



LIFE GrIn

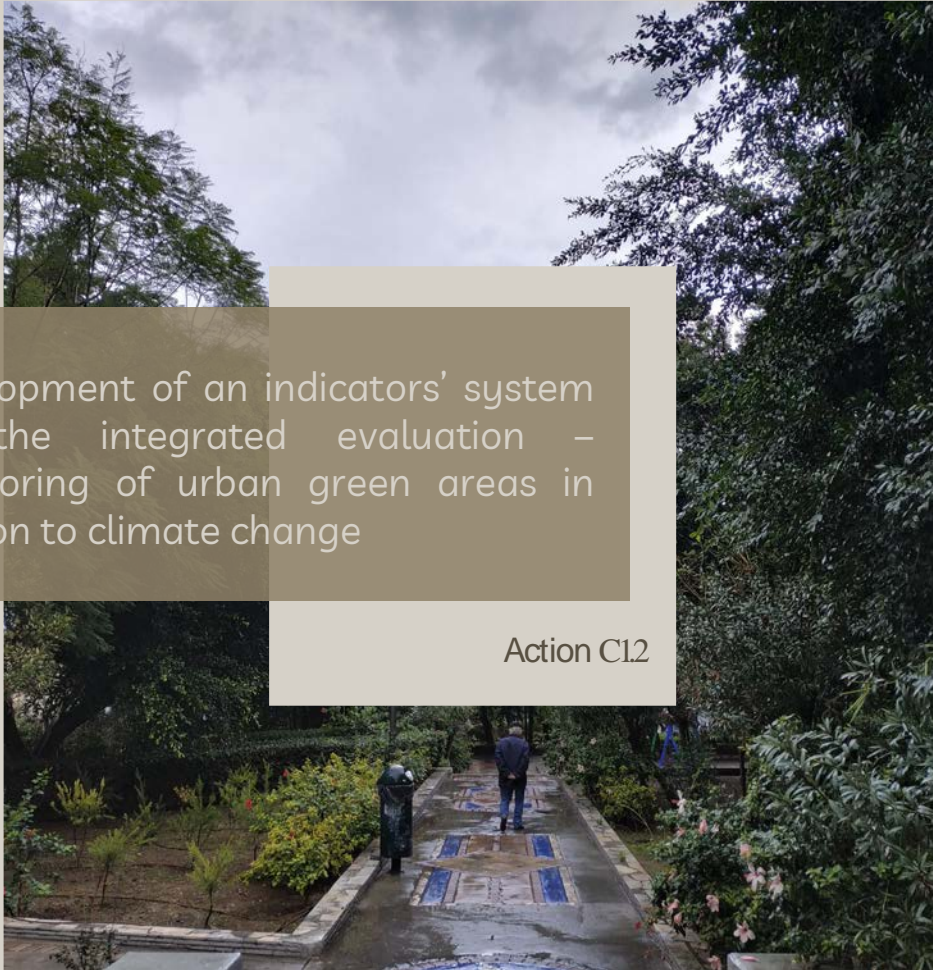


Promoting urban integration of GReen INfrastructure to improve climate governance in cities

LIFE17GIC_GR_000029

Development of an indicators' system for the integrated evaluation – monitoring of urban green areas in relation to climate change

Action C1.2



The project "Promoting urban integration of GReen Infrastructure to improve climate governance in cities" (LIFE17GIC GR000029) is co-funded by the European Union in the context of Programme LIFE, with the contribution of the Green Fund

The project **LIFE GrIn: Promoting urban integration of Green Infrastructure to improve climate governance in cities** (LIFE17GIC/GR/000029) is included in the programme LIFE, the EU's funding instrument for the environment and climate action, and specifically in the category of Environmental Governance and Information actions. This category supports projects related to awareness raising, environmental training and capacity building, compliance and institutionalization of new legislative frameworks, knowledge development and citizen participation.

The main objective of the LIFE GrIn project is **to incorporate climate governance in the management of green infrastructure** at local level through the establishment of an integrated policy framework focusing on Urban Green Areas (UGAs).

The project promotes urban integration, which is translated into thinking of urban green spaces not as isolated units, but as vital elements of the urban landscape, with their own specific set of functions and contribution to climate change mitigation and adaptation. This approach capitalizes on UGAs as valuable resources for the adaptation of cities to climate change and the mitigation of its impacts through the principles of Urban Forestry. The more general view includes the adoption of the EU policies and tools, with the aim of improving the quality and connection of green spaces, with a view to creating more resilient cities to climate change.

Goals

1. Establish an integrated policy framework for the management, monitoring and evaluation of UGAs based on cooperative planning and best practices in urban forestry
2. Integrate and promote the EU policies in relation to climate change in local governance, as well as sustainable urban planning and design
3. Quantify and multiply the impact of UGAs on climate problems in cities
4. Promote the incorporation of sustainable urban forest management for climate change in the Covenant of Mayors
5. Improve citizens' quality of life through the mitigation of the effects of climate change and the multifunctional planning of UGAs
6. Raise awareness amongst decision-makers regarding the necessity and benefits of taking action on climate change adaptation/ mitigation at municipal level
7. Raise public awareness and promote active participation of stakeholders
8. Conserve nature and biodiversity and improve habitats for species in cities

Beneficiary Partners

Coordinating beneficiary is the Institute of Mediterranean Forest Ecosystems and Forest Products Technology (IMFE), one of the oldest research institutes in Greece that falls under the Hellenic Agricultural Organization "DEMETER". Associated beneficiaries are HOMEOTECH Co. a private company that elaborates environmental studies and projects, the Ministry of Environment and Energy, the Central Union of Municipalities of Greece and the Municipalities of Amarousion and Heraklion.

Budget

Total: 1,763,885 Euro
EU Contribution: 1,015,505 Euro (= 58.34%)

EU Policies



The European Commission adopted its **new EU strategy** on adaptation to climate change on February 24, 2021. The new strategy sets out how the European Union can adapt to the unavoidable impacts of climate change and become climate resilient by 2050.

The Strategy has four principal objectives: to make adaptation **smarter, swifter and more systemic**, and to step up **international action** on adaptation to climate change. Aiming to engage and support cities and towns to commit to reaching the EU climate mitigation and adaptation



targets the European Commission set up **the Covenant of Mayors Initiative**, as one of the actions of the EU Adaptation Strategy.

The Covenant of Mayors was launched in 2008 in Europe with the ambition to gather local governments voluntarily committed to achieving and exceeding the EU climate and energy targets. In 2016, the Covenant of Mayors joined forces with the Compact of Mayors, resulting Global Covenant of Mayors for Climate and Energy, the world's largest movement for local climate and energy actions, which brings together more than 10,000 local and regional authorities in 57 countries. Signatory cities pledge action to support implementation of the EU **40% greenhouse gas-reduction target by 2030** and the adoption of a joint approach to tackling mitigation and adaptation to climate change.



To support adaptation action in European cities the European Commission launched the **Urban Adaptation Support Tool**. It provides practical guidance and knowledge to signatories as well as to any other interested stakeholders in Europe and beyond and supports urban adaptation with a quick-start step-by-step guidance through the adaptation planning and implementation cycles. It also facilitates easy access to in-depth, expert information and data by providing a comprehensive up-to-date database of literature and information sources for each step of the urban adaptation cycle.

Generally speaking, not only in Greece but also in many European countries, there is **limited information on how to integrate urban green areas into the city's potential through urban planning**, as there is a **lack of data on their quantity and quality**. Therefore, it is necessary to improve the way of collecting data about urban green characteristics and attributes, and their impact on urban ecosystem, through a methodological framework that is as comprehensive as possible.

Monitoring and evaluation criteria and indicators are a useful tool in this direction.

The aim of the current guide is to create a model system, which meets the requirements and specificities of urban ecosystems for the implementation of governance and decision-making in the exercise of urban forestry and the management of urban green spaces in a holistic and unified way.

The entire project concerns both the **depiction of the existing state** of urban green areas, in order to predict the cities' adaptation to climate change, and the **effectiveness of the management measures** that are implemented during the years.

At first, the collecting data help the decision-making centers to form a comprehensive view of the urban green areas quantity and quality, and their management. In this way, the definition of strategic objectives and their fulfillment, through the planning of the required silvicultural and management measures, is facilitated. This also a technic to calculate corresponding costs and time needed. During the exercise of the management works, the indicators are necessary to monitor the implementation of the measures, to identify and correct any mistakes, but above all to evaluate their effectiveness.

MONITORING



OBJECTIVE



PROCESS



ANALYSIS



MEASURING



EVALUATION

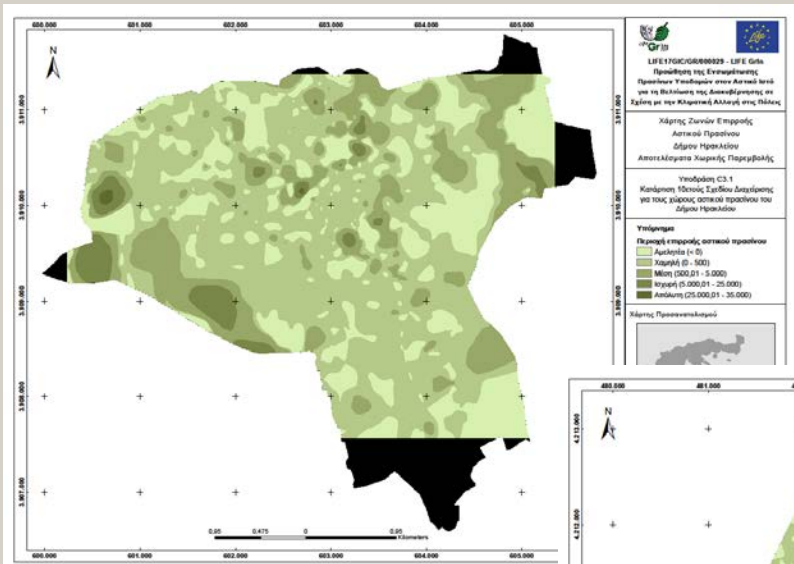


REVIEW

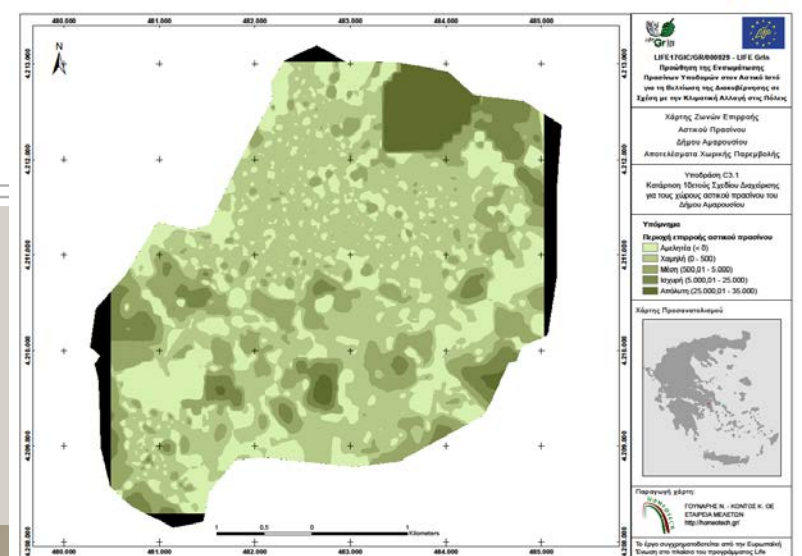
Urban Green Typology Indicators

The Urban Green Infrastructure **typology and its analysis** provide the required information to assess the level of sustainability of the city, in relation to ecological and environmental conditions. In order to investigate it, it is necessary to map the area of interest and then perform an analysis in GIS.

Share of Green Urban Areas	The proportion of the total surface of vegetated areas of any type in the total territory of the city
Distribution of Green Urban Areas	The density of urban green areas in the territory of the city
Effective Green Infrastructure	Efficiency zones around an urban green area
Peri-Urban Forest	The proportion of peri-urban forest that its functionality is connected with the relative one of city's urban green areas
Degree of soil sealing	The proportion of permeable surfaces in relation to impervious ones



Indicators of Effective Green Infrastructure in the Municipalities of Amarousion and Herklion



Urban green Composition and Structure indicators

The urban green infrastructure is a mosaic of growth areas with characteristic **composition, structure and size**. They reflect the historical changes of residential development and Urban green management policies and strategies. Yet, the benefits derived from the existence of urban green are the result of these characteristics, with many of them being directly or indirectly related to **silvicultural characteristics**.

Tree Number Indicator	Total number of the urban trees in the territory of the Municipality
Species Number Indicator	Total number of the woody species in the territory of the Municipality
Tree Canopy Cover Indicator	The proportion of the area covered by the vertical projection of urban tree canopies
Ratio of total urban green area per citizen	The proportion of the total urban green areas surface per resident
Ratio of municipal urban green area per citizen	The proportion of the total municipal urban green areas surface per resident

Urban green Phenology Indicators

Health Indicator	1: Healthy 2: Stressed 3: In decline 4: Dead
Mortality Index	The proportion of dead individuals in relation to the total number of urban trees



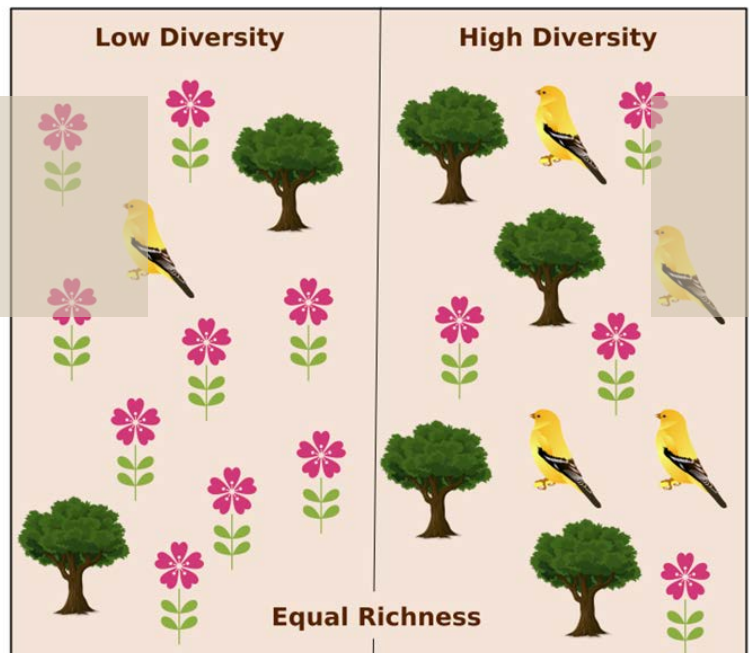
Biodiversity and Alien species occurrence Indicators

The biodiversity of species is very crucial for the **ecological balance, the stability and the functionality** of the mechanisms of an ecosystem.

Species Richness	The total number of species in a specific area (An urban green area or the entire city)
Abundance	The total number of the individuals of one species in a specific area (An urban green area or the entire city)
Relative Abundance	The proportion of individuals of a species to the total number of individuals of all species in a specific area (An urban green area or the entire city)
Evenness	The differences between the relative abundances of the species of an ecosystem
Diversity	The relationship between the species richness and their evenness
Shannon diversity index - H'	The proportion of individuals of one particular species found divided by the total number of individuals found
Alien Species Number	The total number of alien species that participate in the total population

$$H' = - \sum_{i=1}^s p_i \ln p_i$$

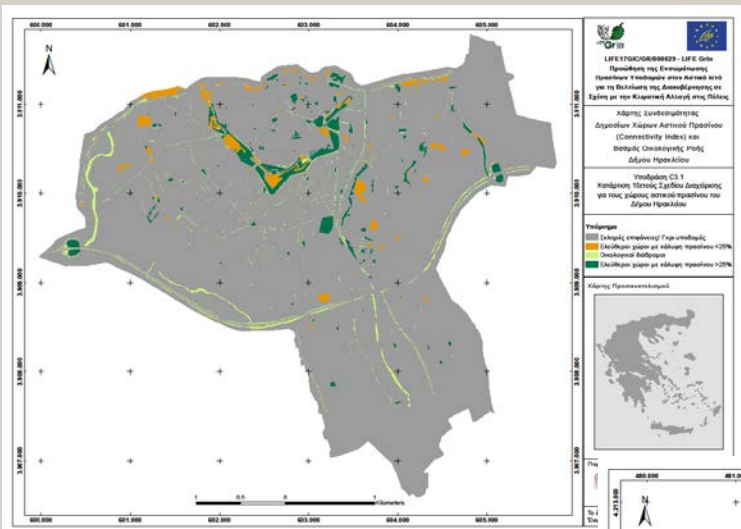
Richness vs. Diversity



Landscape Analysis Indicators

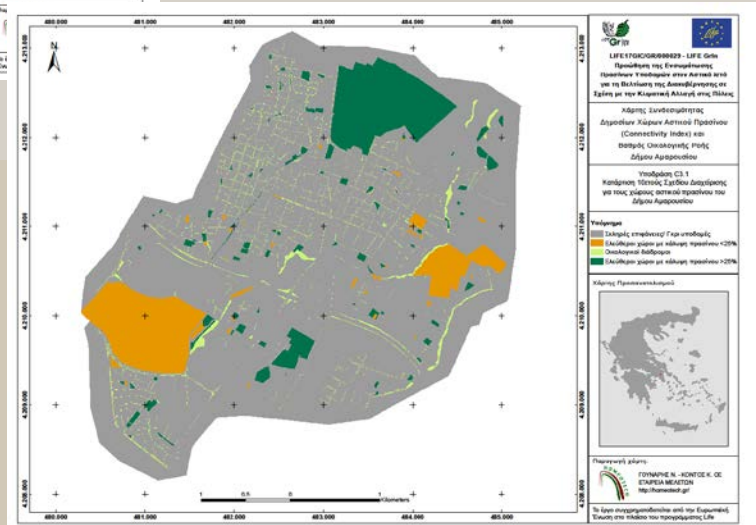
The degree of fragmentation of urban green areas, their **dispersion, connectivity and general spatial distribution**, within the urban fabric, is a critical criterion for the aesthetics of the landscape, the quality of the environment and, by extension, the citizens' quality of life. The aim of this chapter **is not the ecological evaluation** of the urban green areas. It is rather the presentation of spatial structure indicators that place green infrastructure in the urban landscape, and the potential configuration of these indicators if in these areas vegetation would be established.

AREA - Patch Area Index	It indicates landscape composition
Landscape composition index PD - Patch Density	It indicates the pixels density of parcels of each landscape class
CONNECT - Connectance Index	It indicates the degree of facilitation of ecological flows
DIVISION - Division index	It indicates the degree of landscape coherence



**Connectance Index
CONNECT in the
Municipalities of
Amaroussion and Heraklion**

These indicators are chosen because they provide useful information about the urban landscape, while at the same time they are able to assess both the current state and the potential configuration of its structure. Thus, they have an important ecological character and they are comprehensive and interpretable.



Carbon sequestration (carbon storage) Indicators

The carbon that is stored in urban trees is calculated through **allometric equations** for the calculation of the aboveground dry biomass.

The selection of the appropriate equation must be done carefully, according to the plant species and the climate zone.

Bioindicators

In each individual urban green area of interest, which has a different composition, structure and size, but which is connected with the others, systematic sampling is carried out in order to evaluate the species of **lepidoptera (butterflies)**.



Bioclimatic Indicators

They refer to the evaluation of the thermal comfort or discomfort that a person feels when he or she is in a certain environment. Thermal indicators usually show the average state of thermal sensation as perceived by the majority of individuals in a population.

Physiological Equivalent Temperature - PET	It is a thermal indicator that evaluates the thermal comfort of human body. It is defined as the air temperature at which the energy balance of the human body is in equilibrium with its thermal environment.
Predicted Mean Vote - PMV	It indicates the average thermal comfort vote given by a large number of people using a 7-point rating scale. The indicator values show the feeling of most people in a space as their ' <i>vote</i> ' will determine the average value of the ' <i>vote</i> '.

Socio – Economic Indicators

Citizens' Welfare indicator because of the presence of Urban Green Infrastructure - URB_Wel_Ratio	The indicator compares the corresponding urban green area per citizen using as a measure of comparison the value of 9m² of accessible urban green (optimal ratio area per citizen) per citizen proposed by the WHO .
Citizens' Socio-Economic prosperity indicator because of the presence of Urban Green Infrastructure - SOC_URB_Wel_Index	The Citizens' Welfare indicator is multiplied by €10 , and then by the total population of the Municipality

Evaluation Indicators

The evaluation and self-evaluation indicators are used firstly at a **preliminary stage**, in order to set the reference point, secondly **throughout the implementation** period of the strategic plan, and **at the end** of the management period to assess sustainability.

The indicators are classified into three categories, of different weight and importance.

Criterion Category	Weight	Scoreboard for Urban Greening Evaluation			
		Low	Moderate	Good	Excellent
Ecology and Planning (8 criteria)	5.5	0.25	0.5	0.75	1
Organization - Implemented Management (7 criteria)	2.75	0.25	0.5	0.75	1
Public relations (5 criteria)	2.0	0.25	0.5	0.75	1

Promoting urban integration of GReen INfrastructure to improve climate governance in cities

LIFE17GIC_GR_000029



The project "Promoting urban integration of GReen INfrastructure to improve climate governance in cities" (LIFE17GIC GR000029) is co-funded by the European Union in the context of Programme LIFE, with the contribution of the Green Fund

