NATURAL ENVIRONMENT AND INNOVATIVE ENVIRONMENTAL ACTIONS 2020 - PRIORITY AXIS 2: INNOVATIVE ACTIONS - SMART CITIES

Smart Tool

1st Newsletter of the project

CONTENT

The challenge of urban biodiversity conservation in modern era

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Urban and suburban areas are important for the implementation of international and national initiatives and agreements, that have a direct and tangible impact on environmental quality.

According to the United Nations (UN), it is predicted that almost 70% of the world's population will be concentrated in cities by 2050 (*World Urbanization Prospects, 2019*). This situation places urban areas at the forefront of sustainable and rational management to provide ecosystem services and address the negative effects of climate change through appropriate mitigation and adaptation measures.

They are places where nature- based solutions and ecological or sustainable thinking can be implemented through appropriate urban planning. At the same time, intense urbanization is one of the biggest threats to global, regional and local biodiversity (*Seto et al., 2012*).

In addition, cities can be critical for the conservation of sites with high natural biodiversity (*Ives et al., 2016*), mainly through the design, conservation and management of urban and suburban green spaces.

These sites include all natural, semi-natural and artificial ecosystems within or city vicinity (*Cilliers et al., 2013*).

Therefore, urban green areas can be defined as the total area of outdoor space which is covered by parks, and tree corridors on roadsides, squares, and courtyards of public or private spaces (*Aravadinos 1999*).

In the era of ever-increasing urbanization, the value of urban biodiversity preservation remains under question due to the cost of conservation when compared with natural biodiversity, heavily depending to the goals and incentives to protect it (*Dearborn and Kark, 2010*).

It is difficult to identify and assign a specific value, but the conservation of diverse and sustainable urban ecosystems can bring multiple benefits to residents and be an integral part of urban green infrastructure (*Jerome et al., 2019).*

Environmental conditions and increasing pressures *(Pham et al., 2020)* resulting from urbanization are usually more pronounced in large cities *(Norton et al., 2016).*

The rapid increase in human population leading to the development of linear infrastructure worldwide *(Valerio et al. 2021)*, conflicting land uses and finally the high value of land (*Haaland and van den Bosch, 2015)* lead to the conclusion that effective planning is required for conservation of urban biodiversity and habitats in urban areas (*Dearborn and Kark, 2010*).

Urban green areas

The existence of green areas in the urban fabric serves not only aesthetic role but mainly functional ones.

Urban green areas play an important role in shaping the microclimatic conditions that prevail within the urban fabric in many ways. Urban green areas contribute to the conservation of biodiversity in the urban environment *(Tjallingii, 2000)* not only because of the existence of different plant species, but also because it provides shelters for a variety of species of fauna and insects.

In summary, the benefits arising from urban green areas fall into the following broad categories:

- ***Microclimate improvement***
- ***Urban planning and architectural use***
- ***Aesthetic use***
- ***Biodiversity Increase***

However, in order for urban green areas to best serve the above functions, the species used in urban green area should be selected according to scientific criteria and also managed according to the recommendations of the appropriate scientists.

Choosing the right species is one of the most serious problems in urban green areas management.

These species should be adapted to the general climatic environment, respond to the special conditions of the city (pollution, soil, water, growth space, human interventions) and cover the predetermined purpose of use.

Meeting these criteria can bring maximum benefits and improve and regulative role within the city or otherwise create multiple problems and challenges.

City Biodiversity Index (or Singapore Index)

The Singapore Index can serve as a benchmark for monitoring the progress of biodiversity conservation efforts and consists of two parts (link):

A. The outline of the city ("Profile of the City"), which provides information regarding the background of the city (geographical location, size, population, etc.).

B. Twenty-three (23) indicators that measure **local biodiversity**, ecosystem services supported from biodiversity and biodiversity governance and management.

Core Components	Indicators
Native Biodiversity in the City	1_ Proportion of Natural Areas in the City *(4 points)* 2_ Connectivity Measures *(4 points)* 3_ Native Biodiversity in Built Up Areas (Bird Species) *(4 points)* 4_ Change in Number of Vascular Plant Species *(4 points)* 5_ Change in Number of Bird Species *(4 points)* 6_ Change in Number of Butterfly Species *(4 points)* 7_ Change in Number of Species (any other taxonomic group selected by the city)*(4 points)* 8_ Change in Number of Species (any other taxonomic group selected by the city) *(4 points)* 9_ Proportion of Protected Natural Areas *(4 points)* 10_ Proportion of Invasive Alien Species *(4 points)*
Ecosystem Services provided by Biodiversity	11_ Regulation of Quantity of Water *(4 points)* 12_ Climate Regulation: Carbon Storage and Cooling Effect of Vegetation *(4 points)* 13_ Recreation and Education: Area of Parks with Natural Areas *(4 points)* 14_ Recreation and Education: Number of Formal Education Visits per Child Below 16 Years to Parks with Natural Areas per Year *(4 points)*
Governance and Management of Biodiversity	15_ Budget Allocated to Biodiversity *(4 points)* 16_ Number of Biodiversity Projects Implemented by the City Annually *(4 points)* 17_ Existence of Local Biodiversity Strategy and Action Plan *(4 points)* 18_ Institutional Capacity: Number of Biodiversity Related Functions *(4 points)* 19_ Institutional Capacity: Number of City or Local Government Agencies Involved in Inter-agency Cooperation Pertaining to Biodiversity Matters *(4 points)* 20_ Participation and Partnership: Existence of Formal or Informal Public Consultation Process *(4 points)* 21_ Participation and Partnership: Number of Agencies/Private Companies/NGOs/Academic Institutions/International Organizations with which the City is Partnering in Biodiversity Activities, Projects and Programs *(4 points)* 22_ Education and Awareness: Is Biodiversity or Nature Awareness Included in the School Curriculum *(4 points)* 23_ Education and Awareness: Number of Outreach or Public Awareness Events Held in the City per Year *(4 points)*

European indicators for urban biodiversity

European indicators for urban biodiversity are structured in **two** components:

A. The key indicators (**Core Indices**) that can be based on the **Copernicus** system:

- **Proportion of permeable urban area (C01)**
- **Proportion of protected area (C02)**
- **Proportion of green areas (C03)**
- **Proportion of blue areas (C04)**
- **Length of ecotones (C05)**
- **Art. 12 Species richness (C06)**
- **Art. 17 Species richness (C07)**
- **Art. 17 Habitat richness (C08)**

B. Local Indices that are ancillary and dependent on availability in **each city:**

- **Number of native species (L01)**
- **Proportion of invasive alien species (L02)**
- **Proportion of Natural Areas in the City(L03)**
- **Access to urban green areas (L04)**

The context of the Smart-Tool project

Earth Observation data can play an important role in the recording and monitoring of individual of urban biodiversity indicators, and in particular those related to the state of urban green areas, biodiversity supported and the threats that may face due to various factors.

Earth Observation data (satellite, aerial and in situ sensors data) can provide accurate and reliable information on the state of ecosystems, as well as contribute to the monitoring of the changes over time.

Considering the above merits, Earth Observation offer unprecedented opportunities for the improvement of national statistical systems and the improvement of countries' capacity to effectively monitor sustainable development in all sectors and therefore in the urban environment.

In particular during the last couple of years, the launch of the European Copernicus Earth Observation Program has enabled the use of satellite Earth Observation data, with global coverage, continuous updating and free of cost.

Proper processing and utilization of this data can enable the installation of a system for monitoring the urban biodiversity of green areas and its potential threats, which will be based on the observation data of the Copernicus program, in combination with ground data from automated sensors and voluntary public participation for the collection of scientific information (citizen science).

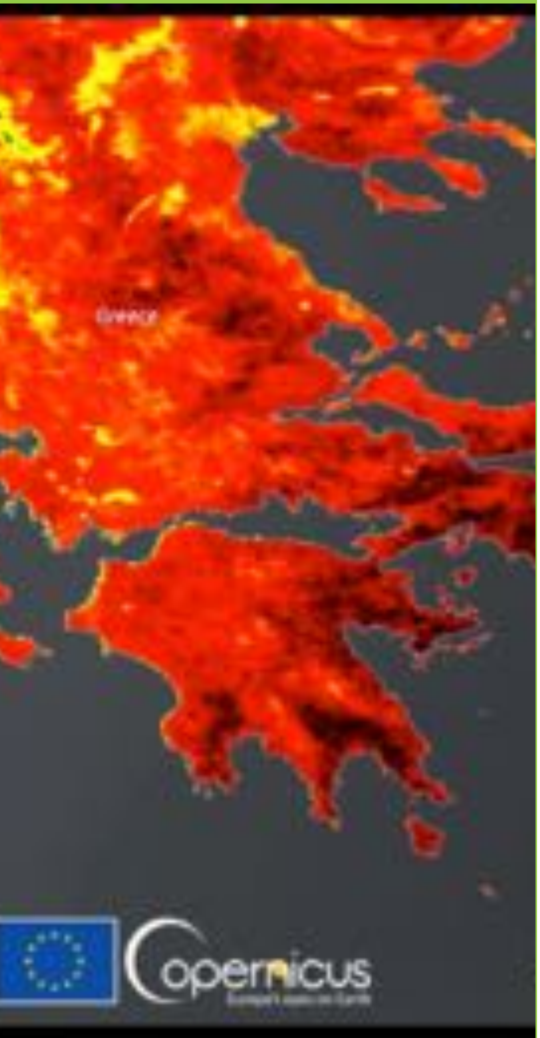
It is important to combine all this Earth Observation data with geospatial data from other sources (statistics, demographics, cartography) to develop smart tools that through innovative ways of disposing and visualizing information and data (visualizations, dashboards, infographics, and graphic design approaches), providing valid and timely information on the status and trends of biodiversity indicators.

The main aim of the project

The main aim of the project "***Development of a smart tool for monitoring threats to the biodiversity of urban and suburban green areas using Earth Observation data, in-situ sensors and citizen science in the Municipality of Thessaloniki",*** relates to the development of a methodology for extracting information and monitoring of urban and suburban green areas and the threats and pressures faced by the biodiversity of these areas from man-made and natural threats.

The methodology will lead to the development of an intelligent digital platform that will integrate data and information from satellite sensors, emphasizing the use of Copernicus satellite imagery, ground-based sensors for collection of relevant scientific data from mobile users through "smart" devices.

This information through the digital platform can be used for the rational, sustainable management and protection of the biodiversity of urban and suburban green.



(Credit: European Union, Copernicus Sentinel-3 imagery)

Specific objectives of the project

- The recording of potential threats to the biodiversity of urban green areas following a review of the international literature and the evaluation of existing indicators for monitoring potential threats to the biodiversity of urban / suburban green areas using Earth Observation data.
- The use of appropriate algorithms for processing freely available satellite data, as well as aerial Earth Observation data, to monitor potential threats to the biodiversity of urban and suburban green areas.
- The development and evaluation of in-situ sensors to monitor potential threats to the biodiversity of urban and suburban green areas and the collection of data through citizen science.
- The integration of individual information in an online smart tool, which will be able to make the information available to public services and citizens.

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