GreenInUrbs:
WG1 Environmental services of Green Infrastructure and Urban Forests and implications of climate change

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Green Infrastructures: nature based solutions for sustainable and resilient cities
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Cost Action FP1204 - ***GreenInUrbs***

Green Infrastructure approach: linking environmental with social aspects in studying and managing urban forests

WG2
Social / Cultural services of GI and UF

WG1
Environmental Services of GI and UF and implication of climate change

WG4
Integration and Dissemination to stakeholders

WG3
Governance of UF in a GI approach

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Objectives

- Qualitative and quantitative data on the environmental services (such as climate change mitigation, water control, phytoremediation, energy saving, microclimate improvement) provided by UF and GI will be collated

- The activities of this WG will also focus on defining the threats represented by climate change on UF

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Focus on trees

What kind of processes/data are we interested in?
(Environmental Ecosystem Services: envESS)

Carbon

Water

Energy

Biodiversity

Air Quality

Soil Quality

Wood and bioenergy production

Phenology and pollen dynamics

Food production (foraging)

Global change

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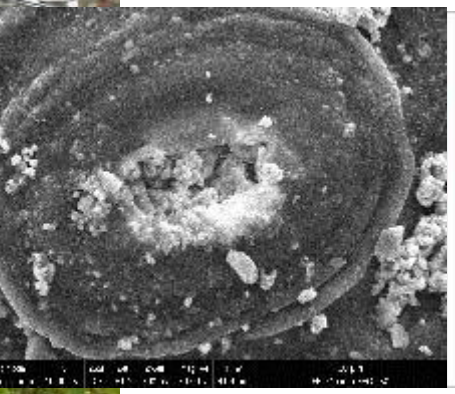
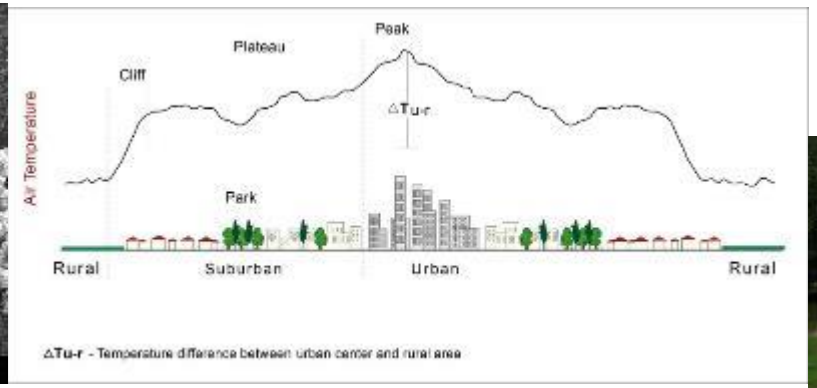
Tree species composition and characteristics

What kind of processes/data are we interested in?
(Environmental Ecosystem Services: envESS)

Air & Climate





Delivery of goods

Biodiversity

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Tree species composition and characteristics

Citizen science and air quality monitoring: European level

- Leaf collection: London plane tree (***Platanus* sp.**)
- **3 environments** (street / residential / park)
- **5 leaves** between 3 and 5 m height
- **Metadata:**
  - *location* of trees (coordinates, street distance)
  - *dimension* of trees (diameter, sampling/tot.height)
  - *distance* of trees to *AQ monitoring* station
  - *AQ data* since leaf development of PM10, PM2,5
  - days without *rain before* sampling
  - *traffic* density
- Analysis of leaf deposited **PM**:

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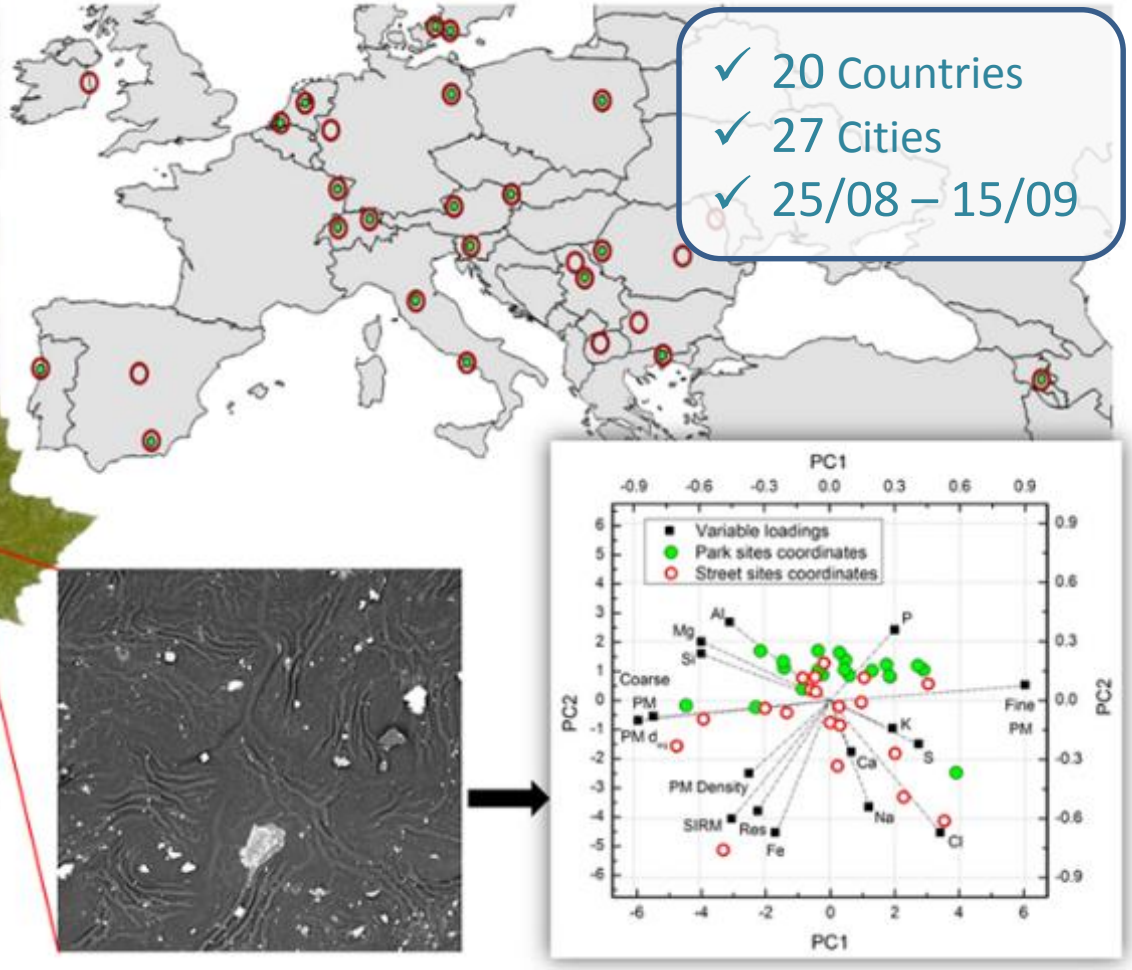
Citizen science and air quality monitoring: European level



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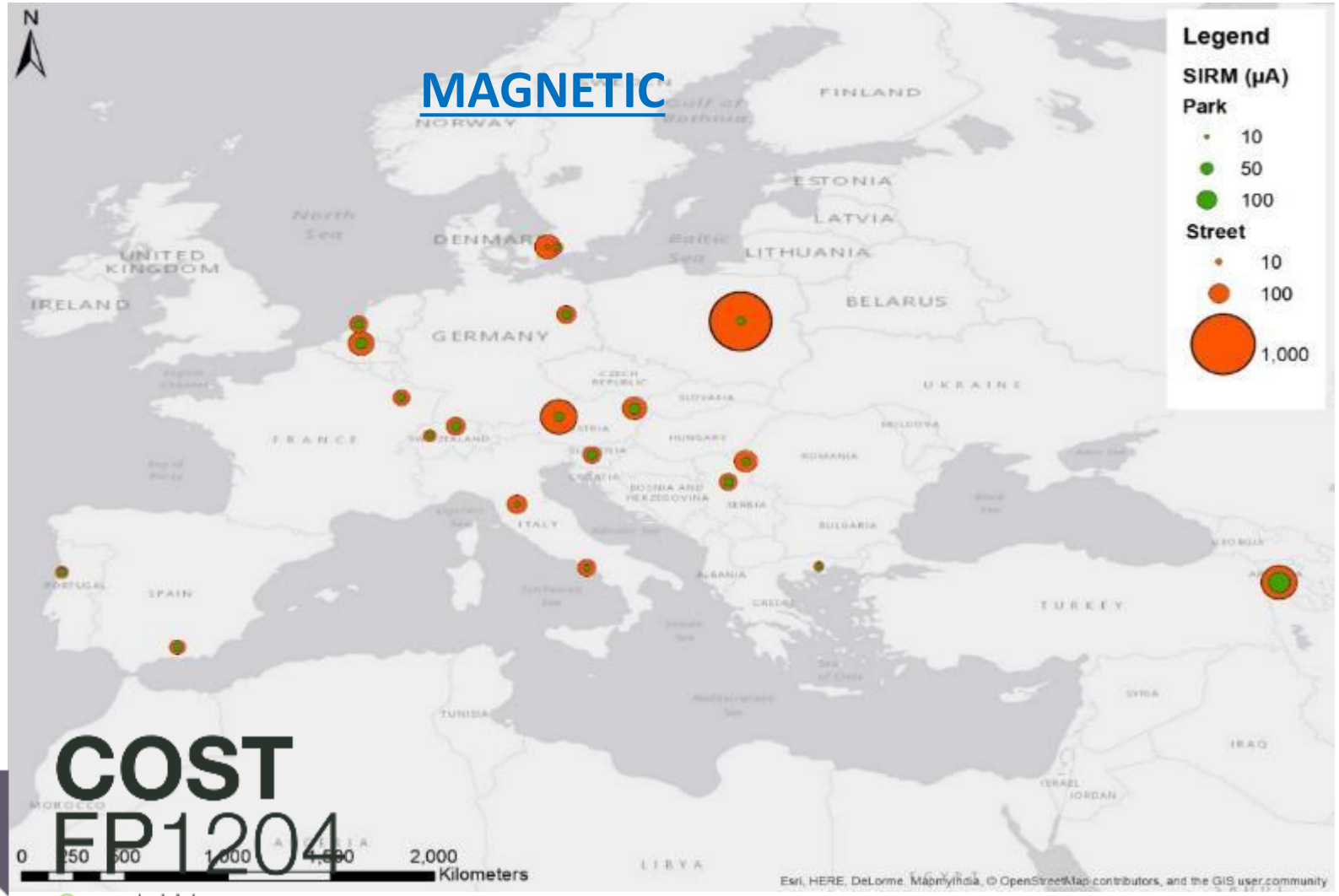
Citizen science and air quality monitoring: European level



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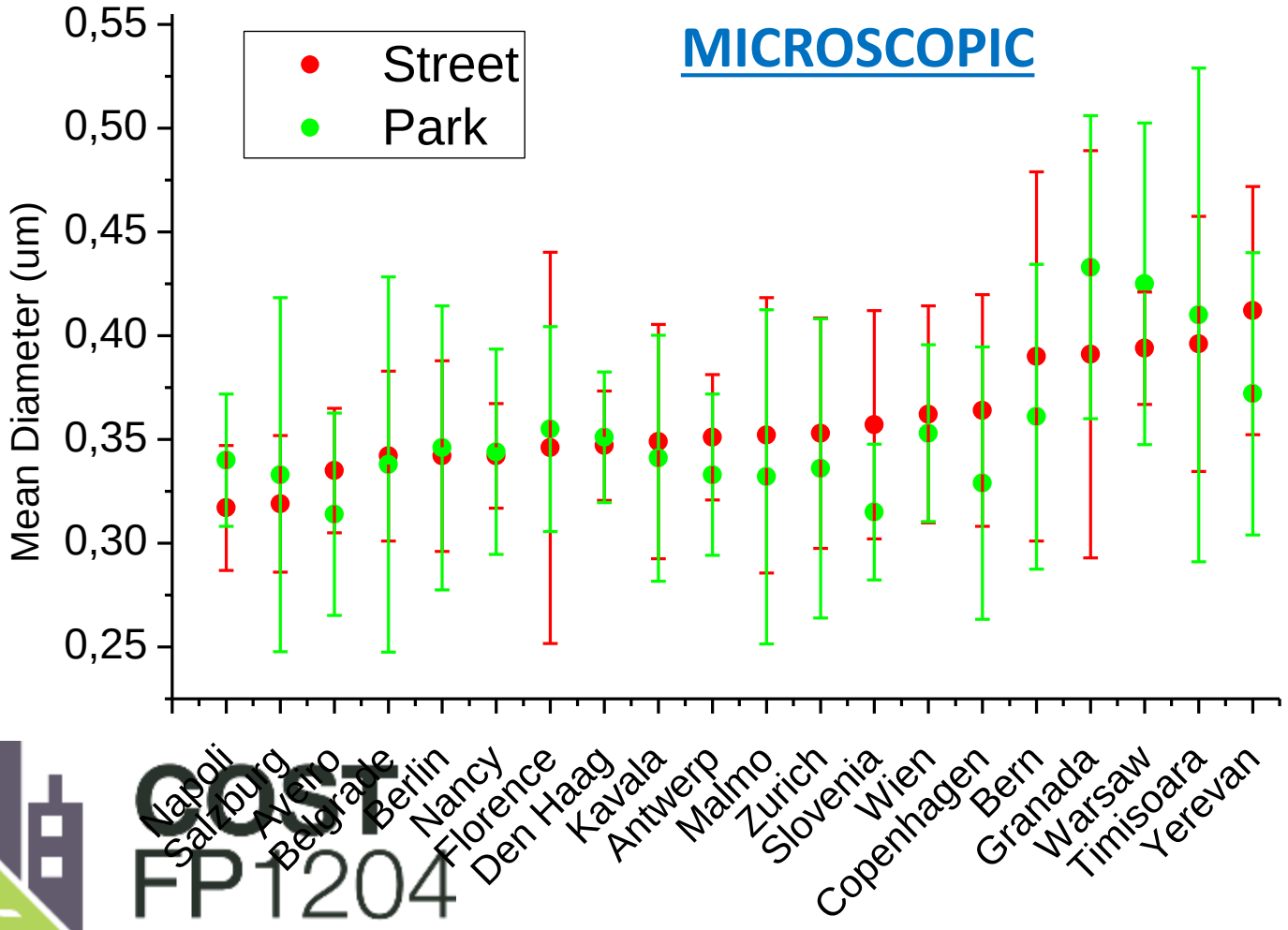
Citizen science and air quality monitoring: European level



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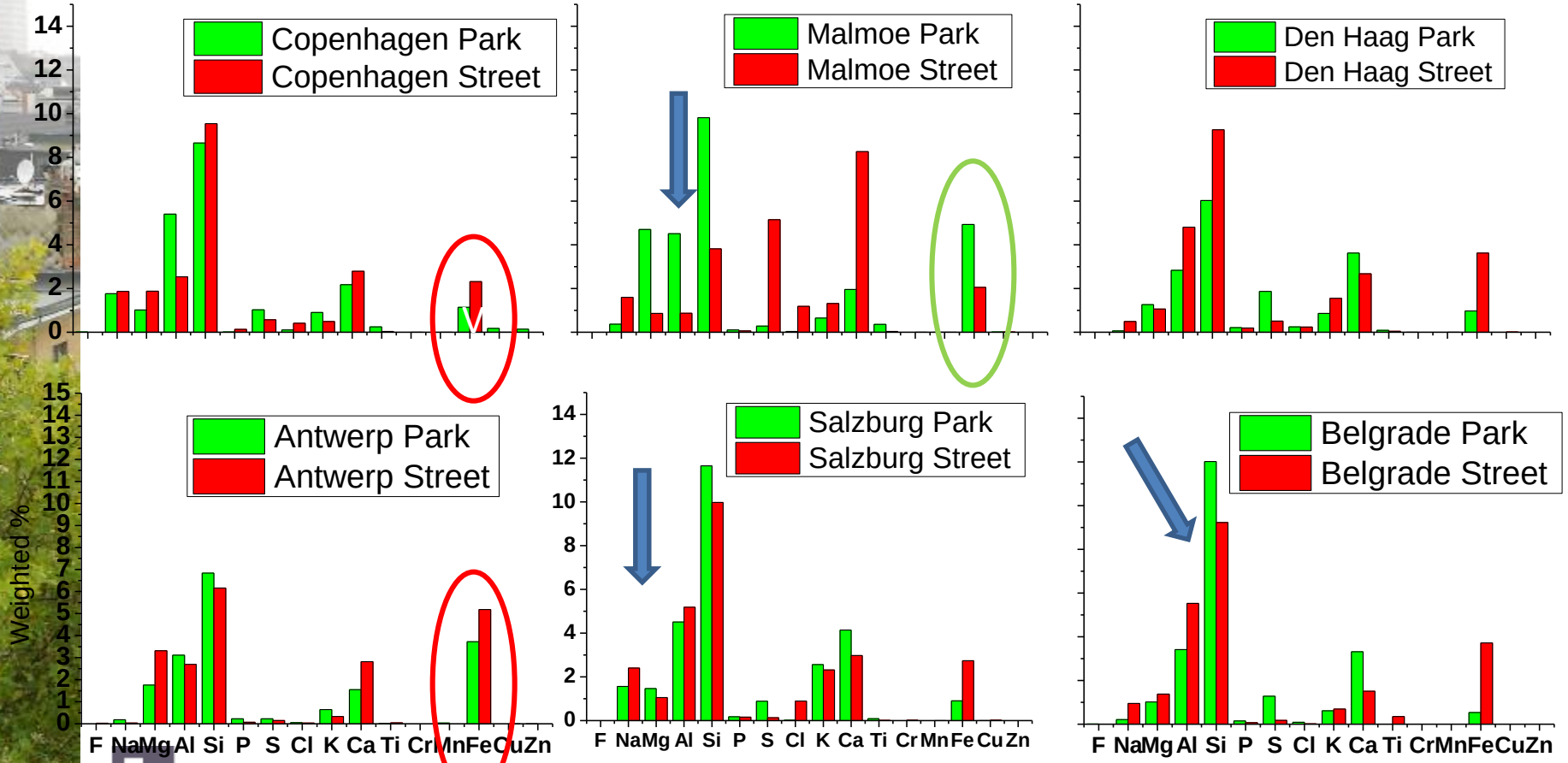
Citizen science and air quality monitoring: European level

ELEMENTAL COMPOSITION



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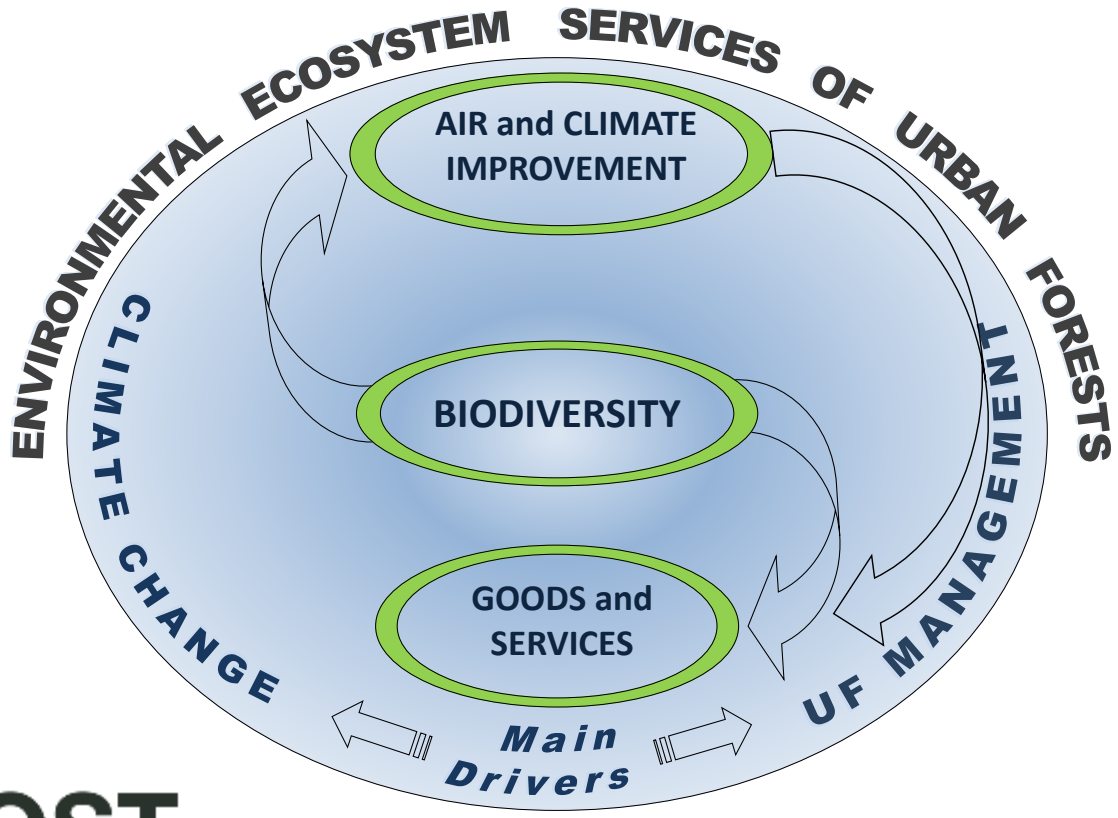
Baldacchini et al. (2017)
Environmental Science and Technology

Position paper: Evaluating the environmental ecosystem services provided by urban forests



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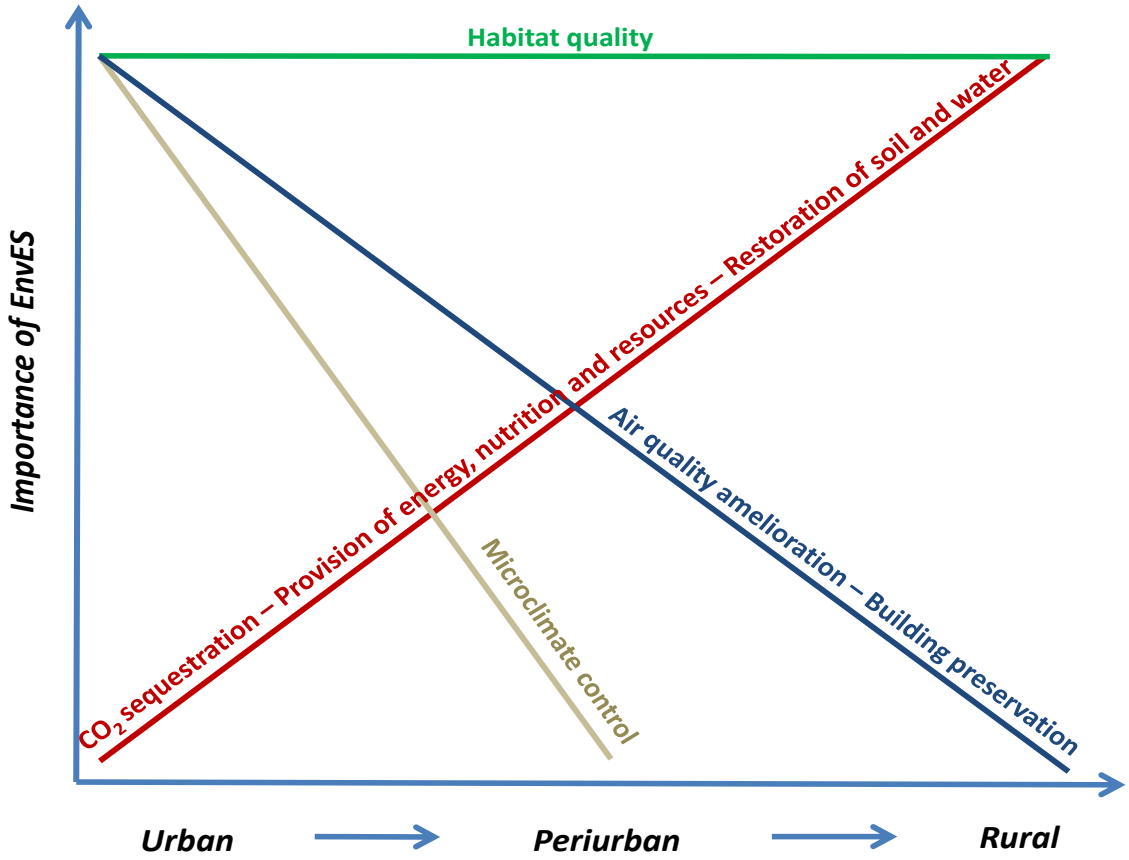
Position paper: Evaluating the environmental ecosystem services provided by urban forests



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Position paper: Evaluating the environmental ecosystem services provided by urban forests

1. Air pollution
2. Soil/water retention
3. Thermal comfort
4. CO2 sequestration
5. Species rich communities
6. Nursery for saproxylic species
7. Resilient communities
8. Genetic flow
9. Bioenergy and compost
10. Food and feed
11. Non-timber forest products
12. Building preservation

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EnvES category/type/ benefit	Indicator	Link to benefit
REGULATION OF AIR, WATER, SOIL AND CLIMATE		
Amelioration of air quality		
1: Reduction of air pollution		
	Stand characteristics (density, continuity, age) ° (Vilhar and Simončič, 2012; Frehner et al. 2005)	1,2,3,5,6, 7,8,12
	Tree characteristics (architecture, DBH, LAI, canopy height, tree height) ° (Tiwary et al., 2016; Nowak et al. 2002; Colding and Barthel, 2013)	1,2,3,4,5, 6,9,12
	Leaf physical traits (shape, persistency, orientation, wettability, hairness, roughness, toughness, albedo) ° (Llorens and Domingo, 2007)	1,2,3,4,5, 9,12
	Stomatal conductance ° (Li et al., 2007)	1,3,4
	Concentration of gaseous pollutants * (Kumar and Imam, 2013)	1,12
	Air temperature and humidity (VPD) * (Tiwary and Kumar, 2014)	1,3,11,12
	Wind speed and direction * (Tiwary and Kumar, 2014)	1,3,11,12
	Tree placement (distance to road, arrangement, orientation) (Amorim et al. 2013; Salmond et al. 2013; Vos et al. 2013; Gromke and Blocken 2015)	1,3,12
	Biogenic volatile compound (BVOC) emission ° (Calfapietra et al., 2013)	1
	Pollen production (Cariñanos et al. 2016; Ziello et al. 2012) °	1

Thematic papers

Air and Climate

1. Carbon
2. Urban heat island
3. Air pollution mitigation [Review: Grote et al. (2016) Frontiers in Ecology and Environment]

Biodiversity

Goods and services

5. Enhancing the potential of underutilised services
6. Evaluation of the regional trends in Europe in utilization of urban GI

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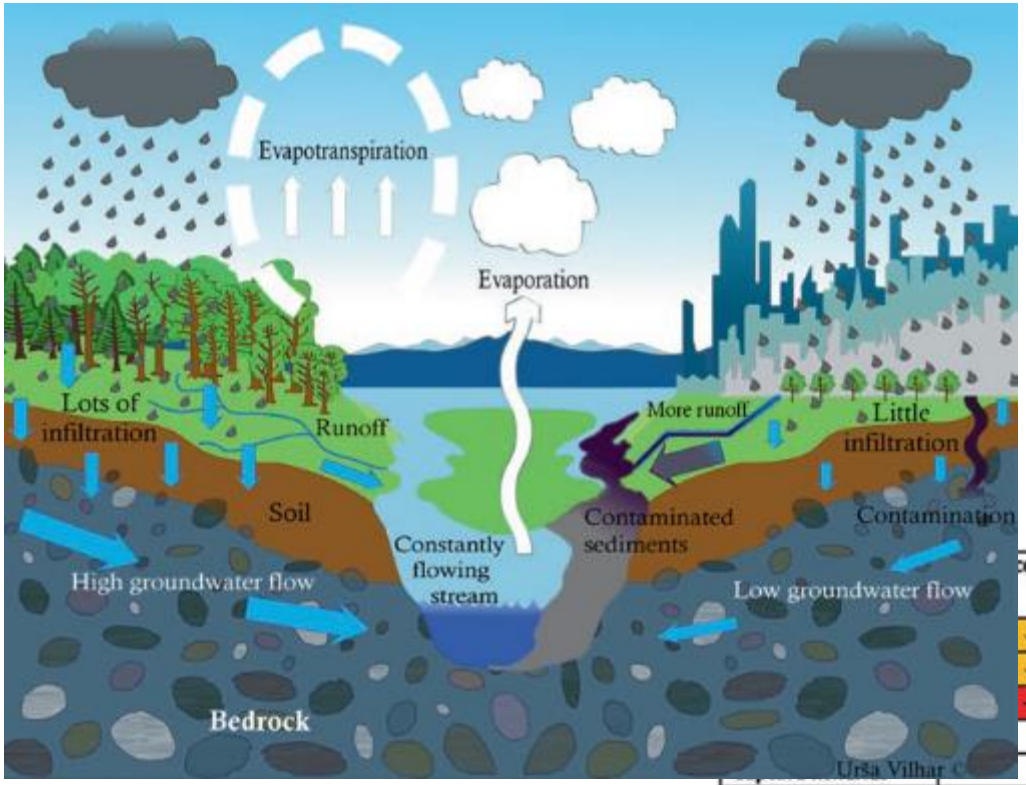
Book chapter

1. *Introduction: Urban Trees as Environmental Engineers*
2. *The Urban Heat Island: Thermal Comfort and the Role of Urban Greening*
3. *Urban Trees and Their Relation to Air Pollution*
4. *Carbon Sequestration by Urban Trees*
5. *Water Regulation and Purification*
6. *Soil Quality*
7. *Delivery of Goods and Services*
8. Biodiversity as Support for Ecosystem Services and Human Wellbeing
9. The Cost of Greening: Disservices of Urban Trees
10. Case Studies: Modeling the Atmospheric Benefits of Urban Greening
11. Assessing the Ecosystem Services Deliverable: The Critical Role of the Urban Tree Inventory
12. Species-Specific Information for Enhancing Ecosystem Services
13. Conclusions and Recommendations

Book chapter



	cosystems	Forests	Grasslands	Heath and scrubs	Wetlands	Lakes and rivers
	↓	↑			↓	
	↓	–	–	–	↓	
	–	↓	↓		–	
		–		–		
					–	–
Aquaculture					↓	↓
Genetic	–	↓	↓	–	–	
Fresh water		↓			↑	↑

Trends between periods	↑ Positive change between periods 1950-1990 and 1990-2010		– No change between periods 1950-1990 and 1990-2010		↓ Negative change between periods 1950-1990 and 1990-2010
Status for period 1990-2010	Degraded	Mixed	Enhanced	Unknown	Not applicable

Book chapter

Table 12.1 Catalog of common and potential urban tree species in Europe, and their ecosystem More detailed information on how to read, interpret and understand the table is given in the this

Species	General tree characteristics			Contribution to environmental ecosystem services			
Scientific name	Hardiness	Soil pH	Drought tolerance	Microclimate regulation	Air pollution mitigation	Soil quality	Net CO_2-sequestration
Acer buergerianum (D)	6b–8	<7.0	Moderate	H			
Acer campestre (D)	5–8	<5.5–>7.5	High	M	High	Moderate	Low
Acer negundo (D)	4–8	<7.5	Low	H	Moderate	Moderate	Moderate
Acer platanoides (D)	4–7	<5.5–<7.5	Moderate	H	Moderate	Moderate	Moderate
Acer pseudoplatanus (D)	4–7	<5.5–<7.5	Moderate	H	Moderate	Moderate	Moderate
Acer rubrum (D)	4–9	<5.5–<7.0	Low	H	High		Moderate

Book chapter

service-related traits. Species are indicated as coniferous (C), deciduous (D) or evergreen (E). chapter's text

			Disservices		Sensitivity	
Precipitation interception	Delivery of goods	Food source	Allergenicity*/ toxicity	BVOC emission*	Salinity tolerance	Snow tolerance
	Low		Moderate	Moderate	Moderate	
Low	Moderate (t)	Pollinators (n+p)	Moderate	Moderate	High	
Low	Moderate (t)	Pollinators (n+p)	High (male)	Moderate	Moderate	
Moderate	Moderate (t)	Pollinators (n+p)	High	Moderate	Moderate	High
Moderate	Moderate (t)	Pollinators (n+p)	High	Moderate	Moderate	
Low	Moderate (t)	Pollinators (n+p)	High (depend. cultivar)	Moderate	Low	Moderate

Conclusions

Very active COST-action

Very active WG1, with as major outcome:

- a common European sampling campaign
- 8 peer reviewed scientific papers
- a book chapter -
- a list of the major European urban tree species and their characteristics (for ESS + management, ….)

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Very active WG1, with as major outcome:

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- many STSM
- collaborative publications
- collaborative (European) projects submitted and obtained

-> 60 authors (from all over Europe)

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Thanks for your attention!