

## EcoTeka, an Open-Source Software for Urban Ecosystem Restoration through Technology

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**Abstract :** Ecosystems must be resilient to ensure cleaner air, better water and soil quality, and thus healthier citizens. Technology can be an excellent tool to support urban ecosystem restoration projects, especially when based on Open Source and promoting Open Data. This is the goal of the ecoTeka application: one single digital tool for tree management which allows decision-makers to improve their urban forestry practices, enabling more responsible urban planning and climate change adaptation. EcoTeka provides city councils with three main functionalities tackling three of their challenges: easier biodiversity inventories, better green space management, and more efficient planning. To answer the cities' need for reliable tree inventories, the application has been first built with open data coming from the websites OpenStreetMap and OpenTrees, but it will also include very soon the possibility of creating new data. To achieve this, a multi-source algorithm will be elaborated, based on existing artificial intelligence Deep Forest, integrating open-source satellite images, 3D representations from LiDAR, and street views from Mapillary. This data processing will permit identifying individual trees' position, height, crown diameter, and taxonomic genus. To support urban forestry management, ecoTeka offers a dashboard for monitoring the city's tree inventory and trigger alerts to inform about upcoming due interventions. This tool was co-constructed with the green space departments of the French cities of Alès, Marseille, and Rouen. The third functionality of the application is a decision-making tool for urban planning, promoting biodiversity and landscape connectivity metrics to drive ecosystem restoration roadmap. Based on landscape graph theory, we are currently experimenting with new methodological approaches to scale down regional ecological connectivity principles to local biodiversity conservation and urban planning policies. This methodological framework will couple graph theoretic approach and biological data, mainly biodiversity occurrences (presence/absence) data available on both international (e.g., GBIF), national (e.g., Système d'Information Nature et Paysage) and local (e.g., Atlas de la Biodiversité Communale) biodiversity data sharing platforms in order to help reasoning new decisions for ecological networks conservation and restoration in urban areas. An experiment on this subject is currently ongoing with Montpellier Méditerranée Métropole. These projects and studies have shown that only 26% of tree inventory data is currently geo-localized in France - the rest is still being done on paper or Excel sheets. It seems that technology is not yet used enough to enrich the knowledge city councils have about biodiversity in their city and that existing biodiversity open data (e.g., occurrences, telemetry, or genetic data), species distribution models, landscape graph connectivity metrics are still underexploited to make rational decisions for landscape and urban planning projects. This is the goal of ecoTeka: to support easier inventories of urban biodiversity and better management of urban spaces through rational planning and decisions relying on open databases. Future studies and projects will focus on the development of tools for reducing the artificialization of soils, selecting plant species adapted to climate change, and highlighting the need for ecosystem and biodiversity services in cities.

**Keywords :** digital software, ecological design of urban landscapes, sustainable urban development, urban ecological corridor, urban forestry, urban planning

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