

# Urban Ecosystems, opportunities and challenges: an overview at the European Scale

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# Overview

- JRC-Research activities related to Urban Ecosystems
  - MAES
  - EnRoute
  - Biodivercities
  - Ad hoc support to the Nature Restoration Law

# EU biodiversity strategy



- Adopted the 20<sup>th</sup> of May 2020
- The work of MAES -> important for shaping the strategy
  - Community of practices
  - EU-wide assessment of ecosystems and ES
- For the first time **urban green** is included
  - Section 2.2.8 “Greening urban and peri-urban areas”

[https://ec.europa.eu/environment/nature/biodiversity/strategy/index\\_en.htm](https://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm)

# EU Proposal for a Nature Restoration Law



- Adopted the 22<sup>th</sup> of June 2022
- The first continent-wide, comprehensive law to restore ecosystems for people, the climate and the planet.
- Green Infrastructure and Urban green infrastructure, indirectly important for Targets on:
  - Forest Ecosystems
  - Urban Ecosystems
  - Agro-ecosystems

# JRC-research activities on Urban Ecosystems

## MAES Urban Pilot

- Developing a framework

2015-2016



## EnRoute

- Benchmarking cities
- Working on science policy interface

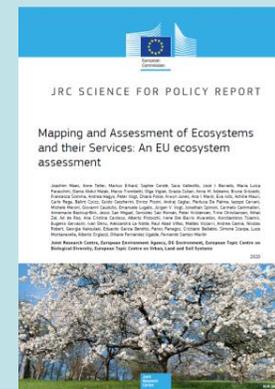
2017-2018-2019



## EU wide assessment

- Assessing Trends

2019-2020



## BiodiverCities

- Mapping the role of UGI on microclimate regulation and urban biodiversity
- Working on citizen engagement

2020-2022



A PARTICIPATORY  
GUIDE TO BUILDING  
BIO DIVERSE  
URBAN FUTURES

# BIO DIVER CITIES ATLAS

# What is MAES and why it is important

## Target 2 -> Action 5 of the Biodiversity strategy to 2020

calls Member states, with the help of the Commission, to

*“..Map and assess the state and economic value of ecosystems and their services in the entire EU territory; promote the recognition of their economic worth into accounting and reporting systems across Europe”.*

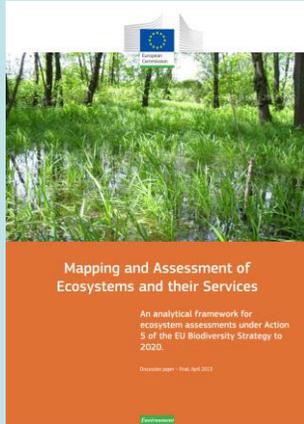
Within **MAES** we started the **JRC-research activities on Urban Ecosystems**

[https://ec.europa.eu/environment/nature/knowledge/ecosystem\\_assessment/index\\_en.htm](https://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/index_en.htm)

# The MAES reports

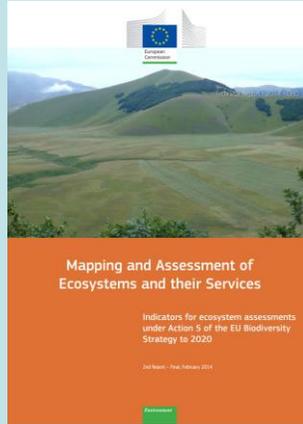
Consistent analytical framework to map and measure ecosystems extent, condition and services

2013

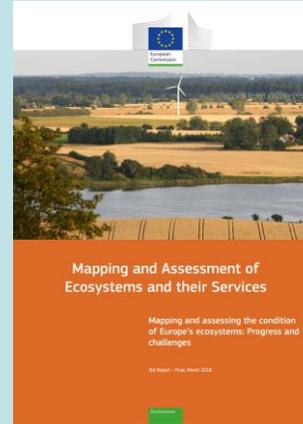


Discussion paper and common ecosystems typology

2014



2016



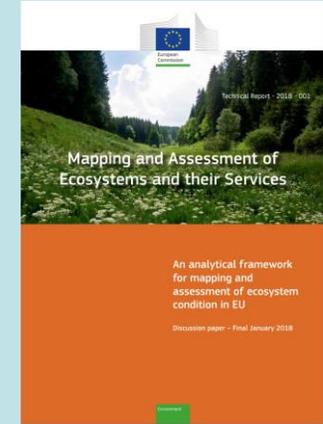
Condition of Europe's ecosystems

2016



Urban ecosystems

2018



Integrated analytical framework and set of indicators for mapping and assessing the condition of ecosystems in the EU

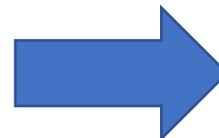
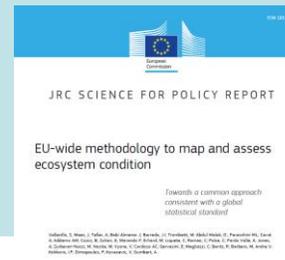
2020



EU wide assessment

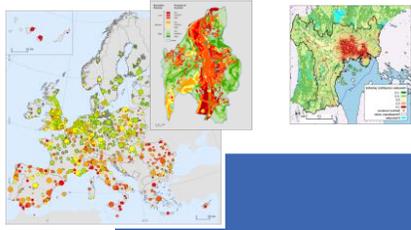
EU wide methodology To map ecosystem condition

2022



# EnRoute in a nutshell

## The MAES framework



- The base MAES knowledge on urban ecosystems was applied at **local** and **EU** level

## The Science Policy Interface



- The collaboration between policymakers and scientists has been **explored** with a survey and deep interviews

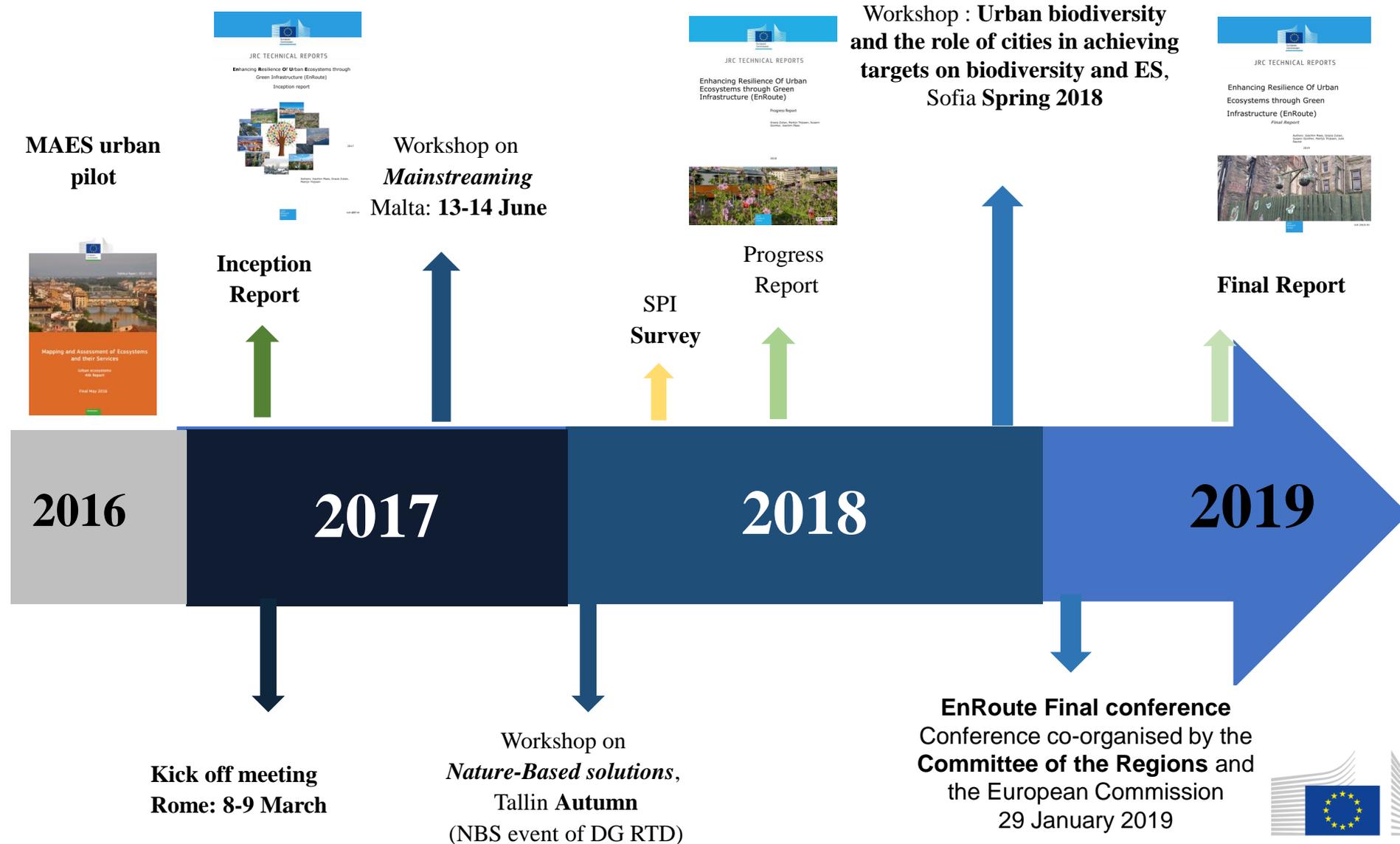
## The Networking



- **Contacts** between communities of practice at local, regional and national level have been promoted

# EnRoute

## Enhancing Resilience of Urban Ecosystems through Green Infrastructure



***Growing with green ambitions***

Growing cities with sufficient green space for everyone

**Leipzig, Utrecht, Karlovo**

***BiodiverCities***

A focus on maintaining urban trees and biodiversity; embedding the city in a regional ecological network, and urban bee keeping

**Lisbon, Limassol, Oslo, Helsinki-Espoo-Vantaa, Padova, Rome**

***Improving the quality of life***

Community based approaches for investing in natural capital and urban green space for recreation

**Manchester, Poznan, Trento**

***Green cities, healthy cities***

Different examples of proper planning of how urban green space delivers benefits for physical and mental health.

**The Hague, Rome**

***Sustainable strategic urban planning***

Development of multi-functional urban green and blue infrastructure and integration in regional planning.

**Antwerp, Valletta, Dublin, Trento**

***Climate-proof cities***

Urban nature to support climate transition

**Glasgow, Tallinn, Utrecht**

**18 city-labs**





## EnRoute

EnRoute stands for Enhancing Resilient infrastructure. EnRoute is a project of the EU Biodiversity Strategy and the G provides scientific knowledge of how u at different stages of policy and for vari making for sustainable cities. It aims to infrastructure at local level and deliver: governance of urban green infrastru collaboration between and across diffe infrastructure policy setting.

## Case studies

**Leipzig**

**City of Utrecht: growing with green ambitions**

**Growing cities with sufficient green space for everyone - Karlovo City-Lab**

**An assessment of green infrastructure and ecosystem services in the Valletta urban area: a case-study for sustainable urban planning**

**The Hague: peacefully green**

**Climate-proof cities: City of Tallinn, Estonia**

**Leipzig**

**Greening Rome for human and ecosystem health**

**Poznan: Mapping and assessing ecosystem services to support decision making towards enhancing green infrastructure and recreation facilities that contribute to the quality of life**

**Climate-proof cities: City of Tallinn, Estonia**

**Keywords:** Green infrastructure, Ecosystem services, Urban planning, etc.

**Enroute themes:** Growing with green ambitions, Improving the quality of life, etc.

**Land 2018, 7(4), 112; doi:10.3390/land7040112**

**Assessing Nature-Based Recreation to Support Urban Green Infrastructure Planning in Trento (Italy)**

**Chiara Cortinovis**, **Grazia Zulian** and **Davide Geneletti**

**Abstract:** Nature-based recreation is among the most relevant ecosystem services supplied by urban green infrastructure, affecting citizens' physical and mental wellbeing. Providing adequate green spaces for nature-based recreation is among the main goals of urban planning, but commonly-used indicators offer a partial view on the issue. Innovative methods and approaches, such as the ESTIMAP-recreation model, appear as promising ways to increase the quality of information available for decision-makers by considering both the range of green spaces that provide the service and the locally-specific demand. The article presents an application of the ESTIMAP-recreation model to the city of Trento (Italy), aimed at testing its adaptation to the local context and the potential improvements brought to urban planning. The comparison of the results with traditional indicators based on the availability and accessibility to urban parks shows significant differences in terms of priority of intervention across the city, with implications on planning decisions. The application demonstrates that

**Remote Sensing 2017, 9(8), 791; doi:10.3390/rs9080791**

**Mapping and Assessment of PM<sub>10</sub> and O<sub>3</sub> Removal by Woody Vegetation at Urban and Regional Level**

**Lina Fusaro**, **Federica Marando**, **Alessandro Sebastiani**, **Giulia Capotorti**, **Carlo Blasi**, **Riccardo Copiz**, **Luca Congedo**, **Michele Munafò**, **Luisella Ciancarella** and **Fausto Manes**

**Abstract:** This study is the follow up of the URBAN-MAES pilot implemented in the framework of the EnRoute project. The study aims at mapping and assessing the process of particulate matter (PM<sub>10</sub>) and tropospheric ozone (O<sub>3</sub>) removal by various forest and shrub ecosystems. Different policy levels and environmental contexts were considered, namely the Metropolitan city of Rome and, at a wider level, the Latium region. The approach involves characterization of the main land cover and ecosystems using Sentinel-2 images, enabling a detailed assessment of Ecosystem Service (ES), and monetary valuation based on externality values. The results showed spatial variations in the pattern of PM<sub>10</sub> and O<sub>3</sub> removal inside the Municipality and in the more rural Latium hinterland, reflecting the

# Papers

# Workshops

**EnRoute conference Evidence-based planning for greener cities: summary report**

**Minutes of the Biodiver-City conference in Sofia, 24 April 2018**

**Group membership**

- Joachim Maas
- Grazia Zulian
- Davide Geneletti
- Julia Reynal
- Trevi O'Doherty
- Iwona Zwierczowska

# City Labs reports

# Options for upscaling based on an EU wide assessment of urban green infrastructure



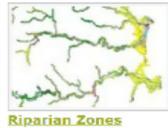
- **25 indicators**
  - Green Infrastructure
  - Air quality
  - Population
  - Soil sealing
  - Ecosystem services
  - Natura 2000

# EU-wide assessment



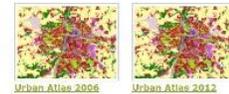
## Data

Local

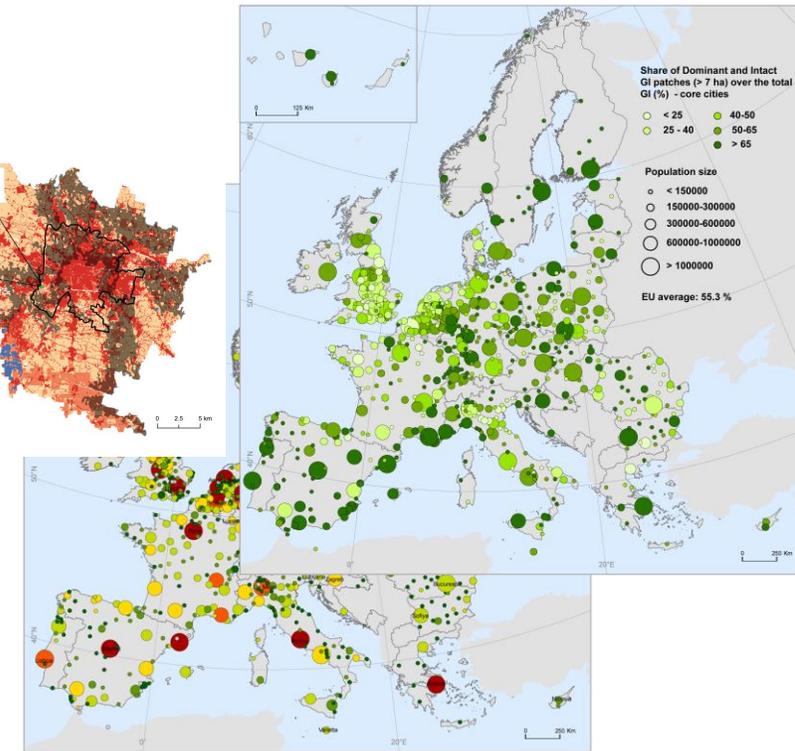
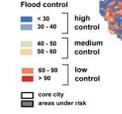
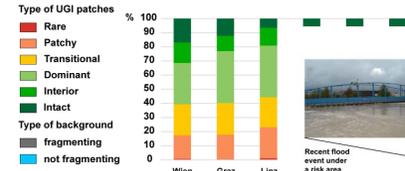
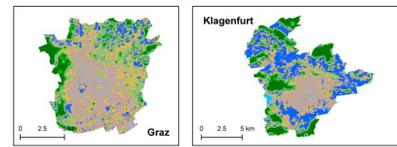


Riparian Zones

Urban Atlas



Urban Atlas 2006 Urban Atlas 2012

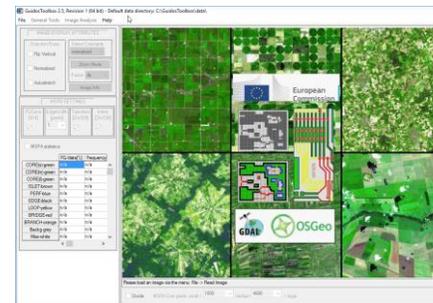


## Maps

## Outputs

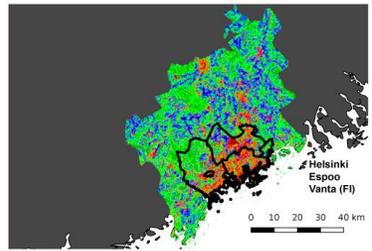
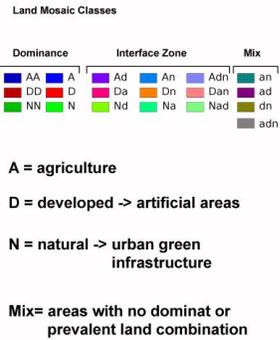
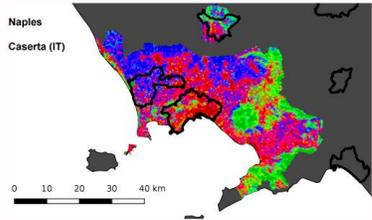
## Tools and Methodologies

- Open source data available at EU scale
- When possible outputs are spatially explicit maps
- Methodologies and tools are available



# Urban-MAES applied: spatially explicit results for 690 EU cities

## Land Mosaic

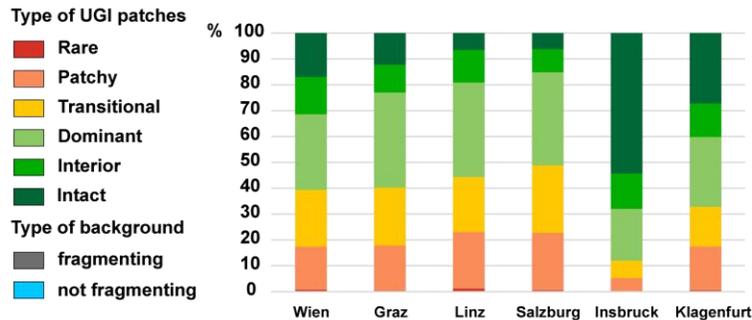
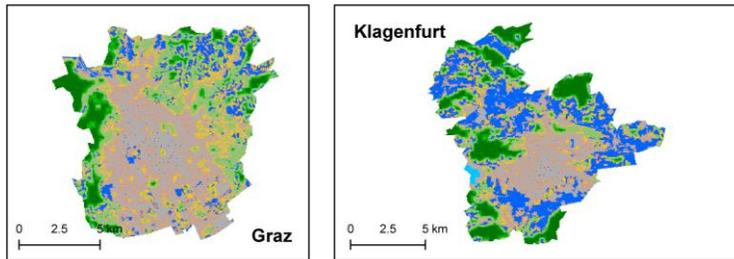


## The nature based Recreation map

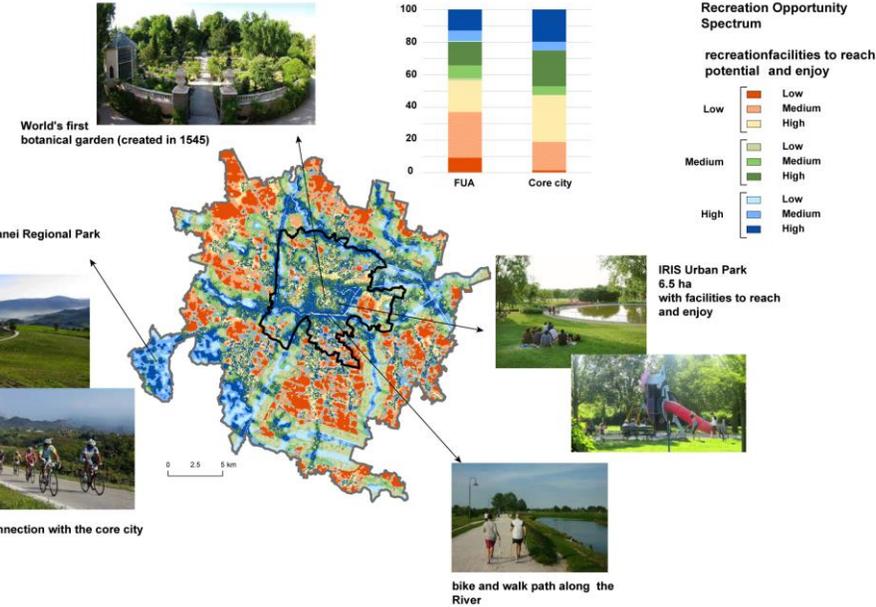
## ESTIMAP modules



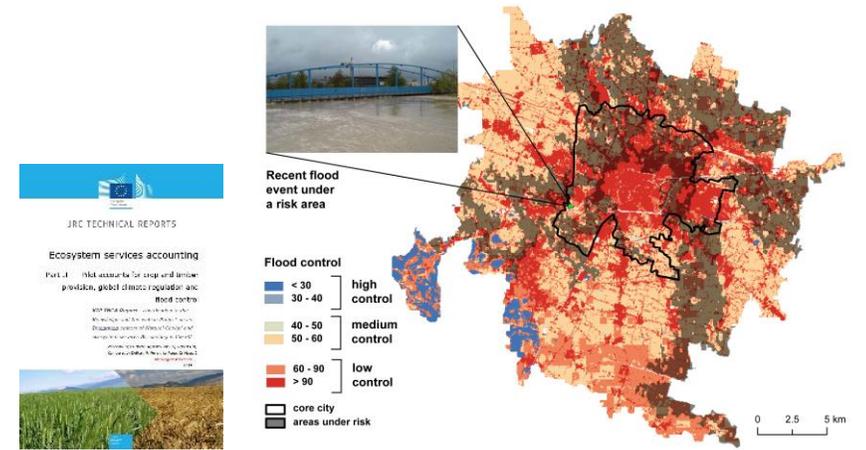
## FOS (Fragmentation analysis at a fixed observation scale)



## Guido's Toolbox



## Flood control map

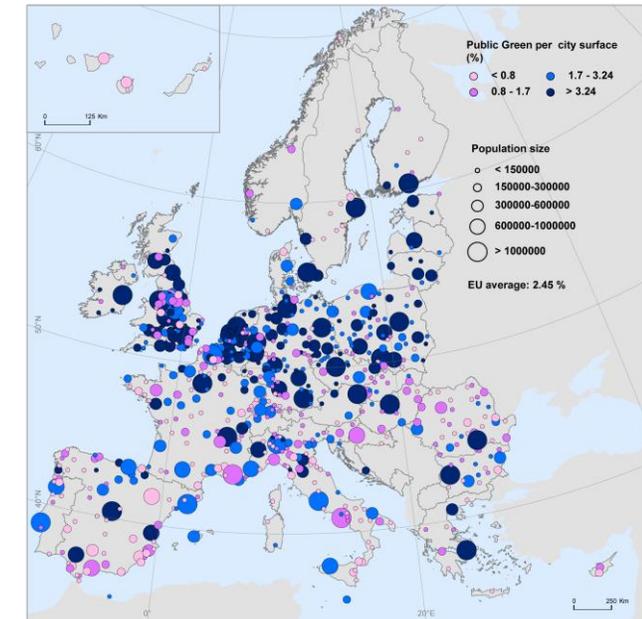
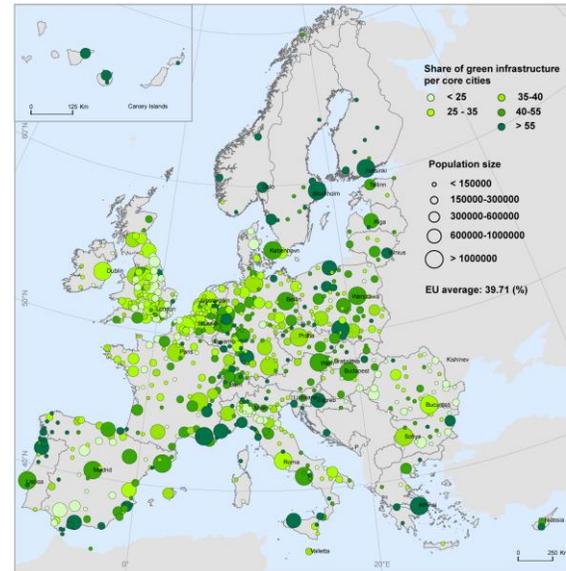
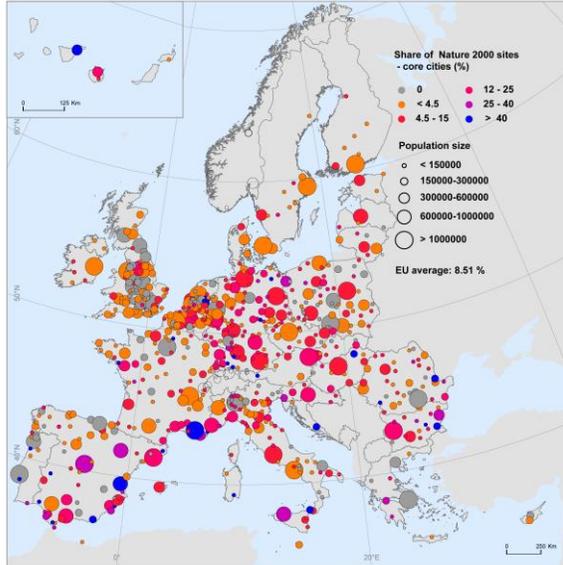


## Core cities reporting unit: EU average values

# Structural Ecosystem Attributes

### Natura 2000 in cities: EU average value

- Share of core city covered by Natura 2000 sites : **8.5 %**  
**1.95 % of Natura 2000 sites is within core cities**



### Share of Urban green infrastructure: EU average values

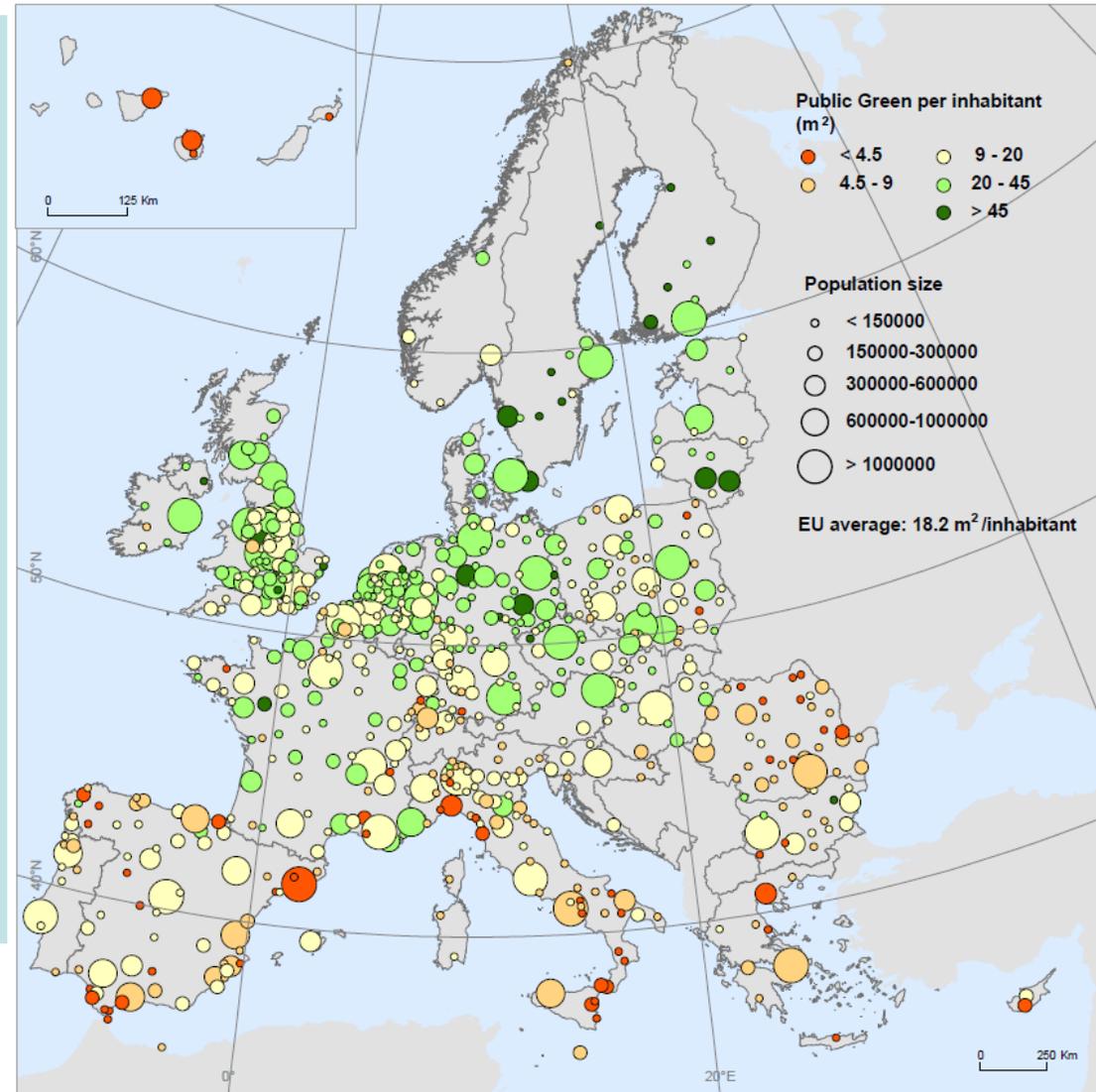
- Urban Green Infrastructure: **39.72 %** (urban forest and urban green)
- Public Urban Green: **2.45 %**

# Cities are probably greener than we think but most urban green space is not publicly accessible.

Average coverage (%) of the surface area of core cities in Europe:

→ 39.7% urban green and blue space

→ 2.5% publicly accessible (urban parks): 18 m<sup>2</sup>/inhabitant



# EU wide ecosystem assessment

- Analysis of the **trends** in the pressures, condition and services of marine, freshwater and land ecosystems of EU+UK (EU28) based on a common integrated monitoring framework and using 2010 as policy baseline year
- Covers total land area of the EU28 as well as the EU28 marine regions
- Evaluation of the impacts of the 2020 biodiversity targets
- Baseline for the 2030 biodiversity policy and EU nature restoration Law

# EU wide ecosystem assessment- urban ecosystems

## Condition- structural indicators

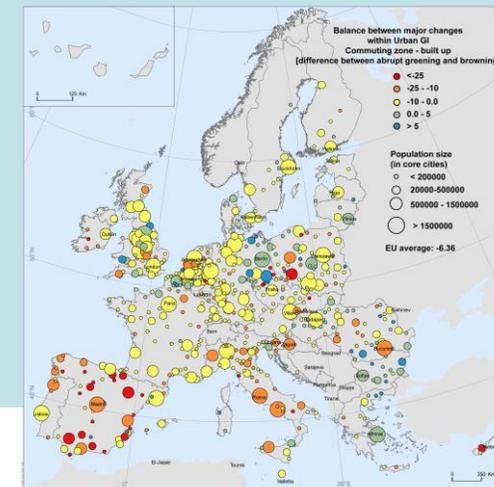
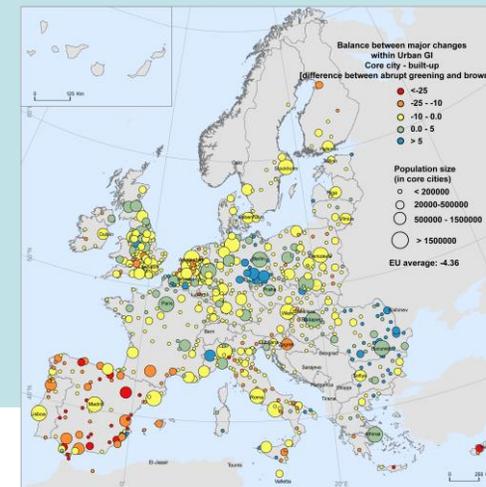
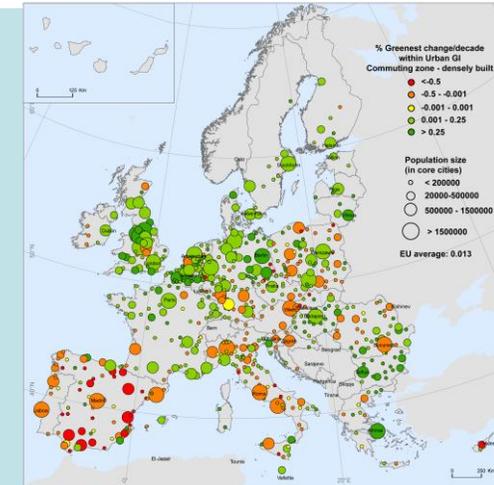
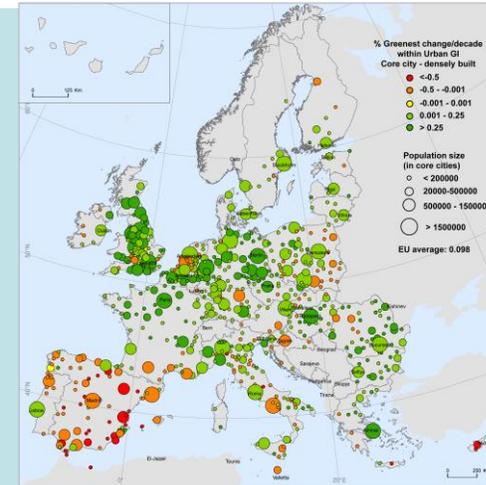
### Vegetation cover of UGI

- Slight increase of vegetation cover at EU level (**0.098 %** in densely built zones - **0.2 %** in not densely built zones)
- **Negative** balance between abrupt changes (**-4.36** and **-6.36%** in densely built zones)



No consistent actions to **compensate** the **loss** of vegetation within UGI

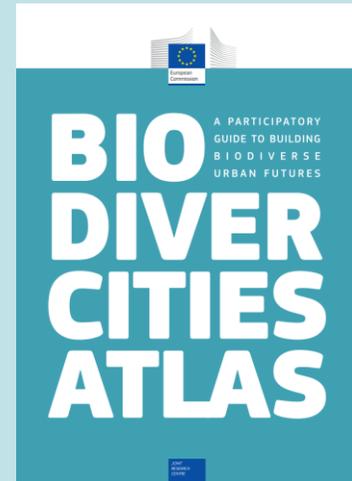
Trends are not geographically homogeneous



# BiodiverCities

<https://oppla.eu/groups/biodivercities>

- **EP Pilot project** — Encouraging civil society to share knowledge and best practices in **connection** with green cities and green urban environments



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### BiodiverCities

BiodiverCities is a project in the context of the EU Biodiversity Strategy. It aims to enhance civil society participation in local and urban decision-making, leading to building a joint vision of the green city of tomorrow shared among civil society, scientists and policymakers. The project will collect practical examples of how to engage citizens in vision building around urban nature, monitoring, and solutions to improve urban biodiversity. It will also assess how urban green infrastructure can be used to provide local benefits for people and nature and how can it contribute to enhancing regional biodiversity. BiodiverCities is funded by a grant of the European Parliament. It is implemented by the Joint Research Centre and DG Environment. Our ambition is to deliver a roadmap to enhance the biodiversity and green infrastructure of European cities by 2030.

**PUBLIC POSTS** PRIVATE POSTS

#### Public posts

Planting of mini-forests in cities is growing in popularity

WORLD ECONOMIC FORUM

#### Group membership

**LEAVE BIODIVERCITIES**

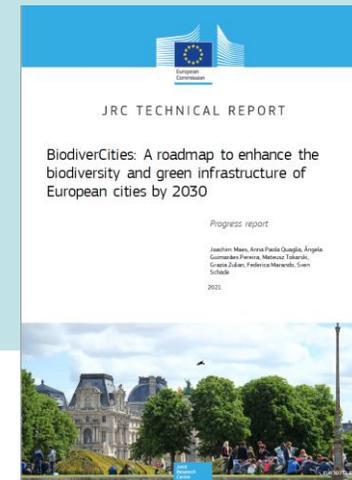
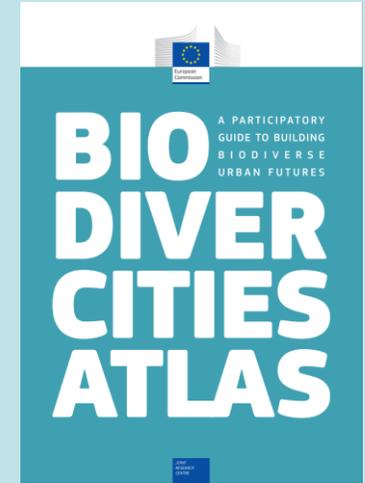
#### Group pages

Group

- Joachim Maes
- Grazia Zulian
- Anna Paola Quaglia
- Sven Schade
- Ir Klemen Risto Bizjak
- Danica Lačarac
- David N. Barton

# Two main strands of work – Need for more integration

- **Local engagement of citizens in urban nature**
  - Practical examples of how to **engage citizens** in vision building around urban nature, monitoring, and solutions to improve urban biodiversity
- **Regional embedding and upscaling**
  - How can urban green infrastructure be used to provide local **benefits** for people and nature and how can it contribute to enhancing regional **biodiversity**
  - Roadmap to 2030



# Urban heat island mitigation by green infrastructure in European Functional Urban Areas

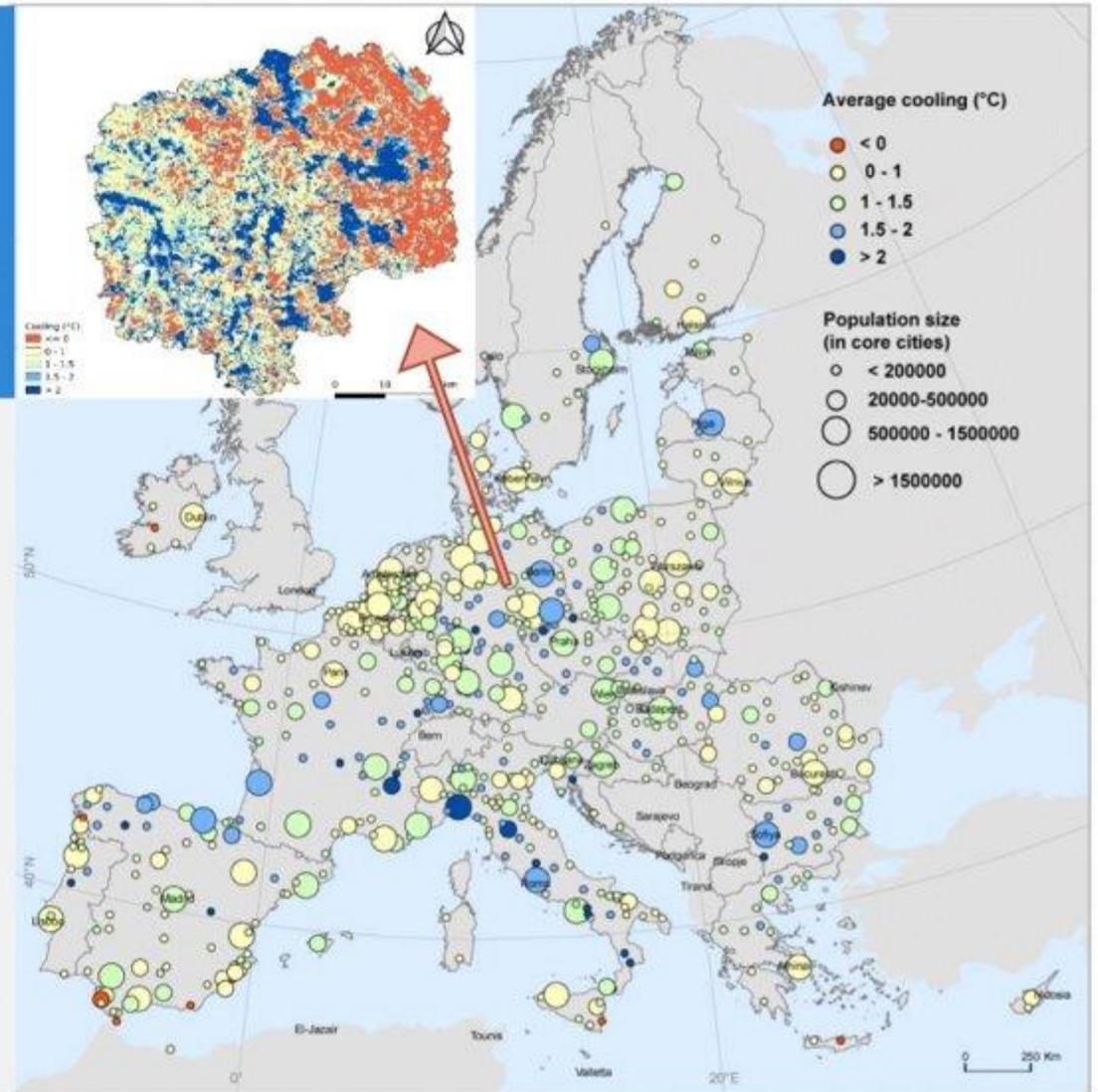
## Methods

The ecosystem service of microclimate regulation of green areas in 601 European cities has been assessed through a model which simulates temperature differences between a baseline and a no-vegetation scenario



## Findings

- Green areas cool European cities by 1.07 °C on average, and up to 2.9 °C
- In order to achieve a 1°C drop in urban temperatures, a tree cover of at least 16% is required
- Around half of the EU population does not benefit from temperature regulation by urban green areas



# Urban GI support biodiversity

Explore the Effects of urban characteristics on birds populations and communities



Pilot at the  
National level

Application at  
the EU Level

## - France

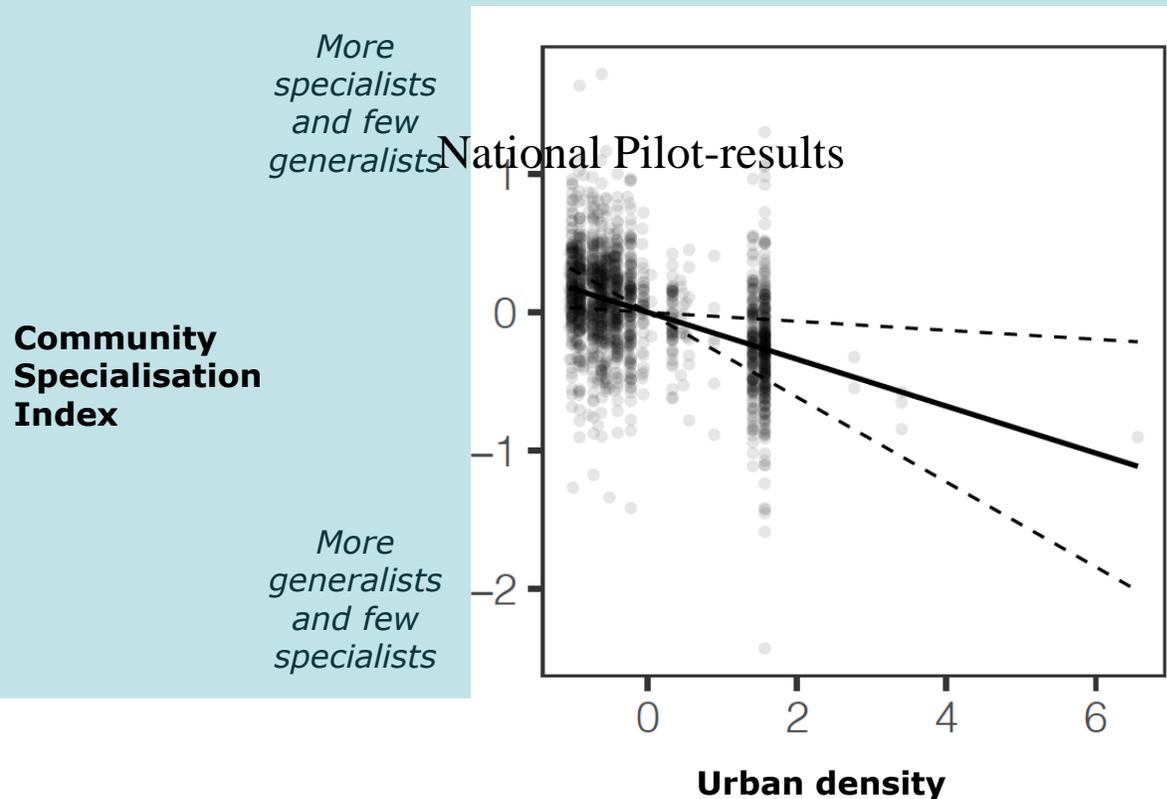
- 34 FUA
- 170 common bird species
- bird data collected from 2015 to 2019
- French Breeding Bird Survey (FBBS)
  - nationwide, standardized monitoring program

## - EU (25 MS)

- 2103 LAU (cities Towns and Suburbs)
- 200  $\approx$  common bird species
- bird data collected from 2015 to 2019
- Pan-European Common Bird Monitoring Scheme (PECBMS), coordinated by the European Bird Census Council

# National Pilot-results (1)

- Urban dense settlements face biotic homogenisation in bird communities



*Lyon city center*

# National Pilot-results(2)

- Urban green infrastructures have the potential to reduce biotic homogenization,

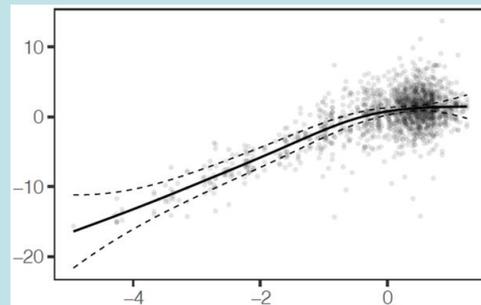


*Bordeaux city*

**Species Richness**

*More species*

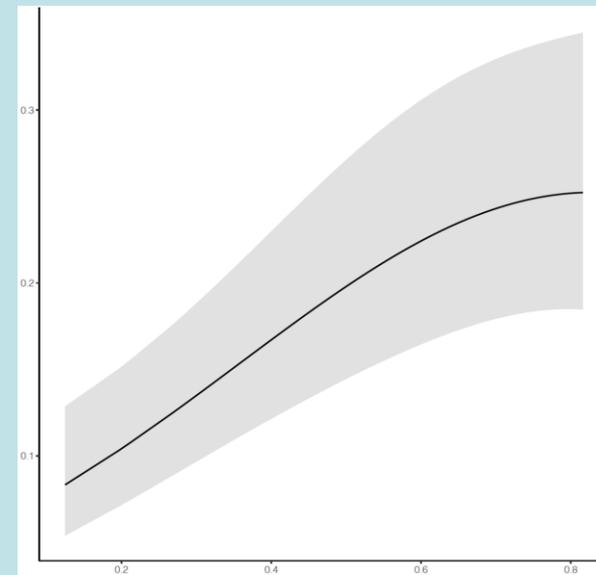
*Less species*



*More birds*

**Overall abundance**

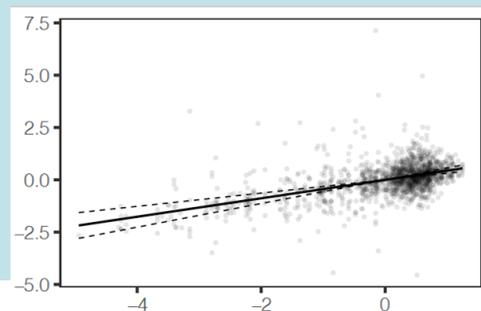
*Less birds*



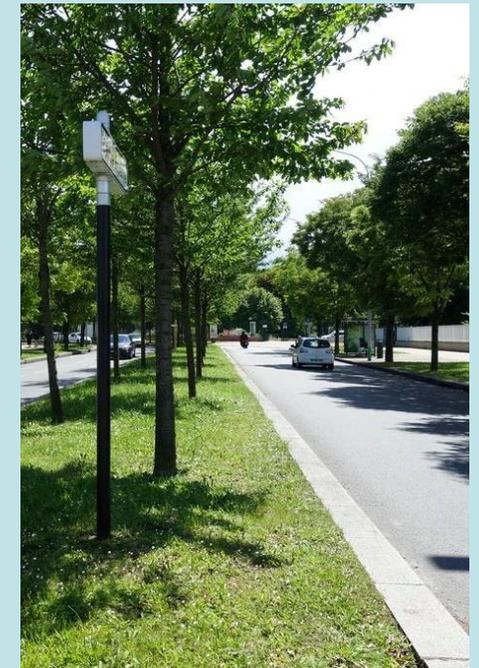
**Community Trophic Level**

*More diverse*

*Less diverse*



**Urban greenness**



*A residential district*

# What is the most representative Land Unit to map and monitor Urban GI

2016-2019

- MAES-Pilot
- EnRoute

2020

- EU-Wide assessment

2020-2022

- Biodivercities

2021-2023

- Support to the NRL

- Land Units:
  - Functional Urban Areas (FUA)
- Green data:
  - Urban Atlas

- Land Units:
  - Functional Urban Areas (FUA)
- Green data:
  - CLC
  - Landsat

- Land Units:
  - Functional Urban Areas (FUA)
  - Lower Administrative Units (LAU)
- Green data:
  - CLC
  - Copernicus Tree Canopy Cover
  - Landsat

- Land Units:
  - Lower Administrative Units (LAU)
- Green data:
  - CLC Plus
  - Copernicus Tree Canopy Cover

# References JRC

## MAES-reports

[https://ec.europa.eu/environment/nature/knowledge/ecosystem\\_assessment/index\\_en.htm](https://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/index_en.htm)

## EnRoute

Maes, J., Zulian, G., Thijssen, M., Enhancing Resilience Of Urban Ecosystems through Green Infrastructure (EnRoute) Inception report, EUR 28653 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-69681-7, doi:10.2760/700437, JRC106443

<https://ec.europa.eu/jrc/en/publication/enhancing-resilience-urban-ecosystems-through-green-infrastructure-enroute-inception-report>

Zulian, G., Thijssen, M., Günther, S. Maes, J., Enhancing Resilience Of Urban Ecosystems through Green Infrastructure (EnRoute). Progress report, EUR 29048 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-77697-7, doi:10.2760/958542, JRC110402

[https://publications.jrc.ec.europa.eu/repository/bitstream/JRC110402/enrouteprogressreport\\_final\\_online.pdf](https://publications.jrc.ec.europa.eu/repository/bitstream/JRC110402/enrouteprogressreport_final_online.pdf)

Maes J, Zulian G, Günther S, Thijssen M, Raynal J, Enhancing Resilience Of Urban Ecosystems through Green Infrastructure. Final Report, EUR 29630 EN; Publications Office of the European Union, Luxembourg, 2019, doi:10.2760/689989, JRC115375.

<https://publications.jrc.ec.europa.eu/repository/handle/JRC115375>

## Oppla

<https://oppla.eu/groups/biodivercities>

## Biodivercities

<https://oppla.eu/groups/enroute>

# References JRC

## Biodivercities

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