



LIFE18 PRE IT 003

Veg Gap

Vegetation for
Urban Green Air
Quality Plans



Layman's report

Project Coordination: Mihaela Mircea - ENEA

Project Team:

ARIANET: S. Finardi, N. Pepe, C. Silibello

CREA: A. Alivernini, S. Fares, I. Zappitelli

ENEA: M. Adani, G. Briganti, A. Cappelletti, L. Cianciarella, G. Cremona, I. D'Elia, A. De Marco, M. D'Isidoro, G. Ferro, M. Gualtieri, M. Mircea, E. Petralia, A. Piersanti, G. Righini, F. Russo, B. Sorrentino, P. Stocchi, M. Stracquadanio, M. G. Villani, D. Visparelli, L. Vitali, G. Zanini

MEEO srl: D. Barboni, M. Cavicchi, S. Mantovani, S. Pasetti

Metropolitan City of Bologna: M. Cavallo, D. Cencioni, S. Ferraro, F. Ferrero, A. Merighi, E. Pighi, V. Stacchini, M. Trabalzini

Municipality of Madrid: J. Azcárate, A. Cristobal, R. R. López de la Cova, L. Tejero

Municipality of Milan: M. A. Mauri, E. Ferrara, P. Pelizzaro, E. Torricelli, F. Putignano, M. Trentin

UPM Technical University of Madrid: R. Borge, D. de la Paz, J.M. de Andrés, A. Narros

The VEG-GAP project (LIFE18 PRE IT 003) is co-financed by the LIFE European Programme for the Environment and Climate Action

2



The opinions expressed in this report are those of the authors and do not necessarily reflect the opinions of the European Commission. The LIFE Programme authorities are not liable for any use that may be made of the information contained therein.

<https://www.lifeveggap.eu/>
info@lifeveggap.eu

Copyright © 2022 by VEG-GAP project

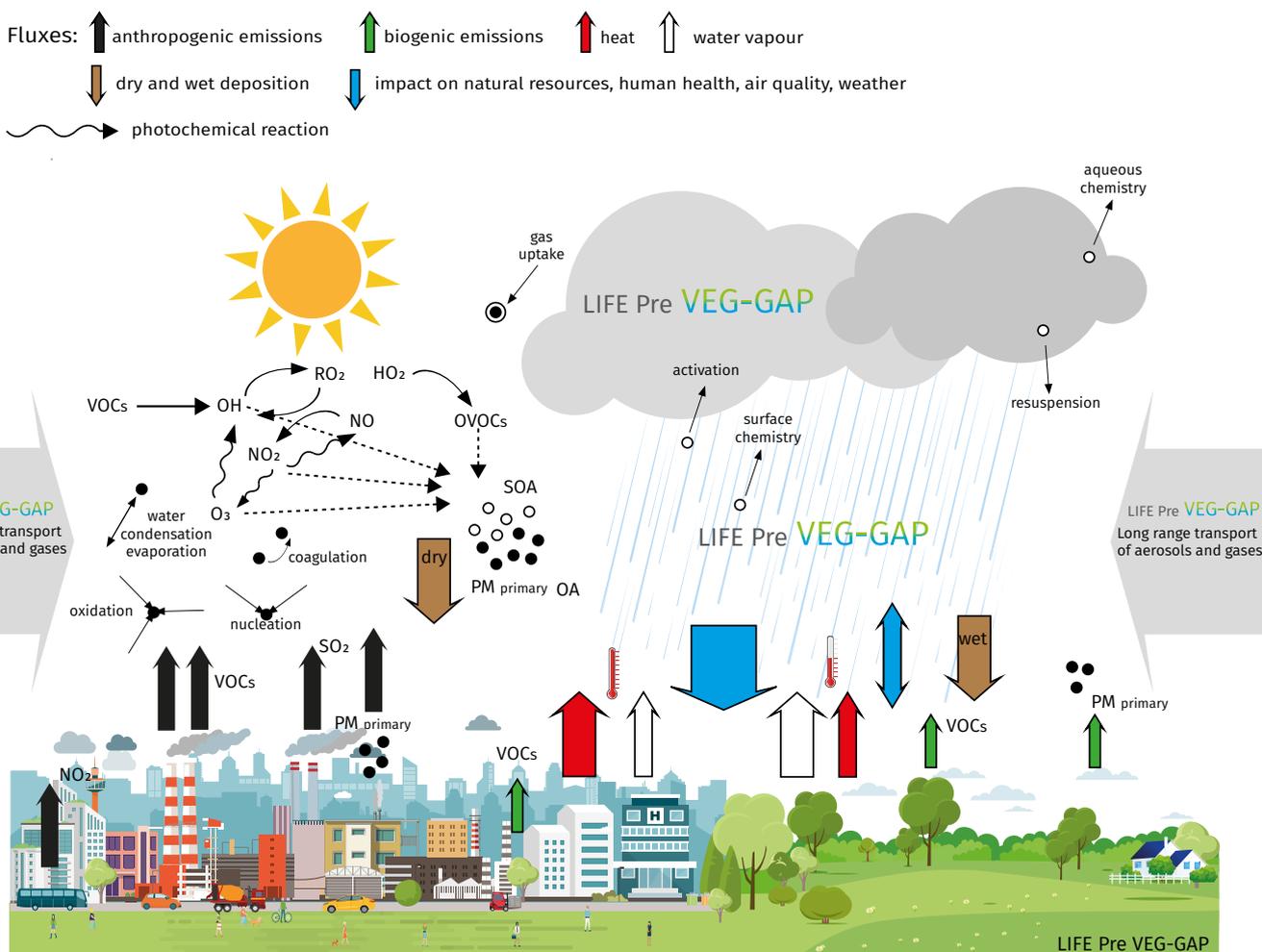


Setting the scene

Today over 70% of emissions harmful to our planet come from cities, and by 2050 over 6 billion people in the world will live in urban areas.

In this scenario, cities are called to play a pivotal role in solving the problem of air pollution, changing their development policies with the utmost attention to the health of citizens and nature.

Greenery represents a great opportunity, thanks to its ability to regulate thermal comfort and provide a large variety of ecological services: however, local authorities often do not have the information and decision-making tools necessary to choose the quantity of vegetation to be planted and its location, as well as the variety of species to be used in the different urban areas in order to maintain or improve the air quality and to increase resilience to climate change.



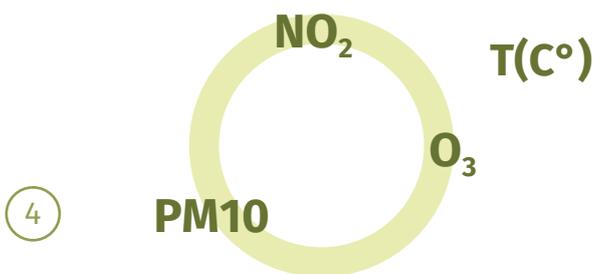
How VEG-GAP worked

Wouldn't it be nice to know the effect of the actions we take today, without having to wait until tomorrow?

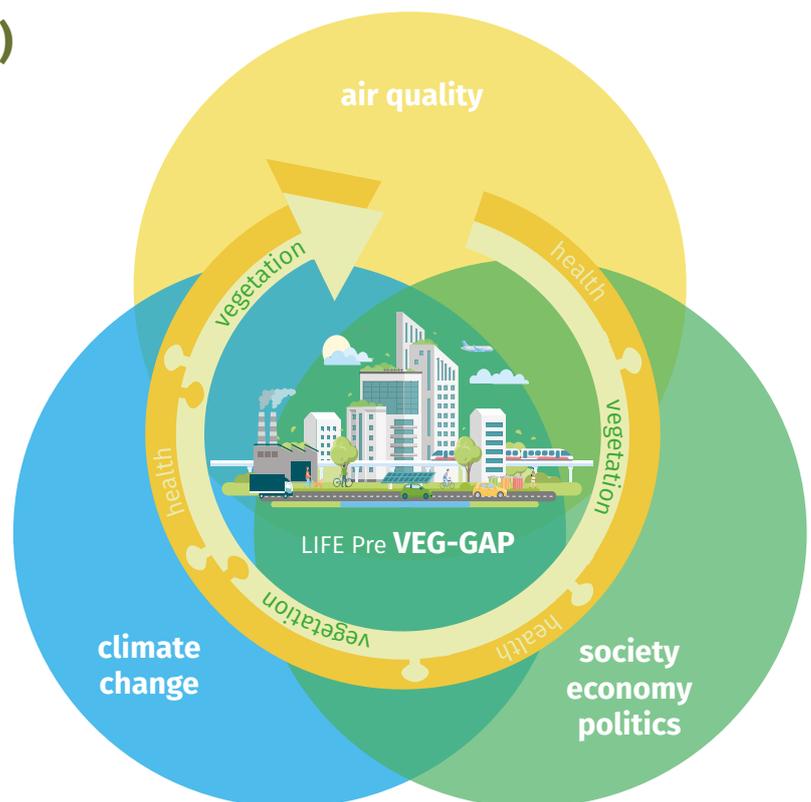
The Life project VEG-GAP has developed tools to answer this question.

VEG-GAP arises from the awareness that the use of a natural resource, as urban green, represents a great opportunity to improve the quality of life in the city in its multiple aspects such as social, economic and cultural, starting from the improvement of air quality and of the thermal comfort, basic elements of the citizens' health and well-being.

VEG-GAP investigated the interactions of vegetation ecosystems with urban atmosphere: **the simultaneous effects of vegetation on air temperature and air quality for the most significant pollutants.**



VEG-GAP is a valuable example of transnational collaboration, and of how governments, research centres, businesses and civil society can team up to build better cities. Thanks to the project, we were able to transform scientific models into operational tools that can be profitably used by cities for better planning and monitoring their policies.



The VEG-GAP journey

The approach used in VEG-GAP quantifies simultaneously the contribution of vegetation ecosystems both as source and sink of air pollutants in urban areas, the effect of urban vegetation on air temperature and its impact on air quality.

VEG-GAP evaluations are based on Atmospheric Modelling Systems (AMS): numerical models that employ a set of equations and many parametrizations to describe the multiple physical and chemical phenomena and processes which take place in atmosphere. AMS provide insights into the effects of vegetation on air quality and temperature in the city, by comparing different simulations which consider the type and quantity of plants in present and future configuration.

The elaborated data are available on the VEG-GAP Information platform where you can see all over the city:

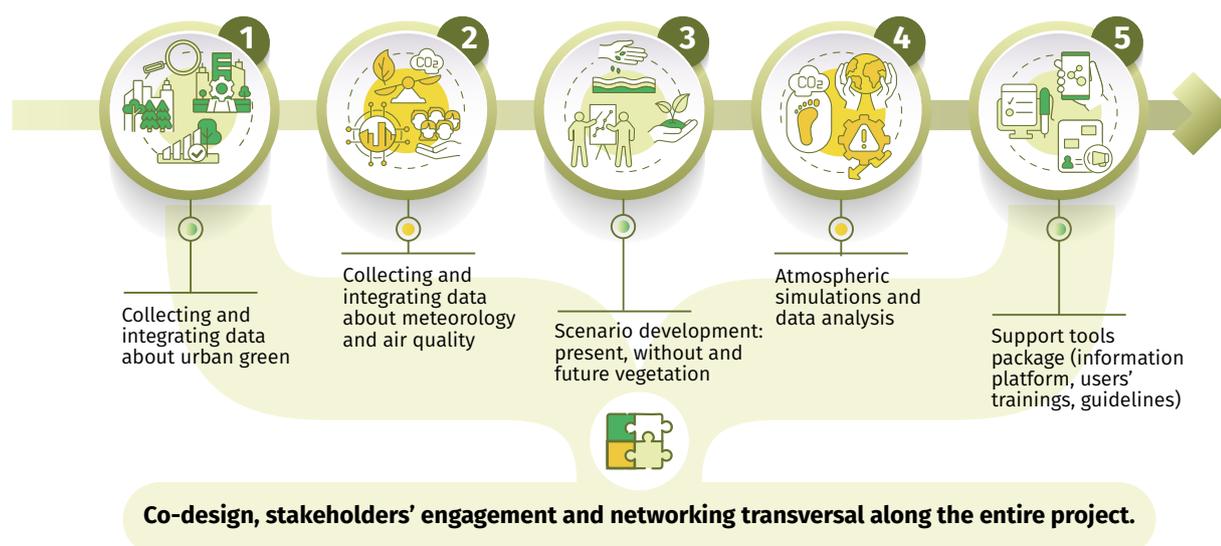
- **how the temperature changes;**
- **how the concentrations of pollutants change;**
- **how much pollution is removed;**
- **how much biogenic volatile organic compounds are emitted.**

The novelty of the approach:

- **integration of different information at different scales: from satellite data to detailed maps (up to the single species and its size);**
- **perspective on the entire urban area, considering other possible regional influences;**
- **assessments of future scenarios in terms of risks and benefits for human health and the vegetation itself.**

5

Thanks to VEG-GAP support tools, decision makers can take informed choices and identify the more effective planning solutions.



The 3 pilot cities



6

	BOLOGNA	MADRID	MILAN
Description	Bologna is the capital and largest city of the Emilia-Romagna region in Northern Italy. It is an important agricultural, industrial, financial and transport hub. Bologna is also one of the wealthiest cities in Italy, often ranking as one of the top cities in terms of quality of life in the country. On the other hand, Bologna has been adversely affected by the impacts of climate change, and suffer of poor air quality, like the whole Po basin.	Madrid is the capital and largest city of Spain, core of a very populated metropolitan area. Air quality and Climate Action are environmental priorities for the city. Transport and building heating systems are the main sources of emissions. The municipality develops plans and actions to reduce pollutants and GHG on atmosphere and mitigate the climate change impacts on the city.	Milan is the business center and the second largest city of Italy, being one of the most densely populated urban areas of the northern part of the country. It is characterized by a predominantly flat topography, with an ancient concentric city grid which has sprawled especially towards the north thanks to its dramatic urban expansion. The city urban fabric's density worsens the main climate change related risks, mainly heat island and floods.
Inhabitants	0.38M	3.3M	1.3M
Surface (km ²)	140.9	604.5	181.7
Density (Inh/Km ²)	2,745	5,500	7,554
Green areas cover (km ²)	55.5	182.3	42.3
Trees most present	Celtis australis Platanus acerifolia Tilia spp. Fraxinus excelsior Acer campestre	Platanus spp. Ulmus pumila Pinus pinea Prunus cerasifera Acer negundo	Celtis australis Platanus spp. Carpinus betulus Acer platanoides Robinia pseudoacacia



The information platform

The VEG-GAP Information Platform is a web-based multi-purpose information platform exploiting the final results of the project.

The platform uses Atmospheric Modelling Systems outputs and inputs.

It is a collaborative framework among end-users (which can interact with data analytics), governance (facilitating the knowledge sharing on successful environmental air quality solutions), and citizens (by showing them the effects of the green interventions).

It can be used both by non-technical users (Basic version), to show them the effects of green interventions, and by operators with technical expertise (Advanced version), to facilitate knowledge sharing on successful environmental air quality solutions.

It is publicly available in English, Italian and Spanish.

Information Platform can be extended to include more cities and data.

The platform in numbers:

+2500

netCDF files as input data generated by scientific partners, converted into

+200

geoTIFF files as platform visualization ready data



To visit the platform

<https://veggapatform.enea.it/>



To know more about the platform, watch our video



The Basic service

The VEG-GAP Platform Basic service is for citizens and non-expert users, everyone can access it, no login is required.

It is made of simple guided path for a smart exploration of the project results, through questions and answers, to inform and raise awareness among citizens regarding the vegetation impact on air quality.

The available information is for the present vegetation and its effect on air temperature, pollutant concentration, pollution removal, biogenic emissions, provided through the following graphical interface features:

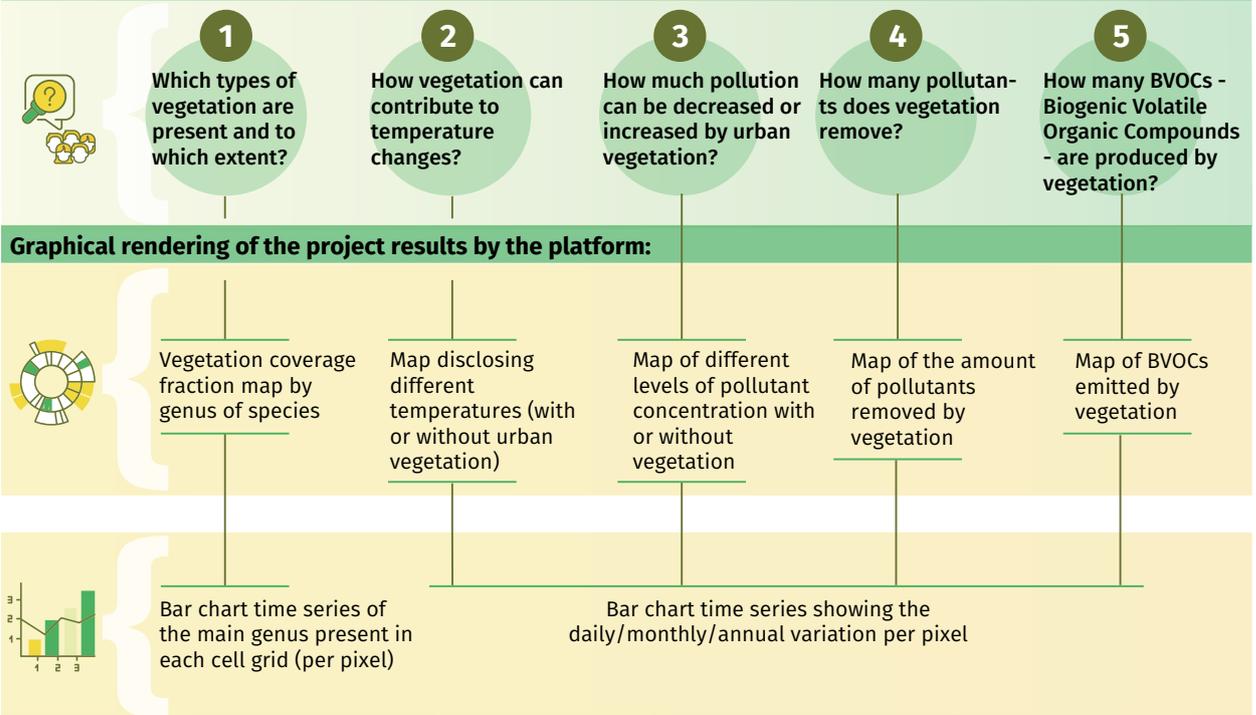
- **A map to spatially represent the physical variables;**
- **A histogram to represent the temporal series of the physical variables selected at one location inside a urban target area;**
- **An informative pop-up (symbol “%”) with statistics information on minimum, maximum and average for air temperature, pollutant concentration and pollutant removal;**
- **An informative pop-up (symbol “i”) with further supporting information in the map interpretation.**

8

The 5 guiding questions of the Basic platform

User questions mapped to the VEG-GAP results:

How vegetation contributes to air quality...



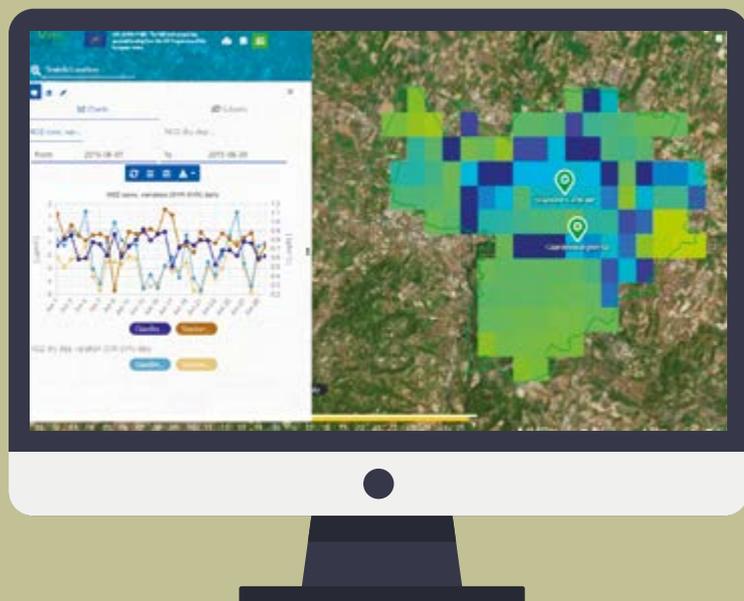
The Advanced service

The VEG-GAP Platform Advanced service is designed to support urban planners, scientists and researchers. It allows access to all VEG-GAP data.

This version requires expertise on webGIS systems and, in general, in the geo-referred data visualization and related temporal series; it provides, indeed, an accurate analysis and it makes available the following further information respect to the Basic version:

- **Additional scenarios (variations induced by the future scenario);**
- **Maps on the whole simulation domain, more extended than the urban area;**
- **Additional variables (PM25 ambient concentration, humidity, precipitation, wind etc.);**
- **Combination of temporal analysis at different time resolution (from hourly to annual);**
- **Comparison of temporal analysis on different location or variables;**
- **Download of data graphs (.csv or .png format) or maps (.tiff format).**

The access is reserved to registered users, if you are interested please contact the project coordinator at info@lifeveggap.eu



User's guide:

IT



EN



VEG-GAP added value

VEG-GAP project provides more realistic and detailed knowledge regarding the impacts of vegetation on cities' atmosphere, and in particular to air quality.

The assessments made for present vegetation scenarios in the three pilot cities provide bases for further testing the effect of environmental solutions such as green infrastructures, urban agriculture, urban green belts, nature-based solutions, etc., on air pollution in an integrated view in space and time.

The results we gained shows that air temperature and pollution levels are not impacted in the same way by vegetation all over the city area, but vary according to different combinations of vegetation and urban morphology, and anthropogenic emission "cocktail"; therefore, pollution impact assessments on human and vegetation health, biodiversity, etc, should consider this aspect together with its variability in time, to avoid undesirable negative effects.

The VEG-GAP assessment methodology may be used by any city, and could help them to develop joint strategies to combat air pollution and climate change considering the urban ecosystems/vegetation characteristics simultaneous with measures to reduce anthropogenic emissions and with urban planning - long term measures in using urban green for adaptation to climate changes.

10



VEG-GAP contributes to achieve the Sustainable Development Goals. In particular it addresses SDG 11 "Sustainable Cities and communities, and the specific targets:



- **TARGET 11.6 - reduce the environmental impact of cities, paying special attention to air quality;**
- **TARGET 11.B - implementing integrated policies and plans aimed at inclusion, resource efficiency, mitigation and adaptation to climate change, disaster resistance.**

Co-design, stakeholders' engagement, networking and communication results

The methodology and tools developed are the result of an intense co-design work, carried out by the scientific partners of VEG-GAP (ENEA, ARIANET Srl, UPM, CREA), combined with the practical contribution of the three pilot cities (Bologna, Madrid and Milan) and the technical support for the Information Platform from MEEO Srl, the intense exchange and dialogue with experts - through networking and the advisory board - as well as the engagement of local stakeholders.



This process has greatly enriched the results, bringing different perspectives, stimulating creativity and pushing for better outcomes. The project also stimulated the pilot cities to develop better air quality and climate plans for the future and to build stronger alliances with other actors.

The project numbers:

+1.300.000 people reached

+51.700 people influenced

+120 media appearances

+55 events

+25 networking projects

Coordinator



VEG-GAP project partners:



<https://www.lifeveggap.eu/>



info@lifeveggap.eu

