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COPERNICUS4REGIONS 2025

ENHANCING URBAN SUSTAINABILITY WITH COPERNICUS DATA: MONITORING URBAN GREEN SPACES

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> Over the last two years, our Copernicus-based tool operated delivering up-to-date information on Palermo's green areas supporting timely decision-making
>
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Villa Giulia garden in Palermo - The photo captures a striking avenue of tall palm trees set against a clear blue sky. Taken in the historic Villa Giulia garden in Palermo, the image highlights the vertical grandeur of the trees and the elegance of one of the city's most iconic green spaces. Photo: Dedda71, CC BY 3.0, via Wikimedia Commons

This study showcases how Palermo utilizes Earth observation data from Copernicus Sentinel satellites to improve the sustainability of urban green spaces. By monitoring vegetation health and optimizing irrigation, the city enhances environmental resilience and ensures better stewardship of its green areas.

THE CHALLENGE

Palermo, with over 1.2 million inhabitants, faces growing challenges in safeguarding its urban green spaces, essential for the well-being of its citizens and the city's sustainability. These spaces mitigate urban heat islands, improve air quality, and enhance public health. The lack of timely and precise data on vegetation health has historically led to delayed maintenance, inefficient irrigation practices, and the gradual degradation of these vital areas. Sistema Palermo Innovazione (SISPI), founded in 1988 by the Municipality of Palermo to design, create, and manage the Municipal Information and Telematic System (SITEC), supports the city's strategic vision of leveraging technology to improve infrastructure and services. SISPI sought an innovative solution to provide actionable insights for better decision-making regarding public green areas, in alignment with European policies such as REACT-EU, SISPI with Planetek Italia to implement the Urban Green Spaces Monitoring Tool.

THE SPACE SOLUTIONS

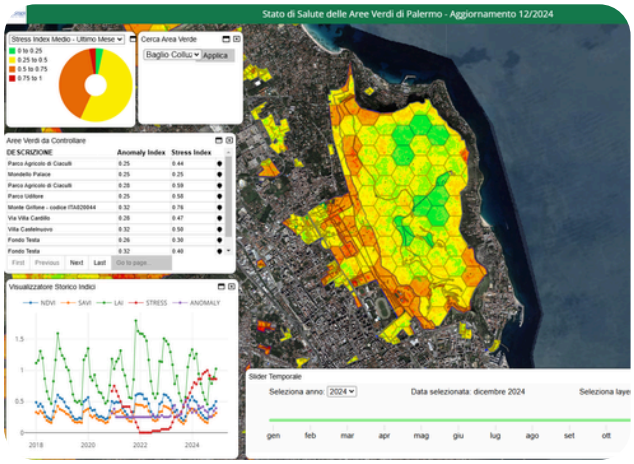
The solution to Palermo's challenge lies in the adoption of a geospatial service powered by Copernicus Sentinel-2 satellite data.

This service enables the monthly monitoring of urban green spaces, providing detailed assessments of vegetation health through indices such as NDVI (Normalized Difference Vegetation Index), SAVI (Soil Adjusted Vegetation Index), and LAI (Leaf Area Index). These indices reveal vegetation vitality, density, and stress levels.

Two key indicators, the Vegetation Stress Index and the Vegetation Anomaly Index, provide actionable insights:

- The Vegetation Stress Index, which ranges from 0 (no stress) to 1 (maximum stress), highlights areas that have consistently been under vegetative stress over the past 12 months.
- The Vegetation Anomaly Index, expressed as a percentage, identifies deviations from historical health trends, flagging zones with abnormal vegetation conditions.

The process begins with the acquisition and preprocessing of Sentinel-2 data. Monthly composites are generated, and vegetation indices are computed using advanced algorithms.



The Dashboard - This image is a screenshot of a dashboard developed for the Municipality of Palermo, designed to monitor the health of urban green areas using satellite data. The map displays vegetation stress levels, ranging from green (low stress) to red (high stress). The dashboard includes tools such as the average stress index, a historical index viewer (NDVI, SAVI, LAI, STRESS, ANOMALY), a list of green areas requiring attention, and a time slider to view monthly data.

The results are stored in a geospatial database and accessed through an intuitive web application. This platform provides interactive maps, true-color imagery for straightforward interpretation, and decision-making tools, including the ability to monitor vegetation trends and identify stress hotspots.

THEMATIC AREA

Territorial Management and Urban Planning

REGION OF APPLICATION

Palermo

SENTINEL MISSION USED

S2

COPERNICUS SERVICE USED

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THE BENEFITS AND THE BENEFICIARIES

The adoption of the Copernicus-based solution has brought significant benefits to Palermo's public administration, its citizens, and the environment. For SISPI, the solution has improved decision-making processes by providing timely and precise information about the health of urban green spaces.

Compared to traditional ground-based methods, the satellite-driven service saves time and resources by eliminating the need for frequent on-site inspections. It also ensures more efficient planning of interventions, such as targeted irrigation or vegetation restoration, based on actionable insights derived from satellite data. For the city administration, the solution aligns with European sustainability goals, such as those outlined in REACT-EU, by enabling more effective and resource-efficient management of green areas.

This translates into better resource allocation, optimized maintenance practices, and minimized risks of vegetation degradation and fire hazards.

Citizens and society benefit from the improved condition of green spaces, which contribute to better air quality, reduced urban heat islands, and enhanced overall well-being. Healthier green spaces offer recreational opportunities, improve the city's aesthetic appeal, and foster biodiversity. Ultimately, this innovative solution reinforces Palermo's role as a forward-thinking city, demonstrating how satellite data can drive smarter, more sustainable urban planning while improving the quality of life for its residents.

	TIER 1 SERVICE PROVIDER	TIER 2 PRIMARY USER	TIER 3 SECONDARY USER	TIER 4 END USER BENEFICIARIES
SERVICES AND BENEFITS	Sentinel-2	NDVI (Normalized Difference Vegetation Index), SAVI (Soil Adjusted Vegetation Index), and LAI (Leaf Area Index)	Vegetation Stress Index, Vegetation Anomaly Index	This platform provides interactive maps, true-color imagery, and tools for decision-making, such as monitoring vegetation trends and identifying stress hotspots.
BENEFICIARIES	Planetek Italia	Sistema Palermo Innovazione (SISPI)	Palermo Municipality, Italy	Local Public Administration

EU POLICY / DIRECTIVE

Other

TYPE OF SERVICE PROVIDER

Commercial Service

TYPE OF FUNDING SOURCE

Other

USAGE MATURITY LEVEL

4



A FUTURE WITH COPERNICUS

The future of Palermo's green space management relies on the continued use and advancement of Copernicus Sentinel satellite data. As Sentinel satellites continue to operate and evolve, with additional missions and improved data capabilities, the monitoring service will benefit from higher data frequency and enhanced resolution, enabling more precise and timely interventions. Sentinel satellites will remain essential for providing reliable, open-access data, ensuring the scalability and sustainability of the solution while supporting Palermo's long-term environmental and urban planning goals.



DID YOU KNOW?

Palermo's green spaces are now monitored monthly using Copernicus Sentinel-2 satellites, offering precise insights into vegetation health. This innovative approach not only optimizes resources such as water and maintenance costs but also enhances sustainability by reducing fire risks and improving biodiversity, thereby setting a model for urban green space management across Europe.

Acknowledgements

Copernicus Data

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