on investigating species-specific habitat connectivity in urban centers and standardizing additional aspects of urban landscape connectivity, such as UGS accessibility. |