VASE

VASE - Vegetation and Land-Use Evapotranspiration

Programm / Ausschreibung	Weltraum, Weltraum, ASAP Ausschreibung 2022	**Status**	abgeschlossen
Projektstart	01.05.2023	**Projektende**	31.07.2024
Zeitraum	2023 - 2024	**Projektlaufzeit**	15 Monate
Keywords	Remote Sensing Urban Evapotranspiration		

Projektbeschreibung

Durch den Klimawandel kommt es in Städten vermehrt zur Bildung von Wärmeinseln und immer häufiger zu tropischen Nächten mit Nachttemperaturen von über 20° Celsius. Eine standortangepasste Vegetation kann diesen Klimawandelfolgen lokal entgegenwirken. Die Verdunstung von Wasser von Bodenoberflächen, auch Evapotranspiration genannt, kann eine wesentliche Rolle bei der Abkühlung in urbanen Gebieten spielen. Ziel des Projekts ist es frei verfügbare Copernicus Sentinel Daten und weitere Geoinformationsdaten zu nutzen, um eine Verdunstungskarte für Wien und Umgebung zu erstellen. So eine Karte kann Aufschluss über offene Grünflächen geben, welche eine besonders gute Verdunstung aufweisen. Dabei werden folgende weitere Aspekte betrachtet:

• Durch die Verschneidung mit dem Baumkataster der Stadt Wien werden Baumreihen identifiziert, die eine herausragende Verdunstungsleistung aufweisen und damit für eine klimaangepasste Bepflanzung besonders gut geeignet sind.
• Es werden auch landwirtschaftliche Flächen betrachtet werden, um mittels Sentinel- und Invekos-Daten Rückschlüsse über landwirtschaftliche Kulturen und deren Verdunstungsrate zu erhalten.
• Es sollen brach liegende Flächen mittels Orthofotos identifiziert werden, die als leerstehende und untergenutzte industrielle beziehungsweise landwirtschaftliche Standorte ein hohes Potenzial haben, mit angepasster Zwischen- oder Dauerbepflanzung eine hohe Evapotranspirationsleistung zu erbringen.
• Identifikation strategisch wichtiger Standorte - an diesen Orten sollte die Evapotranspiration gesteigert werden, da an diesen Standorten ein besonders großes Kühlpotential vorhanden ist.

Daraus entsteht ein digitales Tool mit dem Planungsempfehlungen für Bauwerks-, Dach- und Fassadenbegrünung für Städteplanung abgeleitet werden können.
Dadurch entsteht ein Digital Service Offering für Raum- und Stadtplaner in öffentlichen Einrichtungen und in Architektur und Planungsbüros mit einem Marktpotential von drei Milliarden Euro in 2050.
Das Projekt kann zusätzlich mehrere Nachhaltigkeitsziele erfüllen und berücksichtigt auch genderrelevante Themen.
Das Projekt wird von einem erfahrenen, komplementären Expertenteam aus Innovations-, Begrünungs- und Erdbeobachtungsexpert:innen umgesetzt. Endnutzer:innen sind durch mehrere Stadtplanungsbüros und Magistrate der Stadt Wien vertreten.

Abstract

Due to climate change, heat islands are increasingly forming in cities and tropical nights with night temperatures above 20° Celsius are becoming much more frequent. Site-appropriate vegetation can counteract these climate change impacts locally. Evapotranspiration plays an essential role in the cooling of urban areas. The aim of the project is to use freely available Copernicus Sentinel and other geoinformation data to create an evapotranspiration map for Vienna and the surrounding area, which provides information about open green spaces that exhibit particularly good evapotranspiration.
The following aspects are considered:
• By intersecting with the tree cadastre of the city of Vienna, rows of trees will be identified that have an outstanding evapotranspiration performance and are thus particularly suitable for climate-adapted planting.
• Agricultural areas will also be considered in order to draw conclusions about agricultural crops and their evapotranspiration rates by means of sentinel and Invekos data.
• Fallow land will be identified by using orthophotos according to the exclusion method, since they have a high potential as vacant and underused industrial or agricultural sites, respectively, to provide a high evapotranspiration performance with adapted intermediate or permanent planting.
The result is a digital tool that can be used to develop planning recommendations for building, roof and facade greening for urban planning.
This will create a digital service offering for spatial and urban planners in public institutions and in architecture and planning offices with a market potential of three billion euros in 2050.
The project can additionally meet several sustainability goals and also considers gender-relevant issues.
The project is implemented by an experienced, complementary team of innovation, greening and earth observation experts.
End-users are represented by several urban planning offices and magistrates of the City of Vienna.

Endberichtkurzfassung

Please find the short Version in german and english also attached in the documents:

VASE – Vegetation and Land-Use Evapotranspiration

The VASE project (Vegetation and Land-Use Evapotranspiration) aimed to showcase the phenomenon of urban heat islands, where urban areas experience higher temperatures than surrounding rural regions. This temperature increase is caused by the accumulation of buildings, roads, and other infrastructure that absorb and retain heat. Climate change exacerbates this problem by increasing the intensity and frequency of heatwaves. The project focused on utilizing evapotranspiration (ET) – a process where water from the soil and plants is released into the atmosphere, cooling the surrounding environment – to find solutions for urban overheating.

Project Partners:

The VASE project was made possible through collaboration with DIH Innovate, GRÜNSTATTGRAU, and SISTEMA.

Project Achievements Key accomplishments of the project include:

Algorithm Development: The VASE team developed algorithms to calculate ET data based on satellite imagery.
High-Resolution Mapping: High-resolution ET maps for Vienna were created. The original Sentinel-3 data with a 500-meter resolution was enhanced using ECOSTRESS data with a 70-meter resolution, which was later refined to 10 meters.
Data Validation: The ET data was validated with ground-based measurements, revealing a 37% deviation. Despite this, the results provided valuable insights into the cooling effect of urban vegetation.
Strategic Planning Tool: The ET maps produced are crucial for urban planners. They help identify areas with high cooling potential and assist in strategically placing trees, green roofs, and parks to maximize cooling effects.

Technical Challenges and Solutions The project faced several technical challenges. One significant hurdle was the low resolution of the original satellite data, which was overcome by integrating ECOSTRESS data and using PyDMS to enhance the resolution to 10 meters. Additionally, estimating ET is complex, as it relies on multiple parameters like temperature, radiation, and vegetation health. Combining these data points was simplified using ECOSTRESS data. Furthermore, gaps in data caused by cloud cover were manually cleaned to ensure the accuracy of the results.

Sustainability and Future Impact In the long term, the VASE project is expected to bring significant sustainability benefits. Through the strategic placement of vegetation in urban areas, the following benefits are anticipated within five years:

Reduced Energy Consumption: Cooling urban areas will lower the energy demand for air conditioning, contributing to reduced CO2 emissions and the achievement of climate goals.
Improved Public Health: Cooler urban environments will reduce heat-related health issues, particularly for vulnerable populations.
Social Equity: Green infrastructure will be targeted in underserved areas to reduce social inequalities and provide cooling benefits to residents.

Commercial Viability and Follow Up Projects

The ET maps and algorithms provide a solid foundation for future commercialization, but more work is needed to refine the business model and lower the high costs of updating the datasets. A subscription model could be a solution, but the current financial model does not yet cover the maintenance costs of the evapotranspiration maps.

Ecostress at 70m, image enhanced by DMS to 10m resolution – Augarten in Vienna (Source: SISTEMA, VASE project final report)

Complete Workflow for the Creation of Evapotranspiration Data (Source: SISTEMA, VASE Project Final Report)

Projektkoordinator

- "Digital Innovation Hub innov:ATE" - Österreichs digitaler Innovationshub für Land-, Holz-, Forst- und Energiewirtschaft

Projektpartner

- SISTEMA GmbH
- GrünStattGrau Forschungs- und Innovations-GmbH