Smart Control of Air Pollution

Policy Briefs from the **iSCAPE** project funded by the European Union's Horizon 2020 Research and Innovation Programme

Urban strategies and interventions for planning healthier cities

Contents

Key Take-Aways

Cities and urban areas are particularly affected by the negative consequences of air pollution and climate change driven extremes (e.g. floods, heat waves) due to higher population density, assets and heavily sealed and built-up areas. Thus, cities face new challenges in terms of adaptation and mitigation strategies.

This Policy Brief argues that **spatial planning and the management of urban development offer considerable opportunities for more tightly integrated pro-environmental approaches, adaptation to climate change, strengthening resilience, reducing carbon dioxide emissions and promoting more sustainable development pathways in a city.** However, the identification and selection of integrated, tailor-made and cost-effective interventions, as well as their prioritisation in terms of efficient resource management, **require a clear and systematic framework that can neither be designed and implemented by city planners alone nor without involving all relevant actors.**

So we recommend adopting, and in-depth sharing with all major urban stakeholders, of a detailed - yet flexible and informal - action plan, accompanied by a sustainable implementation strategy. Urban action plans help to make cities more resilient and liveable in the face of climate change. Cities of different sizes and with very different individual impacts and approaches can be supported in adapting to climate change and improving air quality. In doing so, not only political support, but also a multi-perspective evaluation can be ensured, making the planned measures both technically feasible and socially acceptable.

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"Let's plan the Green together!"

Title of a community building event in the pilot city of Bologna.

The Concept

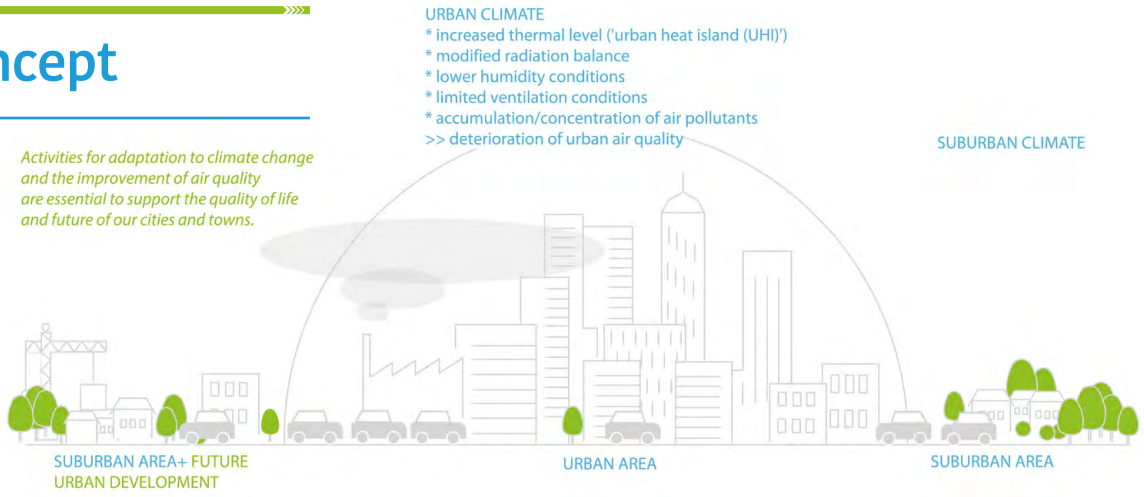

Figure 1: Urban climate and its interaction with urban development.

As Figure 1 shows, the characteristics of the urban climate driven by human activities are fairly well known, especially in contrast with the less built-up and greener surroundings of a city. The effects of climate change and increasing air pollution pose enormous challenges to the design of our way of living and our urban environments.

Exposure to air pollution, including different particulate and gaseous pollutants, is one of the main health hazards in urban environments worldwide, together with an increased thermal level (the so-called urban heat island effect). **The combination of pollutant sources and poorly ventilated areas, such as narrow street canyons, can quickly lead to the accumulation and local concentration of air pollutants above air quality standards.** To tackle these effects, adequate strategies of mitigation and adaptation are required.

Future urban development can also contribute to environmental threats such as air pollution and heat stress through decisions on further land use. A new urban settlement or the extension of an existing one is usually a trigger for more car traffic, particularly due to the daily commuting of inhabitants to and from the city centre, predominantly caused by individual car drivers.

Strategies to mitigate and/or compensate air pollution and urban heat generally emphasise cooling/absorbing surface materials, extension of green elements and 'new' green infrastructure technologies (e.g. green roofs/surfaces), modifications in the urban structure (e.g. building configurations and locations) and traffic related measures. **Interventions** within this range of themes **act at different spatial scales** (see Figure 2) and are either applicable on urban, neighbourhood or street levels.

In countries such as Germany or Italy, the spatial level of interventions is also relevant in terms of legal competence to undertake certain policy

actions. For example, interventions at an urban level are decided by municipal councils, while interventions at a neighbourhood and street level may be discussed by district councils first.

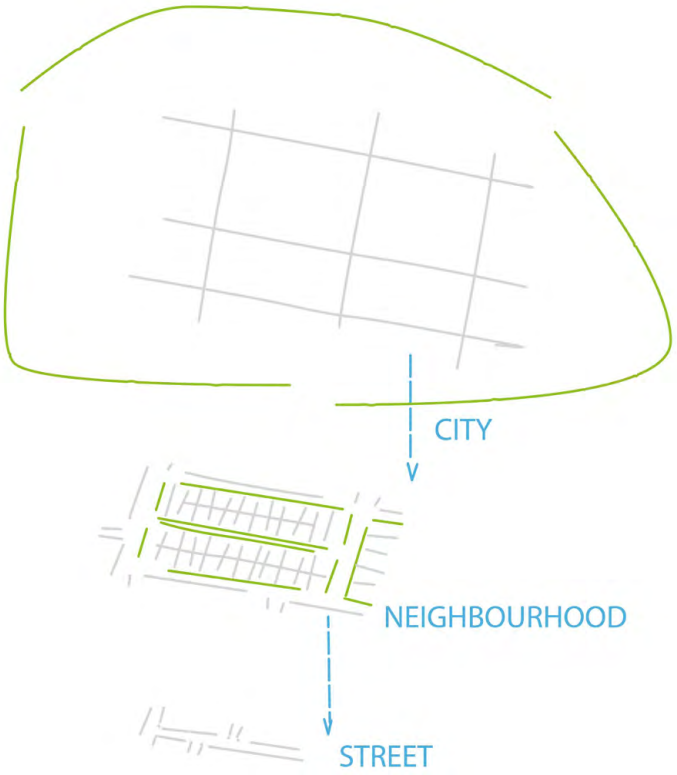

Figure 2: Different levels of planning (based on administrative levels and levels of effectiveness).

The Approach

All this and other evidence show the **importance of urban design and planning, as well as its underlying decision-making processes**, to control, prevent and reduce environmental and climatic impacts. This is further reinforced by a status quo analysis that is recommended before undertaking any structured action, which takes into account a considerable number of quantitative and qualitative parameters and indicators, such as those listed in Table 1 below. The status quo analysis leads to baseline information and deeper reflections on such topics and interventions as those displayed in Figure 3.

Quantitative parameters and indicators	Qualitative parameters and indicators
Urban structure (e.g. sealed ground, population density, urban form)	Political objectives, guiding principles and overall concepts of a municipality
Transport (e.g. commuter outflows, density of motorways, equipment rate for public transport vehicles, road freight vehicles, presence of airport and/ or sea freight port)	Organisational structure in administrations (e.g. (integrated) working groups, (network of) specialist offices and departments)
Industry and trade (e.g. industrial area)	Variety of informal and formal planning instruments
Urban green and agricultural land (e.g. urban green (including forests), agricultural land)	

Table 1: Examples of quantitative and qualitative parameters and indicators for a status quo analysis of urban (infra-)structures and organisations.

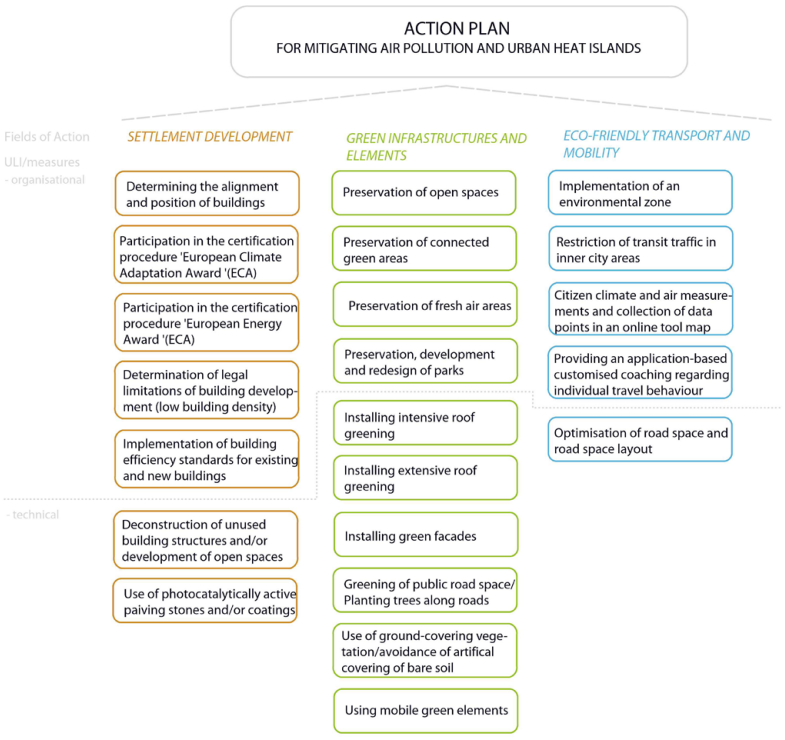

Figure 3: Examples of urban level interventions for mitigating air pollution and urban heat islands as part of an action plan.

What available evidence and interdisciplinary information exchange shows is that many opportunities for synergy can be grasped and potential conflicts can be avoided by a purposeful act of planning.

Without this act of planning, the risk becomes high that uncoordinated actions may lead to an inefficient use of the often limited municipal resources or even to the implementation of conflicting measures.

In some cases, numerical simulations can be used to support decision-making, with the analysis of climate change and air pollution trends, with and without policy interventions. In other cases, a multi-criteria analysis (method for the analysis of possible decisions and actions) and qualitative weighing can be performed, with the intent of weighing the different options according to prioritisation criteria.

The Process

Against this background, **the adoption of the informal instrument of an action plan** is proposed in order to provide urban planners and other local decision-makers with a clearer orientation for the complex and demanding task of developing, implementing and reviewing spatially-related strategies that successfully deal with the environmental and health consequences of climate change and human activities. The approach adopted and experimentally followed for this action plan to materialise has been tested for the first time in the iSCAPE pilot run in the German city of Bottrop (see Figure 4).

Starting with a status quo analysis, suitable objectives and sustainable strategies were identified. The interventions in line with the strategic direction, and considered as suitable, were assessed ex-ante by an interdisciplinary technical team and supplemented by the results of the multi-criteria analysis, during a first workshop. In the case of Bottrop, the status quo analysis highlighted e.g. the low presence of green spaces, with negative consequences on both urban climate and the quality of residents' lives.

Based on the previous results, **intervention fact sheets** (containing information about the time-horizon, costs, effectiveness, suitability, synergies, conflicts, side effects, and further comments) were developed and shared with a broader stakeholder audience during the second workshop, including an exercise of qualitative weighing of associated priorities. In particular greening interventions provide a high potential of synergies even though they could cause conflicts that are controversially discussed by experts.

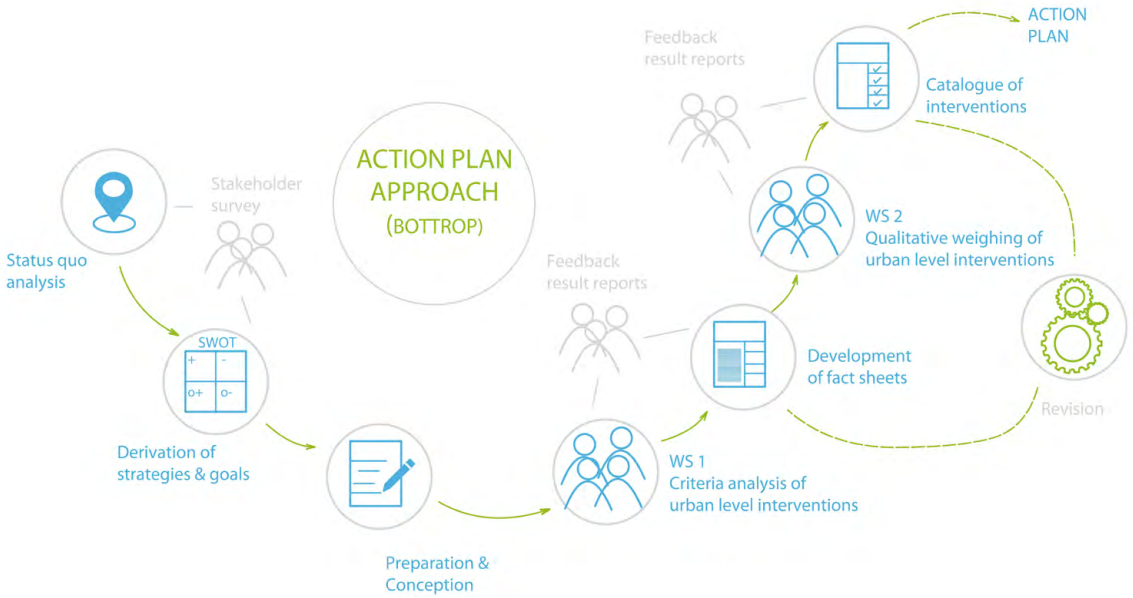

Figure 4: Steps of the action plan approach tested in the case city of Bottrop.

The final **catalogue of interventions** has therefore the nature of both a collection of technically feasible and socially validated initiatives. In fact, during the process the **action plan has been adapted to the needs and expectations of the respective community members** and has better specified the individual steps required to achieve its predefined objectives in an integrated, tailor-made and cost-effective manner.

Figure 5: Impressions of the second co-creation workshop with citizens as part of the field trial/ living lab "Wandering Trees". © Uwe Grützner, TU Dortmund University

However, when it comes to implementation, a number of conditions need to be met to ensure a full realisation of the action plan's goals and objectives. These involve once more the urban stakeholder groups, who play an essential role in the development as they did in the design process. Globally speaking, the **support of political decision-makers is of great importance** since their agreement is the linchpin to implement an action plan. However, the participation (see Figure 5), consent and **acceptance by the citizens** of the interventions and measures being part of the plan is also required. Finally, **good cooperation and networking between different departments of an administration** is key to ensure the exchange of transdisciplinary information, both within and outside the borders of local government.

Further **success factors** of developing and implementing an action plan are as follows:

- Accompanying **sustainable implementation strategy** (mainstreaming or dedicated strategy);
- **Integration** of its provisions **into existing implementation tools** (at best a combination of legally binding as well as informal and more flexible planning instruments);
- **Monitoring and evaluation**, since an action plan is dynamic and must be kept flexible in terms of adjustments to changing framework conditions;
- **Availability of adequate personnel resources, financing or subsidies**.

"This is a prime example of transdisciplinary perspective in air quality management."

One of the policy experts involved in the iSCAPE project.

Keywords to remember

Air pollution:
Harmful emissions of particulate matter (PM), nitrogen oxides (NO_x), carbon monoxide (CO) and other volatile organic compounds (VOCs). Air pollution is particularly harmful for children, senior citizens and people with breathing related health issues.

Urban heat island effect:
An urban area that is significantly warmer than its surroundings due to the presence of human activities. The temperature difference is usually larger at night than during the day, and most apparent when winds are weak.

Passive Control Systems:
Green and built urban infrastructure for air quality and/or urban thermal comfort improvement, including e.g. low boundary walls, trees and hedges, green walls and roofs, photocatalytic coatings, green urban spaces and road geometry interventions.

Action plan:
An action plan is an instrument that describes the steps that need to be taken in order to achieve a specific objective. An action plan therefore contains a description of the problem and the need for action, defines the goals to be achieved, prioritises them or sets priorities and bundles existing or new measures to achieve these goals. An action plan is developed in a participatory way, involving all relevant actors.

Read More

The content presented herein is based on the following key project deliverables: **D3.4** 'Report on Solutions at Urban Level' (September 2017), **D3.8** 'Report on deployment of neighbourhood level interventions' (February 2019), and **D3.9** 'Report on potentialities of urban interventions and action plans' (July 2019). The underlying evidence refers to the six iSCAPE pilots run in the cities of Bologna-IT, Bottrop-DE, Dublin-IE, Guildford-UK, Hasselt-BE and Vantaa-FI.

All reports are available on the iSCAPE project website: www.iscapeproject.eu

Impressum

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The iSCAPE project

iSCAPE aimed to reduce urban air pollution and the negative impacts of climate change by leveraging sustainable passive control systems, behavioural change initiatives and the Living Lab approach.

For more information: www.iscapeproject.eu.

iSCAPE partners:

- University College Dublin
- University of Bologna
- University of Surrey
- Finnish Meteorological Institute
- Hasselt University
- TU Dortmund University
- JRC - Joint Research Centre - European Commission - Institute for Environment & Sustainability
- Institute for Advanced Architecture of Catalonia - FabLab Barcelona
- T6 Ecosystems S.r.l.
- Nanoair Solutions S.r.l.
- Future Cities Catapult Ltd.
- Dublin City Council
- Regional Agency for Prevention, Environment and Energy of Emilia-Romagna
- European Network of Living Labs
- Trinity College Dublin

Smart Control of Air Pollution - Policy Briefs

The Smart Control of Air Pollution - Policy Briefs series summarises key outcomes of the iSCAPE project with a clear policy orientation, to provide practical information to EU local decision-makers and other urban stakeholders. They cover the following topics: