PHENOTYPE

Health from outside in

Positive health effects of the natural outdoor environment in typical populations of different regions in Europe

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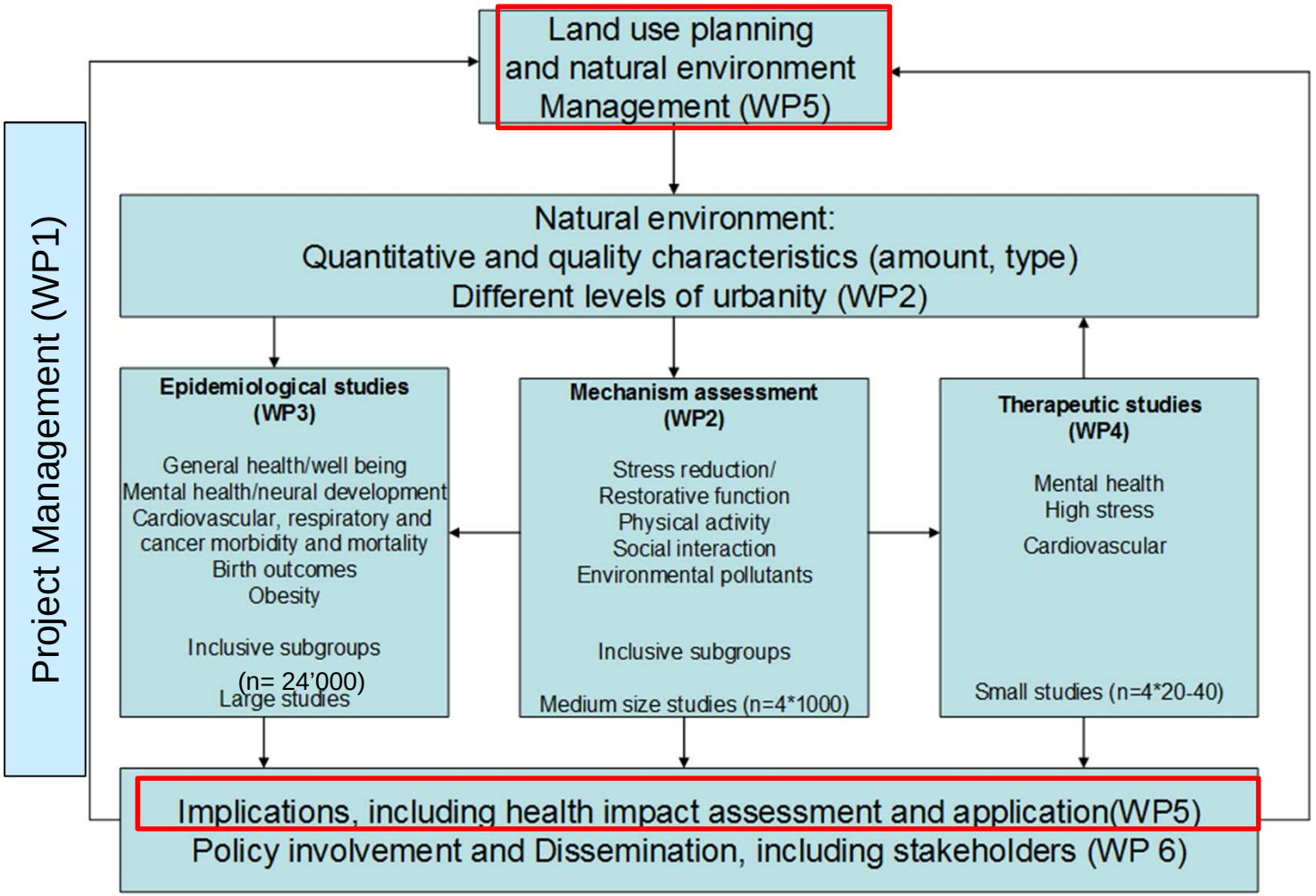
Setting the Scene: Research Questions

How can we explain that close contact with nature brings benefits to human health and wellbeing?

1. What *quantitative and qualitative* characteristics of the natural environment are important?
2. How does the way people *perceive* the natural environment influence this relationship?
3. How does the way people *use* the natural environment influence this association?
4. How does the *importance* people attribute to the natural environment influence this relationship?
5. Are there *differences between subpopulations* in these associations?

PHENOTYPE Structure & Organization

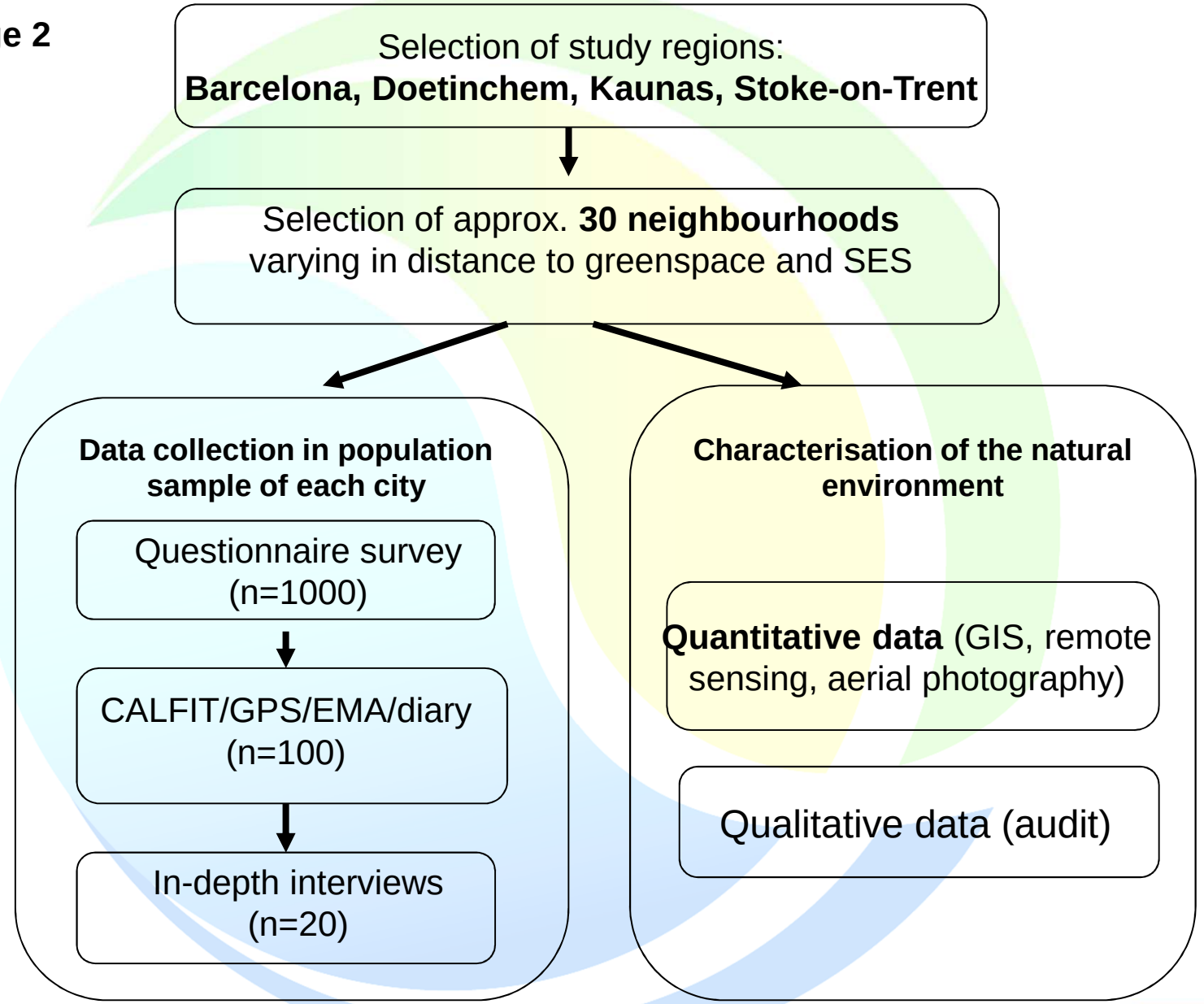


What is New ?

Data Collection in Barcelona,Spain; Doetinchem, NL; & Kaunas, Lithuania; Stoke-on-Trent, UK;

- characteristics and uses of natural environments
- use of, perception of, and attitudes towards the natural environment
- physical activity, stress reduction, social interaction/social cohesion, exposure to environmental hazards
- self-reported health & well-being
- experimental studies
- socio-demographic variables: age, gender, education level, employment status.

Workpackage 2



Diverse Research Methods, Different Results

- Overall project: the role of mechanisms /mediators varies between health outcomes (general and mental health)
- Overall project: different research methods provide different results (e.g. questionnaire survey vs. smartphone data analysis regarding contact with NOE)
- Overall project: some differences in health outcomes for subpopulations are not confirmed by pooled data
- Overall project: there are some significant differences between results in the 4 European cities

Questionnaire Survey (4* 1000)

- **Face-to-face**, except for Lithuania; max. 1 hr

- **Topics:**
  - Residential situation
    - ✓Green and blue space

      availability, use, satisfaction, importance
    - ✓Dwelling & area

      satisfaction, acoustical quality, annoyance, social contacts, a.o.
  - General & Mental health & wellbeing

    BMI, coping, restoration, physical exercise, lifestyle
  - Personal characteristics & lifestyle
  - Concentration test.

New Methods: Smartphones (4*100)

- Aim: To obtain data on -
  - physical activity and positioning
  - mood
  - environmental perception
- 7 days
- Android based application ‘Calfit’
- Ecological Momentary Assessment of mood
- Diaries (entrance, daily, exit)

New Methods: Smartphones (4*100)

- First time smartphones used to record actual time spent in natural environments in 4 European cities.

- Data analysis is complicated & time consuming but provides interesting results based on real time spent in natural environments rather than general calculations about exposure.

- Results about mental health outcomes:

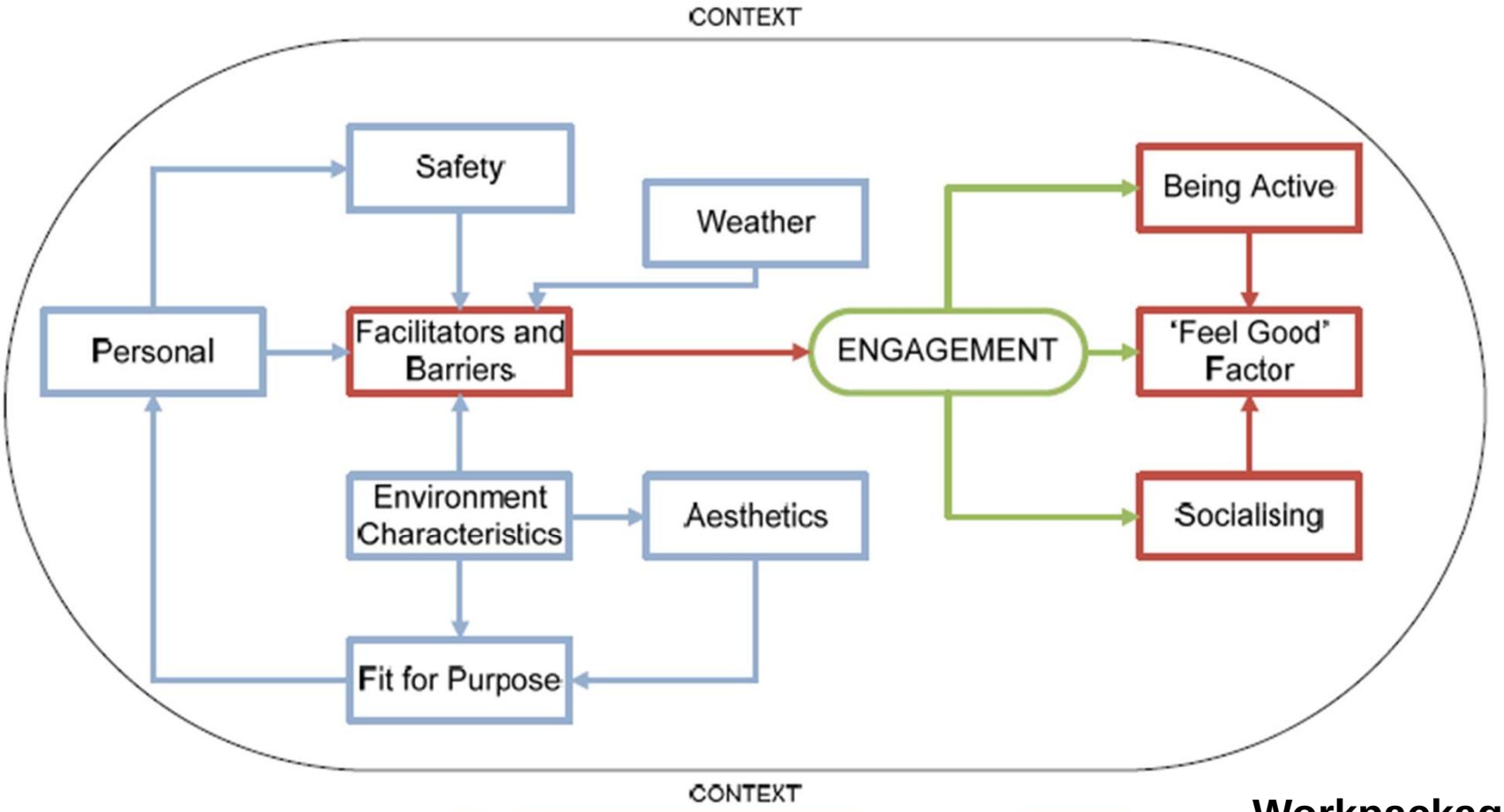
  - no association with general exposure to natural environment

  - associations found with actual time spent.

In-depth interviews (4*20)

- Semi-structured
- Research questions about potential and actual uses:
  - How and why do people engage (or not engage) with the natural environment in relation to physical activity; social interaction; stress reduction; attention restoration; and environmental hazards?
  - What are the barriers and facilitators to engagement with the natural environment in relation to potential mechanisms?
- Thematic analyses.

Thematic Map In-depth Interviews: Example Stoke-on-Trent



Workpackage 4

Experimental Studies in Cities

Health Outcomes: Preventive (Stoke-on-Trent, UK)

In healthy, unstressed adults, light intensity walk in a natural environment confers greater benefit for perceived restoration and cognitive function; but pleasant urban and natural environment walks reduced stress and improved mood for all, over and above a healthy, unstressed baseline

Health Outcomes: Preventive (Stoke-on-Trent, UK)

In healthy, unstressed adults, repeated light intensity walks in a natural environment conferred similar changes each day (not differentially attenuated or increased by environment).

Workpackage 4

New Characterising of Natural Environments

Aim

Consistent classification of natural environments

Three levels

1. **Basic Measures (level 1):** Using Europe-wide, secondary data (e.g., NDVI; Urban Atlas)
2. **Detailed Measures (level 2):** Using locally held secondary data (City Council, etc.) for a more detailed classification of environments
3. **Environment Quality:** Primary data collection using a Streetscape Audit and Neighbourhood Green Space Tool to report environment quality data

Typology	Barcelona		Stoke-on-Trent		Doetinchem		Kaunas	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Parks	657.11	6.93	364.46	5.53	71.01	1.23	743.76	7.61
Semi-natural / natural	3.23	0.03	764.23	11.60	34.80	0.60	509.10	5.21
Formal Recreation	1.38	0.01	686.60	10.42	44.83	0.78		0.00
Civic space	291.96	3.08	7.80	0.12	9.23	0.16	3,825.31	39.15
Functional / Amenity + Street greenery	34.00	0.36	1,084.40	16.46	193.30	3.35	1.34	0.01
Natural / green corridor	73.58	0.78	170.47	2.59	57.66	1.00	54.26	0.56
Derilict / vacant	4.04	0.04	627.86	9.53	4.37	0.08	136.49	1.40
Woodland / Forests		0.00	1,617.70	24.55	859.55	14.90	2,189.13	22.41
Rural and agricultural land		0.00	839.11	12.74	4,430.39	76.78		0.00
City parks	8,295.09	87.43	311.93	4.73		0.00		0.00
Lakes / resevoirs / ponds (standing water bodies)		0.00	87.54	1.33	20.02	0.35	631.10	6.46
Rivers, streams, canals (linear water features)	102.81	1.08	26.20	0.40	44.74	0.78	1,679.44	17.19
including beeches (type of coastline)	24.12	0.25		0.00		0.00		0.00
Total	9,487.32	100	6,588.30	100	5,769.90	100	9,769.91	100

Characterisation Natural Environment-Audit

Domains	Items	Items (summarised)
1. Access	3	Entrance points, Walking paths – amount, Walking paths – quality,
2. Recreational Facilities	7	Playground equipment, Grass pitches, Courts, Skateboard ramp(s), Other sports or fitness facilities, Amount of open space (for informal games, play and walking), Quality of open space (for informal games, play and walking)
3. Amenities	8	Seating/benches, Litter bins, Dog mess bins (or equivalent), Public toilets, Cafe / kiosk, Shelter/shade - man-made, Picnic tables, Drinking fountains
4a. Aesthetics (Natural features)	3	Primary surface quality, Flower beds / planters / wild flowers, Other planted trees / shrubs / plants
4b. Aesthetics (Non-natural)	3	Water fountain (decorative), Other public art, Historic/attractive buildings/structures
5. Incivilities	9	General litter, Evidence of alcohol use, Evidence of drug taking, Graffiti, Broken glass, Vandalism, Dog mess, Excessive noise, Unpleasant smells
6. Significant natural feature	3	% area occupied by the water (≥50%), Good view points, vistas, scenic views, % area occupied by trees (≥50%)
7. Usability (suitability for…)	11	Sport, Informal games (football, frisby, etc.), Walking / running Children's play, Conservation/biodiversity , Enjoying the , landscape / visual qualities, Meeting, socialising with friends, neighbours, etc., Relaxing, unwinding, Cycling, Water sports, Fishing

Lessons from Selected Results

- Perception of natural environment stronger & more consistent associated with mental health, social contacts and physical exercise than quantitative and qualitative characteristics of natural environment
- More time spent in the natural environment is associated with higher mental health scores, higher frequency of social contacts, and more physical exercise
- Mixed results for the importance people attach to the natural environment and outcome variables
- There are differences between cities, and
- There are differences between sub-populations: significant associations were found between perceptions of neighbourhood green space and general health of low-educated residents.

Lessons from Selected Results

- Exploratory analysis of causation:
  more in-depth systemic research is needed
- No support for the assumption that the elderly, women and residents not employed full-time benefit more from neighbourhood green space than others.
- Associations found between variables related to perceptions of, and time spent in, natural environments (especially audit amount of neighbourhood green) and mental health.
- Perceptions of residential surrounding greenness and subjective proximity to green spaces were associated with better self-perceived general health.

Key Messages for Research and Public policy

- The relationships between the natural environment and health and well-being are complex. Having a natural environment nearby does not automatically lead to more health improving activities.

  This needs to be considered in a wider (physical and social) context.

- There are differences between sub-populations and between cities. Therefore creating healthy designed natural environments requires knowledge of the local context and local populations.

- The important role of perception (e.g. attractiveness) pleads for involvement of local stakeholders and citizens in the policy and planning processes related to the natural environment and health.

- Research and monitoring to better understand human agency in relation to use of the natural environments is just as important as the quantification of green space.

The Co-Benefits of the Natural Outdoor Environment

Added value of co-benefits - some examples:

- *Health* (e.g. impacts on health & well-being)
- *Social* (e.g. diversity of human use)
- *Biological* (e.g. habitat for animals & plants)
- *Environmental* (e.g. climate change)
- *Economic* (e.g. added economic value)

Source: R. Lawrence

9 Key Variables & Indicators

- Indicators to assess the attractiveness of public green space to promote health promotion
- Multiscale analysis (street, neighbourhood, city, region).

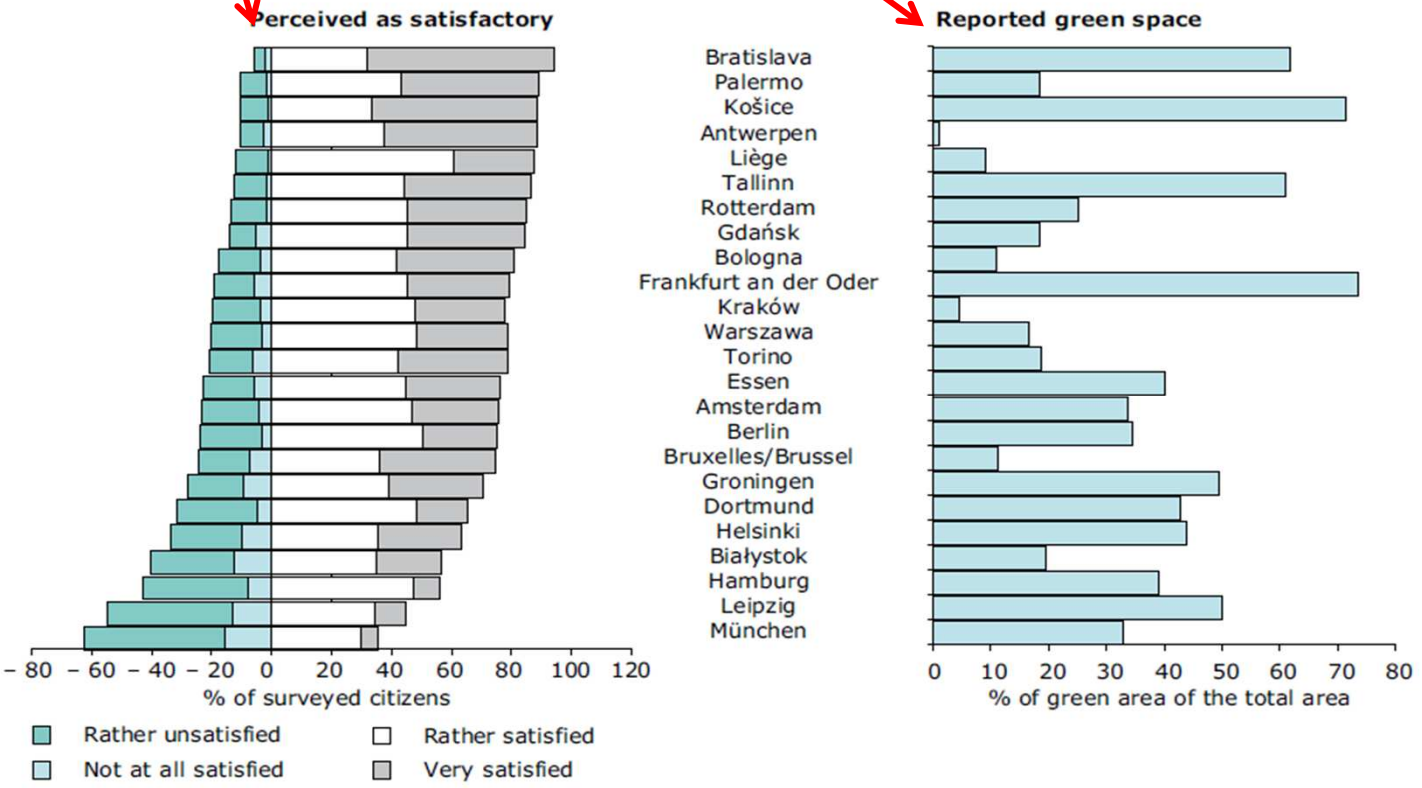
9 Categories of Key Variables

- Ownership
- Size/Shape
- Biological characteristics
- Functional uses
- Localisation
- Management
- Community and group identity
- Climate/Weather
- Nuisances

Key Variables and Indicators

- 9 categories of key variables identified
- Qualitative and quantitative measures (what is the appropriate geographic scale?)

Figure 1.4 Perceived and reported green space



Source: EC, 2007a and Urban Audit Database, data 2004 on core cities (Eurostat).

The list of core indicators related to each of the 9 key variables

Variable category	Indicator	Definition
1. Ownership	1.1 Public accessibility	Number of public green and blue spaces in the city where people have a right of access for recreational purposes
	1.2 Perceived ownership (sense of ownership)	Perception of ownership of public green and blue spaces by its users
2. Size/ Shape	2.1 Normalized Difference Vegetation Index (NDVI)	Amount of greenness in a given locality
	2.2 Relative surface area of public and private green spaces in the city	Percentage of the surface area of public and private green spaces relative to the surface area of the city
	2.3 Total public green area suitable for physical activity	Percentage of adult residents who perceive the green areas in their neighbourhood to be suitable for active recreational activities
	2.4 Perception of attractiveness of public green and blue spaces	Users perception of the attractiveness of public green and blue spaces for specific activities (jogging, walking, children's play, social contact)
3. Biological characteristics	3.1 Species diversity of public green and blue spaces	Number of species of breeding birds and vascular plants in public green and blue spaces
	3.2 Biotope diversity of public green and blue spaces	Number of different types of habitat present within the public green and blue spaces of a city or region
	3.3 Perception of biodiversity by users of public green and blue spaces	Individual assessment of biodiversity level
	3.4 Water quality	Percentage of measurements exceeding the WHO guidelines
4. Functional uses	4.1 Human-made amenities and facilities in specific public green and blue spaces	Number of human-made amenities and facilities per public green and blue spaces
	4.2 Quality of human-made amenities and facilities	Individual assessment by on-site survey on the quality of the human-made amenities and facilities
	4.3 Bathing water quality	Percentage of inland and coastal bathing waters complying with the mandatory standards and guide levels for microbiological and physicochemical parameters
5. Localisation	5.1 Distance in metres or time to walk	Distance in metres or time to walk from home or work to different types of public green and blue spaces
	5.2 Proximity of transport infrastructures	Proximity of transport infrastructures to large public green and blue spaces
	5.3 Time of travel by bike	Time of travel by bike to large public green and blue spaces
	5.4 Access points	Amount and quality of access points to public transport, pavements, cycle lanes
	5.5 Total amount of accessible public green and blue spaces	Total area of public green and blue spaces that can be accessed within 300m, 500m, and 1000m walking distance from the participant's residence
	5.6 300 meters accessibility indicator	Total number of public green and blue spaces that can be accessed within

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Localisation

5.7 Individual perception of proximity

Name of indicator: Individual perception of proximity.

Definition: Percentage of residents who perceive a given public green or blue space to be nearby.

Individual perception of distance to public green and blue spaces by on-site survey of adults, adolescents or other specific groups.

Method of calculation: on-site survey. Key question: How do you consider the distance of this green/blue space from home/ work? Possible answers using a Likert scale: ‘far’, ‘close’, ‘I don’t know’

Unit of measurement: percentage

Interpretation/comments:

- This quantitative indicator based on individual assessment can be applied at the level of cities and neighbourhoods.
- This indicator is based on the perception that people have about distance from their housing to public green and blue spaces. The distance and the means to reach the park differ according to population groups and thus can be considered as a barrier by the elderly, children or people suffering from disability.

The list of core indicators related to each of the 9 key variables

		300m of residence
	5.7 Individual perception of proximity	Percentage of adult residents who perceive a given public green or blue space to be nearby
6. Management	6.1 Waste management	Number of trash cans per public green and blue space
	6.2 Incidence of vandalism	Damage recorded in public green and blue spaces in a year
	6.3 Crime in public green and blue spaces	Percentage of people who reported presence of crime, violence, or vandalism in public green and blue spaces
	6.4 Users' satisfaction of management	User's satisfaction of public green and blue space management
	6.5 Perceived security	Individual assessment of the sense of security in public green and blue spaces
7. Community identity	7.1 Cultural identity	Uses of specific spaces for specific community events as well as informal recreation OR number of cultural features and monuments presents in public green and blue spaces OR number of social and cultural events which takes places in public green and blue spaces
	7.2 Social cohesion	Percentage of adult residents who perceive their neighbourhood public green and blue spaces to be socially cohesive
	7.3 Meaning of public green and blue spaces	Individual meaning of public green and blue spaces to be understood by field survey
8. Climate / weather	8.1 Sunlight hours	Numbers of hours of sunshine per day
	8.2 Ultraviolet radiation index	Description of the level of solar UV radiation at the Earths' surface
	8.3 Precipitation	Amount of precipitation per day
	8.4 Diurnal temperature	Average of diurnal temperature
	8.5 Perception of appropriate weather	Individual perception of appropriate weather for outdoor activities
	8.6 Perceived temperature	Perceived temperature by public green and blue spaces' users
9. Nuisances	9.1 Ambient noise levels	Sound level measurement
	9.2 Perceived noise	Individual perception of ambient noise to be gathered by field survey
	9.3 Atmospheric pollution	Assessement of the air quality in cities through evaluation of atmospheric pollutants (NO_2, CO, O_3, SO_2, Dust, Black smoke, Lead)
	9.4 Perceived conflicting uses	Individual perception of conflicts between different users of public green and blue spaces

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PHENOTYPE Policy Recommendations

- **A.** Research confirms that the specific characteristics of public green spaces influence their attractiveness for individuals and population groups, but these characteristics are still not well understood. The definition of attractiveness is dependent on multiple factors including the specific culture of users as well as the bio-physical and geographical characteristics of public green spaces, and their intended use by individuals and groups.

- **Policy makers and professional practitioners should broaden their approach about the recommended size of public green space. There is no validated norm or standard for the size of public green space!** Instead, PHENOTYPE has formulated 9 key variables of the characteristics of public green spaces that define their attractiveness. These key variables are 1.) Ownership 2.) Size and shape 3.) Biological characteristics 4.) Functional uses 5.) Localisation 6.) Management 7.) Community identity 8.) Climate/weather 9.) Nuisances. These variables have been validated by stakeholders in both the public and private sectors in 4 European countries.

PHENOTYPE Policy recommendations

- **B.** PHENOTYPE and other research show that the health benefits of access to green spaces varies between different population groups. For example, the health of cardiac-patients and especially populations with relatively low socio-economic status, benefits more than other groups from access to public green spaces, residential proximity and uses of public green and blue spaces when these are localities for health promoting behaviours.
- **Consequently, policy makers cannot avoid dealing with rights of access to and multiple uses of public green spaces for specific user groups, especially those with relatively low socio-economic status.**
- The provision and maintenance of public green spaces involves political choices that have consequences for the promotion of public health. Beyond a common concern about the quantity of public green spaces in large urban areas, it is important to address social justice, such as issues of equity and fairness, especially those populations in residential neighbourhoods that do not live nearby these kinds of public spaces.

PHENOTYPE Policy recommendations

- **C.** PHENOTYPE and other research confirm that investments in the provision and the maintenance of public green spaces are also investments in public health. Public green spaces serve multiple functions, having co-benefits such as providing a cooling effect during periods of extreme heat; the absorption of storm water in case of prolonged rainfall or flash flooding; a retreat from relatively high ambient noise levels; and attractive localities for different kinds of health promoting behaviours (e.g. physical activity, children's play, social interaction).
- **Consequently, valuations of public green spaces should be requested by policy makers before they decide about the provision and maintenance of these spaces. The intrinsic value of these spaces, and especially those having high biodiversity, should not be equated with exchange values of land markets.**

PHENOTYPE Policy recommendations

- **D.** Research shows that the multiple uses of public green spaces highlight conflicts of interest between local residents, visitors, elected officials and civil servants especially concerning their rights and responsibilities. Public green spaces can be localities for small group or larger community meetings, recreational activities of members of local associations, or informal interaction between individuals. These spaces can also be sites for incivilities, drug trafficking or muggings.
- **Therefore, appropriate landscape designs, management strategies and regular surveillance are necessary to prevent public green spaces becoming unattractive for health promoting behaviours.**
- Alternative maintenance projects and management regimes founded on common property rights can enable local communities to maintain and manage these spaces.

PHENOTYPE Policy recommendations

- **E.** Research shows that a lack of information and coordination between departments in local and national authorities concerned about land-use planning, green space management, transport and road infrastructure, social care and public health is not only common but also problematic and should be addressed.
- **Consequently, intersectoral initiatives developed from a strategic and holistic vision, can provide a shared framework for the provision and maintenance of public green spaces that are attractive localities for healthy behaviours.** This kind of initiative could begin with pilot projects in order to show the added value of intersectoral collaboration. Outcomes can only be effective if there is strong political commitment and sufficient resources.
- General practitioners should be interested in health promotion and prevention by diverse uses of public green and blue spaces. Doctors could attend public meetings about land use planning projects by local authorities in order to integrate health promotion into decision making processes. Public authorities should inform citizens about the health benefits of contact with public green and blue spaces.

PHENOTYPE Policy recommendations

- **F.** Research shows that there is a lack of data and information about the characteristics of public green spaces in several European countries. Proxy measures are frequently used rather than measured variables in specific localities. This “missing information syndrome” is even greater with respect to the diversity of users, the multiple and diverse functions of public green and blue spaces, and the behaviour of residents and visitors in public green spaces.
- **Consequently, there is an urgent need for policy makers and professionals to have access to reliable data and different kinds of information about the inherent characteristics and the multiple functions and uses of public green spaces. Systematic monitoring of these spaces is necessary.**
- In addition to allocating public funds to fill this gap, citizen science could contribute to the collection and dissemination of data and information if local authorities and institutes of higher education and NGOs develop partnerships for their mutual benefits.

Forward Look

- **Rethinking Research Agendas**

  Funding research: need for in-depth systemic contributions

- **Quantification** VS **Creative & Integrative Thinking**

  Addressing Complexity, Differences, & the Web of causality

  Overcoming the lack of cumulative empirical research

- **Beyond Rhetoric: Bridge the Gap!**

  Research for whom?

  Improving societal impact: need for transdiciplinarity

Conclusion

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