



Adaptation to the changing climate: time to intensify efforts

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Background document for Workshop 4: Adaptation in cities & quality of life

Chair: Mr Holger Robrecht (ICLEI – Local Governments for Sustainability)

Rapporteur: Mr Peter Bosch (TNO – Knowledge for business)

Authors: ICLEI – Local Governments for Sustainability

Mr Holger Robrecht & Mr Daniel Morchain

***Section 3 is a contribution from TNO – Knowledge for business,
Mr Peter Bosch**



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1. Introduction

This preparatory document intends to provide background information and set the stage for discussion among participants to workshop session n° 4 ‘Adaptation in cities & quality of life,’ which is part of the conference ‘Adaptation to the changing climate – Time to intensify efforts’ taking place in Brussels on 23 and 24 November 2010, organised in the context of the Belgian Presidency of the EU Council.

First, it would be useful to know what some key terms, such as ‘quality of life’ and ‘vulnerability’ to climate change, are generally understood to mean.

Quality of life

Trying to define quality of life is problematic in itself, as this can depend on the personal preferences of individuals. One solution is to define it vaguely, for example as existing when individuals have freedom of choice and action, and can lead a “healthy, pleasant and safe life.”¹ Even so, there are only slight differences about what is considered quality of life by Europeans, who share roughly the same basic idea about what it constitutes.¹ Indeed, according to the EEA, Europe’s citizens list as most relevant, apart from their salary, “public services, employment, shopping, transport, green open space, culture and sporting facilities, as well as space to live.” These factors are thought to contribute to a city’s attractiveness. Conversely, the environment, instead of being thought of as a direct attractiveness factor, is rather defined indirectly by its lack of attractiveness when it is mentioned, and is mostly seen by Europe’s citizens as a tradeoff against the advantages of big city life.¹ That climate change is considered a potential threat to quality of life is reflected in the Eurobarometer (2008) – a European opinion survey: 75% of the population believes that climate change is a very serious problem.

This should concern policy makers independent from particular legal requirements, as their very task and interest is very much related to delivering services for a good quality of life.² To this end public management can be considered as the processes and procedures used to ensure that public and governmental institutions providing public services fulfill all their goals and obligations to promote citizens’ well-being and to manage the resources available.

Vulnerability

Cities are particularly vulnerable to climate change because of the large number of people living in relatively concentrated areas, together with the complexity of the systems that interact within them—transport, energy and water supply, waste management, etc. Vulnerability is “the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change.” According to this definition, vulnerability then covers not only vulnerable systems themselves, but also possible impacts to these systems as well as the root causes of these impacts. Based on these considerations, the European Commission suggests the following formula for vulnerability:

$$\text{Vulnerability} = \text{function} [\text{exposure (+)}; \text{sensitivity (+)}; \text{adaptive capacity (-)}]^3$$

For example, coastal cities are vulnerable, and can be impacted by coastal flooding, which can be caused by ice sheet disintegration – all three are related to vulnerability.⁴ But also continental cities have been seriously impacted by temperature rise causing heat island effects due to highly sealed surface. Ageing transport infrastructure can be deformed limiting the citizens’ mobility. The European heat-wave in this very summer has caused the death of about 35,000 Europeans. Next to the heat stress phenomenon, the main reasons for this have been inappropriate buildings, social disaggregation, ineffective alerting systems and emergency management. Heavy snowfall and weather extremes in winter 2007 led to a

break-down of high voltage wires and ultimately the entire electricity grid in the Munsterland-region in Germany leaving some municipalities without heating.

When trying to understand vulnerability, the development of vulnerability indices is particularly helpful. However, the primary purpose of the index to be developed has to be considered, as this will determine what should be included within it, namely “the choice of vulnerable systems, hazards, attributes, time horizon, spatial resolution, reference level, and normalization.”¹⁷

According to these definitions, it then follows that infrastructure — whether ‘hardware’ in the sense of buildings, pipes, etc., or ‘software’ in the sense of governance issues, healthcare, social interactions, etc — is impacted by climate change threats and challenges, especially in vulnerable regions, and that this potentially jeopardises the quality of life of citizens. Different levels of government, certainly not least at the local level, have an important role in dealing with the foreseen challenges in a way ensuring that cities remain livable and safe places. It is becoming increasingly evident to a number of authorities and citizens that developing a strategy to adapt to the changing climate will not only be mandatory, but that adaptation considerations will need to be increasingly mainstreamed into the usual operations of a local government and of citizens’ lifestyles.

There already exists some consensus that a multi-level approach is necessary, with all levels of government – including local and regional authorities – needing to be recognized as having a role in adaptation. This is a view espoused by the Committee of the Regions, which views the consideration of regional differences as part of the development of instruments for action at European framework level as essential for reducing economic, environmental and social impacts. This multi-level approach also needs to be accompanied by information and knowledge dissemination, so that adaptation can be instigated at consistent levels across Europe and that action can be undertaken most effectively.⁵

This document seeks to address some of the important themes surrounding the issue of adaptation to climate change in cities. In the following section, some of the main vulnerabilities of cities and urban regions are listed, while section 3 examines the influence of city size on urban adaptive capacity. Section 4 takes a view on the implications of geographical location of cities. Section 5 looks at the role of the different levels of government with regards to climate change and quality of life, while section 6 outlines a methodology for adaptation strategies. Section 7 details some of the adaptation options available and current adaptation actions being taken by cities, and finally section 8 presents some final thoughts and questions about adaptation in cities to trigger discussion.

2. Climate change threats from an urban system perspective⁶

Cities are highly dependent on their “lifelines” – infrastructure systems to transport people and goods, communications systems, water and energy distribution, sewers and waste removal systems.⁷ With their high population density, their often large numbers of poor and elderly residents, their dense physical structure and their dependencies on – often ageing - infrastructure systems, cities and towns are extremely vulnerable to the impacts of climate change.⁸ Moreover, the vulnerability of urban areas to climate change is also a function of well-established social, economic, governance and management processes. The main vulnerabilities of cities and urban regions to climate change can be defined in form of “climate change issues” for European cities and urban regions, as developed in AEA et al. (2009)⁹. These issues are a combination of the following factors, which are described in further detail below:

- a climate threat (e.g., drought, heat waves, flooding, sea level rise, etc);
- a European macro-region (e.g., Mediterranean, central Europe, Baltic coast, etc);
- a sector, function or specific system (e.g., forestry, human health, energy network, buildings, etc);
and
- a target group or group most affected (e.g., elderly, land managers, outside workers, low income group, etc).

Climate threat

Urban areas and cities in Europe face different climate threats, of which some of the most relevant are:

- temperature increase leading to heat waves and – more particular to cities – urban heat island effects;
- sea level rise leading to storm surges and salt water intrusion;
- heavy precipitation leading to fluvial and urban drainage floods;
- storms (wind, rain, thunder and snow storms);
- decreased precipitation leading to water scarcity and droughts;
- climate impacts leading to natural disturbances, e.g. wild fires, pests;
- climate impacts leading to earth movements (landslides, erosion); and
- climate impacts leading to increased human diseases.

Vulnerable regions

The vulnerability of urban regions is highly influenced by their *geographical location*. European macro-regions¹⁰, which are areas from a number of different countries or regions associated with one or more common features or challenges are likely to be exposed to similar climate threats due to geographical similarities. Functional regions may well overlap, so that a given location is in more than one macro-region. According to an assessment by the EEA¹¹ biogeographic macro-regions in Europe facing similar climatic threats have been defined as follows:

- Arctic: decrease in Arctic sea ice coverage, Greenland ice sheet loss.
- North-western Europe (North Sea Region and Atlantic Region): increase in winter precipitation and river flow, northward movement of freshwater species.
- North-eastern Europe (Boreal Region): less snow, lake and river ice cover, increased river flows, higher forest growth, northward movement of species, higher risk of damage by winter storms.
- Central and eastern Europe: more temperature extremes, less summer precipitation, more river floods in winter, higher water temperature, increased forest fire danger, lower forest stability.

- Mediterranean region: decrease in annual precipitation and annual river flow, increase in water demand, more forest fires, higher risk for desertification, biodiversity loss and heat waves, more vector-borne diseases.
- Coastal areas (Mediterranean Sea, Atlantic, North Sea, Baltic Sea, Black Sea): higher risks of coastal flooding, coastal erosion and salt water intrusion.
- Mountains: high temperature increase, less glacier mass and permafrost, higher risk of soil erosion, rock falls and species extinction, upward shift of plants and animals.

Sector, function or specific system

Cities are very complex and combine in one geographic location a large number of inter-related physical and social systems. The focal point of all urban systems is the preservation of the health and well-being of the urban population. Most systems are threatened by more than one climate change-related impact and most climate change threats have influence on more than one system. Therefore, threats and systems are multiply connected. Some systems, such as the energy supply system, feed many other systems, creating a risky dependence and the potential for domino-effect failures in systems in the face of, for instance, climate change-related pressures. An example of the multiple effects has been experienced in Canada and USA in summer 2003 during the historic power outage leaving cities like Toronto and New York some days without electricity. An overwhelming demand of electricity particularly for air conditioning and cooling led to problems in the cooling system of a particular power plant and consequently to overstraining the entire energy supply system in greater parts of North America resulting in a cascading break-down of numerous power plants and finally the entire grid.

The urban systems considered the most important in terms of potential climate change impacts and their subsequent potential to affect citizens' quality of life are:

- energy supply
- communication and information;
- transportation;
- water supply;
- sewage and drainage;
- solid waste;
- buildings and built-up area;
- urban green areas and biodiversity;
- health & air quality;
- food production & supply;
- governance and management
- social systems; and
- tourism (and economy of the urban region).

Target group or group most affected

In general, according to Carmin & Zhang (2010)¹², the most common vulnerable groups in urban areas are:

- the elderly;
- low income groups;
- disabled or sick persons;
- the young; and
- ethnic or religious minorities.

Having examined some of the main factors which govern the vulnerability of cities and urban areas to climate change, this paper goes on in the next section to briefly explore to what extent these areas' adaptive capacity is influenced by their size and geographic location.

3. Does size matter? The importance of city size and geographical location for adaptation (by P. Bosch)

Cities will need to deal with the effects of climate change: extremes in temperature, drought and flooding. Depending on the geography the focus will differ from city to city. For delta and coastal cities, such as Rotterdam, vulnerability is highest for flooding risk from the rivers and their tributaries. Consequently adaptive strategies focus on these, while the impacts of the urban heat island effect are potentially lower on the action list. In contrast, the attention for increased frequency of heat waves and the aggravating impacts of the Urban Heat Island effect is high in inland cities, such as Frankfurt, Stuttgart and Paris. In other, often low lying, cities the stress is on flooding during rainstorms.

The extent of the urban heat island effect and consequently the impacts of heat waves depend on the structure of the city and especially the area of dense urban fabric, the population density and the share of vulnerable groups, and in particular elderly, in the population. In general, large cities will be more vulnerable to heat wave impacts than small cities. However, there are several medium sized old industrial cities in Europe with an old centre without water or green spaces that could be as vulnerable as big city centers.

In contrast, the vulnerability for flooding and drought does not depend on city size. Location and local geography determine if and which parts of cities may be at risk.

Whereas the vulnerability for marine or river flooding depends on the relative height of the land and the distance to flood defenses that might fail, the vulnerability for pluvial flooding (water run-off on the street caused by high intensity rainstorms and inadequate capacity of the sewage system) depends on numerous factors. Local topography that might cause flashfloods is important, but also the natural soil (e.g. sandy or heavy clay), the degree of sealing of the soil within the city, and the network of open water and drainage systems.

The vulnerability for drought has two sides: on the one hand climate change may lead to a lowering of the groundwater table in general or in summer only, on the other hand drinking water supply for the city may be endangered. Lowering of the groundwater level may in turn lead to additional subsidence in clay and peat areas, leading to damage to buildings and infrastructure. Information on the scale of these impacts is still very scarce.

In conclusion: city size is not a determining factor in vulnerability to climate change; many other local factors need to be taken into account. As the vulnerability for pluvial flooding depends on localized conditions, the response is predominantly a local affair and probably not an area to develop national policies.

The capacity to deal with the impacts of climate change and to reduce vulnerability consists of four types of capacities:

- Structural capacity: the capacity to prevent damage
- Damage reduction capacity: the capacity to limit damage
- Recovery capacity: the capacity to arrange rapid repairs, and
- Adaptive capacity: the capacity to adapt to changing conditions.

Cities usually apply a mix of options to increase their capacities, depending on the vulnerability for each of the impacts. For instance, the French Heat wave Plan (Plan Canicule) aims at reducing the damage by public information and paying special attention to elderly and disabled people during heat waves. In addition structural measures are proposed to increase the amount of green space in the city and making buildings cooler and better ventilated.

It is a strategic choice, depending on many factors, which types of capacity will be strengthened.

Currently it is overwhelmingly the larger cities in the EU that have embarked on the journey towards an adaptation strategy. However, more and more also smaller cities are taking up the challenge of developing a climate adaptation strategy, such as the region Arnhem-Nijmegen (NL), Tatabanya (HU), or Brent (UK).

Table 1: Commonality in vulnerability of different city types

Aspect of vulnerability	Qualification of difference in vulnerability per city	Commonality
Heat waves / Urban Heat Island	The Urban Heat Island effect seems to occur in the centre of medium to large cities with a high surface share of pavement and roofs and a little evapotranspiration	High
Pluvial flooding	Risks highly dependent on local topography, and maintenance of discharge systems	Low
Marine and Fluvial flooding	Risks dependent on geographical location and quality of embankments	Medium
Droughts	Impacts depend on soil, and local water tables. With climate changing more severe impacts in terms of water shortage expected in southern Europe.	Water shortage issues: High; other aspects of drought: Low

Table 2: Are small cities in disadvantage in comparison to bigger ones to face the adaptation challenge?

Aspect	Advantages	Disadvantages
Vulnerability to climate change	Less subject to urban heat island effect ¹⁾	-
Population development: growing population	For all cities, population growth will mean more tax revenue, hence more resources with which to act.	Small and medium-sized cities are disproportionately affected by population growth through urbanization ²⁾
Population development: decline in population	Adaptation can be integrated in strategies for adapting to a shrinking population	A decline in population will probably (depending on the region) also affect smaller cities more, aggravating the economic disadvantages of small cities.
Economic development	Smaller cities “tend to have more flexibility in terms of territorial expansion, attracting investment and decision-making” ³⁾	Small cities have less budget for developing adaptation plans and implementing solutions ⁴⁾ . Small cities do not profit from economies of scale, which has consequences for the (maintenance of) urban infrastructures ⁵⁾
Institutional	Due to better connections, initiatives involving several stakeholders develop easier and faster.	Small cities lack the personal capacities to participate in (national and international) adaptation initiatives. They are vulnerable to loss of knowledge because of the small number of experienced staff in the municipal organization. ⁶⁾

Notes related to table 2:

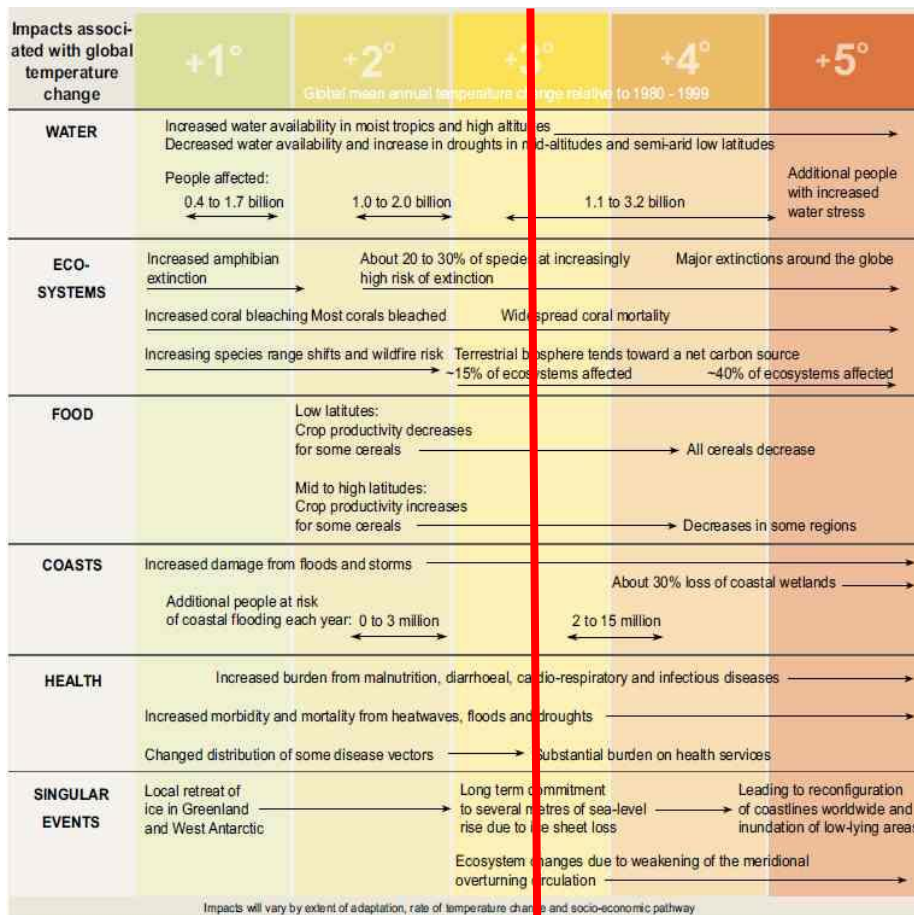
- 1) Martine et al., 2007, pp. 59;
- 2) “most of the new growth will occur in smaller towns and cities, which have fewer resources to respond to the magnitude of the change” than bigger ones; <http://www.unfpa.org/pds/urbanization.htm>
- 3) Martine et al., 2007, pp. 10
- 4) “One of the cities with the largest adaptation efforts is London” (Swart et al., 2009, pp. 275)
- 5) “smaller cities generally have more unaddressed problems and fewer human, financial and technical resources at their disposal. Smaller cities— especially those under 100,000 inhabitants—are notably underserved in housing, transportation, piped water, waste disposal and other services” (Martine et al., 2007, pp. 10)
- 6) Storbjörk, 2010, pp. 251

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4. Regional implications of climate change

According to the International Energy Agency's World Energy Outlook 2010, the nations carbon pledges after Copenhagen point at an increase of the global average surface temperature of 3.5 ° C. Based on the IPCC scenarios, this will mean that about 2 billion people are likely to be affected by water stress. 20 to 30 % of the species are at high risk of extinction with a wide spread coral mortality being observed. More than 15 % of the World's ecosystems will be affected. Crop productivity will significantly reduce. Increased burden from malnutrition, diarrhoeal, cardio-respiratory and infectious diseases will be observed. And of course: more singular extreme events will happen.



For Southern Europe, this is to lead to dramatically less precipitation, increase in wild fires, negative agricultural changes and a significant increase in the amount of tropical nights and heat waves (see graphics below from UNEP¹³). Opposite to this, Northern Europe will suffer from increased precipitation, impact on mountain regions, melting glaciers.

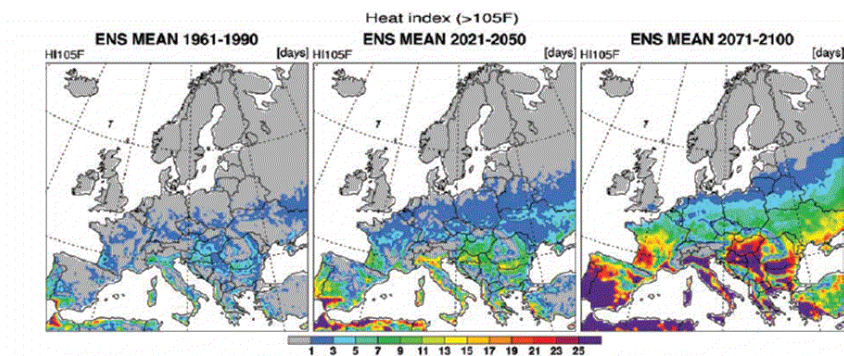


Figure 6.21: Projected average number of summer days exceeding the apparent temperature (heat index) threshold of 40.7°C (105°F). Ensemble mean summer (JJA) days as simulated by five ENSEMBLES RCM runs (MPI, KNMI, HC, ETH, C4I) are shown.

Under these circumstances, one needs to reflect on the quality of life in cities. By now, places like Siena in Italy are perceived as the general image of good life quality. But will cities like Siena remain ‘liveable cities’? Or otherwise: how will the urban form and design have to be developed and adapted to these changing conditions to maintain the good life quality? Not many examples are currently available that would give appropriate response to these questions. As one of the few, the city of Bologna has adopted building codes addressing climate adaptation eg. requesting facade colours that will combat the urban heat island effect, or building regulations requesting the establishment of water storage on new construction to address store rain-water run-off and water shortages.

5. The role of government

What is the role of government—and its different levels—in the face of climate change threats and of pressures decreasing quality of life?

The challenge of climate change

Climate change – above all – can be considered an exam in good governance and management, requesting strong political leadership and commitment. Extreme weather events regularly highlight deficient adaptive capacity within urban systems and management – damages in technical infrastructure and buildings, disruption of municipal and health services, poor social cohesion and emergency management – which can be considered as failures of previous political decisions and administrative actions. These impacts may be interpreted as the result of previous long-term political priorities and objectives overweighting economic development at the expense of ecosystems services, creating a de facto governance and accountability issue leading to lowered trust in political and administrative institutions. Moreover, the more capacities and resources are needed for emergency action, the less are available for future orientation and strategic investments: local and regional development is put at risk.

There is little doubt that climate change is an issue of political accountability – a governance and management issue. Refer eg. to the reactions of citizens reflecting on the governmental performance during the 2005 Hurricane Katrina in the USA, or the 2010 flood in Pakistan, or the forest fires in Russia. But, when dealing with new challenges which need to be looked at with a long-term perspective, governments (at whatever level) need to understand the long-term implications and focus their efforts accordingly. However, this state of mind or an understanding of the scale of the problem is frequently lacking. For instance, researchers have analysed the main political reactions following extreme weather events (in this example in the Netherlands and Germany after river floods in 1993-95 and 2002 respectively) and concluded that there is a risk of focusing on ‘visible short-term’ rather than ‘effective long-term’ measures. Climate change response, however, requests a long-term commitment supported by effective managerial instruments.¹⁴

Multi-level reponse

There is, of course, an added complication as different levels of government interact—local, regional, national and EU level—and responsibilities and jurisdictions among them can at times be blurry.

Uhel and Georgi¹⁵ illustrate the complexity of multi-level governance issues, while showing that they are inextricably linked and need to work in collaboration; indeed, the global nature of the climate change challenge implies action from the United Nations, the EU and national governments, which means that any action taken by a city is automatically linked to action taken by other cities, regions and nations worldwide. Using the example of energy savings, the authors also highlight the interdependence of cities and nations: while the bulk of energy savings mandated by national policies will be realised in cities, these also have the capacity to achieve further savings because of the local government authority over many policy options affecting energy consumption. This example demonstrates the importance of aligning policies across different levels of government, whether for climate change mitigation or adaptation, and the importance of giving cities a relevant role in the process. As the authors conclude, “the challenge is too complex to be tackled at higher administrative levels only.”¹⁵

The example of National Adaptation Strategies

It is indeed Local Governments which are closest to citizens and which often design and mostly implement measures at the city level. It was Yvo de Boer, former Executive Secretary, United Nations Framework Convention on Climate Change that concluded his experiences with saying: „Perhaps more than anywhere else, cities offer the opportunity to develop adaptation and mitigation win-win initiatives. In the absence of decisive global policies on climate change, cities need to serve as centres of policy ingenuity to drive real action.”¹⁶ Indeed, bottom-up approaches frequently began to form before a national top-down strategy was envisioned, as the PEER report (2009) found, particularly in the case of municipalities which perceived themselves as especially vulnerable to climate change. These used subsequently-developed national strategies as a framework for their vulnerability reduction actions, and as a motivation for continuing their implementation in a more harmonized way. Local Governments are, thus, in a position to best understand the needs of citizens and to identify the range of stakeholders that need to be included in their local adaptation strategy. This can be seen in real examples: In Denmark, for example, the national government’s National Adaptation Strategy (NAS) uses the subsidiarity principle as guiding force, highlighting the need for adaptive action to be taken at the lowest possible level of governance and responsibility while respecting the existing legislative, financial and technological framework. The Danish NAS nevertheless acknowledges the need for higher levels of governance to agree upon and launch adaptation measures in cases where autonomous adaptation is societally sub-optimal.”¹⁴ In the Danish scheme even private landowners have a responsibility to protect their own (coastal) land.

Another example of an NAS emphasizing the need for local adaptation action to take precedence – bolstered by nationally-provided tools, incentives and information – is that of the UK, where the national government intends to work with Local Governments on the incorporation of adaptation considerations into such areas of work as “investment in public infrastructure and building planning, procurement of goods and services.” By adding an adaptation performance indicator in its Local Government Performance Framework, it has signaled its commitment to supporting devolved adaptation action.¹⁴

Still, different countries have adopted bottom-up and top-down approaches to tackle climate change adaptation, with a general understanding in NASs that responsibilities for climate change impacts need to be taken at the level that is mostly affected. However, this distinction and division of responsibilities remains largely vague. What does seem to be clear is that different levels of government have to work together to develop synergies and mainstream the introduction of adaptation concerns into policy making and implementation. Furthermore, the EEA argues that the integration of climate change in the planning band implementation of EU directives is indeed increasingly starting to happen.¹⁷

Cities at the frontline of adaptation

The NASs described above illustrate the belief among many national governments that adaptation action is best undertaken at regional and local levels. The PEER report (2009)¹⁴ reaches the same conclusion, while also highlighting the need for national involvement, particularly when it comes to encouraging action through providing incentives and reducing hindrances, or providing a framework for action. Similarly, the 1st World Congress on Cities and Adaptation to Climate Change in Bonn in 2010 came to a common understanding regarding multilevel governance for adaptation and resilience, namely that while local and regional implementation of adaptation is key, it must be supported at national, European and worldwide levels. In sum, “multilevel governance is therefore key for building resilient cities.”¹⁸

In addition to the vertical issues discussed above, another point which has come into discussion recently concerns the supply and demand of knowledge related to climate change and adaptation,¹⁹ suggesting

that governments and stakeholders should make efforts to provide a fertile ground to facilitate the balanced development between the supply of knowledge (e.g. research) and its demand (e.g. the implementation of adaptation measures by cities). What is needed is the creation of a ‘market-place for adaptation knowledge’.

The crucial role of governments and of buy-in at the political level in Local Governments is a cornerstone of the development of adaptation measures and strategies, as evidence across Europe suggests. Integration of Local Governments processes through a cyclical approach for managing adaptation to climate change is a proper tool to plan, execute and monitor results. This approach is described in the next section. But first, it is important to fully understand the crucial role and responsibility of politicians throughout the entire process, as they are a critical steering actor. To achieve commitment of politicians, it is important to understand the significant political benefits offered by an effective and efficient climate change response based on integrated management.

6. Approaching a methodology for an adaptation strategy

The ‘one size does not fit all’ philosophy is clearly applicable when considering adaptation to climate change in different cities because of their different characteristics and the fact that they are faced with a myriad of different challenges. As discussed earlier, the long-term horizon of adaptation measures means that, politically, these measures are difficult to implement; however, highlighting the co-benefits of adaptation in terms of quality of life improvements can play a strong role in helping to convince policy makers. Therefore, it is key to mainstream adaptation into other policy areas.²⁶ In addition, existing interdependencies across and within sectors at the city level can serve urban adaptation actions, since these will address related climate and non-climate problems.³⁰ It follows that an integrative methodology is necessary to bring order and structure to this great challenge filled with uncertainties, necessary long-term commitments and cross-sectoral interactions. An article co-authored by UNECE and UN-HABITAT supports, among others, this argumentation, by concluding that multi-level global actors need a methodology and a tool in order to undertake effective decision making in response to climate change. This article posits that such a methodology would enable effective coordination of efforts and priority setting.²⁰

The city of London has shown that an approach centered on the provision of co-benefits can provide the immediate results which otherwise act as a barrier to policy making, since politicians find the often decadal timescales of adaptation off-putting. An example of this integrated approach “... is the ‘Green Grid’ that aims to provide a green infrastructure network for London and enhance the functionality of the existing green space network. Climate change adaptation is one of the objectives of Green Grid. Much of London's Urban Greening Programme is likely to be delivered through spatial planning measures and grant funding or sponsorship to catalyse business and public engagement. Much will be delivered by the individual London Boroughs who are the primary delivery agents. Specific budgets have been secured for the Street Trees and Priority Parks initiatives, but over the longer term the objective is to demonstrate that an urban greening programme



Fig. 1: The 5-step integrated cyclical adaptation strategy approach

should be integral to urban regeneration because of the economic benefits of green infrastructure, measured by increased productivity and sustained private sector investment. The London Urban Greening programme aims to reduce the risk and sensitivity of people, property and nature to the urban heat island effect and surface water flooding. The programme has numerous ancillary benefits ('win-win opportunities') including carbon sequestration, conservation of biodiversity, improving air quality and increasing the desirability of communities. The programme also has health and welfare benefits and some elements of the programme are designed to meet social objectives, such as increasing access to nature, where this is currently deficient. In particular, street tree planting has been prioritised according to the areas thought to be most vulnerable to the urban heat island effect under extreme summer temperatures; current street tree density; areas of multiple deprivation, air and noise quality and areas of deficiency for access to nature."³⁰ Figure 1²¹ presents the concept of a methodology for a Local Governments adaptation planning and implementation in a coherent and inclusive way—that is, avoiding a piecemeal approach, while rather focusing on integrating measures in a more optimal and complementary way. It is a cyclical process, fostering flexibility and a learning curve approach.

Its steps are described below.

Step 1: Baseline review

Evaluating the local situation and the nature of the risks and vulnerabilities is a critical initial step, which will allow an overall understanding of the situation and the extent to which the city or region may be subject to climate change threats. Climate models are tools used to obtain evidence and predict the changes in climatic variables over time which make assumptions about the evolution of society. Impact studies can be derived from these models and can help determine the impacts of climate change on urban services and functions.³⁰

Local Governments should also consider whether existing organisational conditions allow an efficient and effective management of the process, or whether structural changes are necessary. New ways of thinking and governance practices are likely to be necessary.

The Baseline Review, however, should not just focus on vulnerabilities, but also economic opportunities and societal benefits to allow for buy-in of stakeholders. Meanwhile, numerous tools are available to support local governments in conducting vulnerability assessments. Some examples of tools are listed below:

- **Local Climate Impact Profile (LCLIP)** is a fairly easy to use tool. It has been developed by the UK Climate Impacts Partnership (UKCIP). By looking into media releases of the last years a report is created showing the impact the local weather and climate has today. This can help local authorities and organisations to assess their vulnerability to extreme weather events and the impacts they entail. An LCLIP is a non-scientific process that can raise awareness of the service areas at risk from extreme weather impacts. It can also help gain buy-in and commitment from senior management, as well as the wider employee base, to adapt to extreme weather impacts. Its strength is raising awareness. The LCLIP guidance, templates and case studies can be downloaded at www.ukcip.org.uk/index.php.
- **ICLEI Oceania Toolkit and Australian Department for Climate change: Local Government Climate Change Adaptation Toolkit, Melbourne, 2009:** The toolkit challenges councils to learn how to operate in a changing, complex and uncertain environment. It outlines an adaptive management process and provides a set of tools and exercises ranging from examination of climate change scenarios and projections to understand the potential impacts, and the associated risks/opportunities, analysis, evaluation and prioritisation of the risks/opportunities identified by council according to its local and regional context, adaptive capacity and the likelihood and consequence of each risk/opportunity, to the exploration of treatment options for the prioritised risks/opportunities to develop an adaptation action plan. Available at www.iclei.org/oceania
- **The UKCIP Adaptation Wizard (2008)** The UKCIP Adaptation Wizard V 2.0. UKCIP, Oxford: The Adaptation Wizard is an online tool to help local governments to adapt to climate change. It applies a 5-step process to assess vulnerability to current climate and future climate change, identify options to

address your key climate risks, and helps to develop a climate change adaptation strategy. Available at www.ukcip.org.uk/wizard

- The **Klimalotse** (2010). This German instrument provided on the adaptation portal of the German Federal Environmental Agency adopts and updates the UKCIP Adaptation Wizard. Available at http://www.klimalotse.anpassung.net/clin_104/klimalotse/DE/02_Intensivdurchlauf/0_home/home_node.html

Step 2: Target setting

Once a vulnerability assessment has been carried out, Local Governments will need to evaluate, quantify and prioritise adaptation measures. In doing so, a strategy begins to be formed. The long-term characteristics of adaptation measures have to be developed in such a way that shorter-term co-benefits can be obtained. Also, work with several departments and stakeholders is necessary to maximize synergies and avoid developing initiatives that will conflict with one another (e.g. it is especially important to align adaptation with mitigation measures). This process of working for the first time with new stakeholders and departments can be a demanding, but is nonetheless necessary step, which should produce satisfactory results. An example for this approach is offered by the City of Dresden, which as part of the project REGKLAM delivered regional fora.²² However, appropriate target setting for managing climate adaptation remains an issue as the success cannot just be measured as ‘less damages resulting from extreme weather events’.

Step 3: Political commitment

This document has stressed the crucial importance of having long-term political commitment for the development of an adaptation strategy, as well as for the assignment of sufficient budget to implement the more and also the less ‘visible’ measures. Again, co-benefits can be a way to help gain political commitment.

The existence of national or regional adaptation strategies can facilitate the process at the local level and offer valuable orientation.

Step 4: Implementation and monitoring

This step refers to the implementation and monitoring of activities supporting the achievement of the adaptation strategy. These activities will be coordinated by the Local Government, though it may also include projects implemented by other stakeholders and actions in combination with the private sector. An increasing number of interesting examples of adaptation options, measures and tools is being provided. An interesting collection can be found eg. at the website of the Bonn Resilient Cities Conference 2010.²³ However, appropriate monitoring remains an issue as by now a coherent set of indicators for climate adaptation is missing. This might be solved with the ongoing work of the European Environment Agency.²⁴

Step 5: Evaluating and reporting

In this last step of the cycle, the level of achievement of all targets is measured, the implementation of the strategy is assessed, and shortcomings are analysed. This evaluation contributes to the preparation of the next Baseline Review (hopefully assessing a less vulnerable city), and, with it, the start of the new cycle.

This step will inform the Local Government of the degree of appropriateness of the actions and their success obtained, and presents an opportunity to maintain, rethink or modify the priorities and direction of the strategy. The remarks made on indicators and targets for climate adaptation, however, remain valid.

Integrated Climate Adaptation Strategies

Some cities, such as Leeds and Newcastle in the UK, have focused on developing climate change strategies that embrace mitigation and adaptation and explicitly connect to quality of life of their citizens. As an example, the vision for Leeds is for “a place resilient to climate change with a strong low carbon economy and a high quality of life”. “Climate change has the potential to fundamentally affect how we, in Leeds, live. Our way of life relies on a temperate climate. Not too hot. Not too cold. Not too wet and not too dry. Climate change will alter this, threatening the health of our citizens, damaging our natural environment and disrupting the supply chain that our local economy relies upon.”²⁵ Potential areas of implementation of these integrated strategies are municipal buildings, municipal operations and services, municipal infrastructure, municipal utilities, private buildings, private companies operations and services, private sector production, private sector consumption patterns, citizens’ behaviour. The co-benefits of such integrated approaches can be described as:

- Creating a vision for the city (‘resilient city’)
- Increased resilience against climate change impacts
- Ensured service delivery due to reduced vulnerabilities and increased resilience of municipal operations, governance and management structures
- Cost reduction in municipal budget due to more efficient and effective governance and management structures and procedures
- Cost reduction in municipal budget due to increased efficiency in municipal consumption of resources (particularly water and energy)
- In the mid-term cost reduction in municipal budget due to less damages caused by extreme weather events
- Increased quality of life due to enhanced adaptive capacity and improved urban design, infrastructure and services
- Generating new projects (job creation)
- Support to local and regional manufactures and craftsmen through investments in adaptation measures (job creation)
- Generating local / regional know-how and innovations (job creation)
- Role model to the private sector and households
- Stimulating sustainable local/regional development (quality of life, economic stability & job creation, environmental quality)
- Gaining profile as front-runner community
- Attracting investments and resources from external sources (job creation)

7. What are cities doing today for adapting to climate change?

“Adaptation is already taking place but in a piecemeal manner. A more strategic approach is needed to ensure that timely and effective adaptation measures are taken, ensuring coherency across different sectors and levels of governance. (...) A strong political commitment in a city is key to start adaptation action.”²⁶ These notes are a quick and easy way to understand what is happening at the city level: adaptation is shaped by “contextual factors.”³⁰ The long-term horizons of adaptation measures and plans, together with much shorter political cycles (to wit: elections) have jeopardised their further and faster adoption.²⁷ However, a good number of cases show that things are starting to change, and an appropriate framework and coordination among different levels of government could be a boost—almost a ‘make or break factor’--in this direction.

But actions, especially ‘isolated’ measures, i.e. measures not integrated into an adaptation strategy, have been implemented for decades across Europe. Based on their approach, they can be separated into four categories:²⁸

- Some actions have been mostly a reaction to an imminent threat, such as heat or tide reaction and alert systems, or infrastructural adaptation planning.
- Actions focused on raising awareness among the population, as well as training citizens on emergency planning and capacity building for reacting in cases of extreme weather events.
- Actions implemented as part of a project to improve infrastructure that has become obsolete or is no longer functioning adequately. Examples are promotion of green infrastructure²⁹ and green roofs, or the development of policies to change building regulations.
- Baseline review development as a foundation for an overarching adaptation strategy. As mentioned above, the number of cities approaching adaptation in this manner is quite limited at present.

It is also important to understand the drivers behind cities’ and Local Governments’ implementation of adaptation measures: their approach to adaptation is determined by the complex interaction between climate and non-climate problems, interaction which also determines the extent of the challenge faced in succeeding to be resilient in the face of climate change.³⁰ In other words, the economic aspect of potential adaptation actions will, to a relevant extent, determine whether they are implemented. And therefore, making measures and strategies win-win-win (citizens-business-environment/sustainability) solutions is a necessary challenge for Local Governments, with public-private-partnerships being likely to play a relevant role in the process.

Finally, city officials and research institutions are increasingly realizing the need to work together and speak the same language in order to make research more useful and applicable to the demands of cities facing climate change threats. This also implies uniting research in the natural sciences with research in the social sciences. To illustrate this, the U.S. Geological Survey (USGS) has switched from a pure science focus to a focus on strategies for resilience, which are more relevant and will help communities prevent or minimise the impact of natural disasters.³¹

Instruments to implement political climate commitments

There are different suggestions for the types of adaptation options available to cities:

1. PEER, 2009 suggest the following main categories: (see PEER, 2009):
 - communicative instruments, such as inclusion in the constitution, environmental and sustainable development strategies, requirements for sectoral strategies, obligations to report performance and external and independent reviews of performance;

- organisational instruments, such as combinations of departments, green cabinets, environmental units within sectoral departments and independent working groups; and
 - procedural instruments, such as veto or obligatory consultation rights for environmental departments, green budgeting and impact assessment.
2. Ecologic et.al suggest the following types adaptation options³²
- Grey infrastructure is physical interventions or construction measures that use engineering services to make buildings and infrastructure resilient to extreme weather
 - Green infrastructure is using the functions and services provided by ecosystems to achieve more cost-effective and sometimes more feasible adaptation solutions. The Green infrastructure approaches contribute, for example, to wider sustainability objectives, such as halting biodiversity loss and the degradation of ecosystem or restoring water cycles
 - “Soft” non-structural approaches relate to policy incentives such as land-use controls, information dissemination, and economic incentives to reduce or prevent disaster vulnerability
3. ICLEI offers the Adaptation options may be any combination of the following:³³
- Modifying policies, plans, practices and procedures: Existing by-laws, codes, regulations, policies, development plans, and operating practices may have to be modified in order to adapt for climate change impacts.
 - Building new or upgrading existing infrastructure: Examples of this include expanding storm water collection systems, expanding wastewater treatment capacity, increasing bridge heights or strengthening levees.
 - Improving community awareness and public education: To generate support for adaptation efforts the municipality will likely need to use outreach and education actions. These can also be useful to effect voluntary change at the individual level, such as water or energy conservation.
 - Varying and/or diversifying options: By developing “safeguards” against climate change impacts you can increase the preparedness of community. Examples can include: diversifying the community’s economic base to move away from sources that will be negatively affected by climate change (i.e. coastal recreation); developing new groundwater sources to expand water supply; or diversifying the energy supply to include renewable energy to both help mitigate climate change impacts and reduce demand from the electric grid during heat waves.

Some examples of adaptation options include, amongst others:

- Heat: Traffic restrictions (Budapest), Media heat warnings (Tatabanya). Neighbourhood adaptation plans (Birmingham)
- Green space: Urban greening programme (London), Increase urban tree canopy (Lyon)
- Buildings: Insulation (Vienna), Energy Efficient a/c (Dresden), Green building code and resilience (Bologna)
- Adaptive urban maintenance (Venice)
- Spatial planning (Almada)
- Capacity Building: Communications strategy (Dresden), Risks systems & Communications (Birmingham)

Each selected policy tool individually should be described and valued in regard of its benefits. The evaluation could draw upon a grid suggested by the EEA.³⁴

Criterion	Indicators/sub-criteria	Questions to be asked
Effectiveness of adaptation	Adaptation function	Does the measure provide adaptation in terms of reducing impacts, reducing exposure, enhancing resilience or enhancing opportunities?
	Robustness to uncertainty	Is the measure effective under different climate scenarios and different socio-economic scenarios?
	Flexibility	Can adjustments be made later if conditions change again or if changes are different from those expected today?
Side-effects	No regret	Does the measure contribute to more sustainable water management and bring benefits in terms of also alleviating already existing problems?
	Win-win (or win-lose)?	Does the measure entail side-benefits for other social, environmental or economic objectives? E.g. does it: <ul style="list-style-type: none"> • contribute to closing the gap between water availability and demand? • affect the delivery of other WFD objectives (e.g. river flow)? • create synergies with mitigation (e.g. does it lead to decreased GHG emissions)?
	Spill-over effects	Does the measure affect other sectors or agents in terms of their adaptive capacity? Does the measure cause or exacerbate other environmental pressures?
Efficiency/ costs and benefits	Low-regret	Are the benefits the measure will bring high relative to the costs? (If possible, consider also distributional effects (e.g. balance between public and private costs), as well as non-market values and adverse impacts on other policy goals)
Framework conditions for decision-making	Equity and legitimacy	Who wins and who loses from adaptation? Who decides about adaptation? Are decision-making procedures accepted by those affected and do they involve stakeholders? Are there any distributional impacts of the climate change impacts or of the adaptation measures?
	Feasibility of implementation	What barriers are there to implementation? <ul style="list-style-type: none"> • Technical • Social (number of stakeholders, diversity of values and interests, level of resistance) • Institutional (conflicts between regulations, degree of cooperation, necessary changes to current administrative arrangements)
	Alternatives	Are there alternatives to the envisaged adaptation measure that would e.g. be less costly or would have fewer negative side-effects?
	Priority and urgency	How severe are the climate impacts the adaptation measure would address relative to other impacts expected in the area/river basin/country? When are the climate change impacts expected to occur? At what timescales does action need to be taken?

8. Final thoughts and questions to facilitate discussion

- Coordination of adaptation measures into a strategy is a desirable outcome in order for measures to push in a common direction. Isolated measures tackling one sector will fail to make a city climate resilient. Even so, this approach is still frequent across cities in Europe. Often, and curiously, cities do not think they are ‘working on adaptation’, although they implement related measures. The reason is that they consider these measures to be related to a specific sector, and not measures to have been taken in response to climate change.
- With a view on climate change, available information suggests that it is both cheaper and more beneficial to invest in climate mitigation action and adaptation measures than not to do so. The so-called Stern Review gives evidence of both the cost resulting from damages caused by extreme weather events and the expected economic impacts in case of non-response.³⁵ The Review argues that if no action is taken, the overall costs and risks of climate change will be equivalent to losing at least 5 % of global GDP each year worldwide, whereas the costs of action — reducing greenhouse gas emissions to avoid the worst impacts of climate change — can be limited to around 1 % of global GDP each year. This view is adopted by the EC’s White Paper on Climate Adaptation: “Although more specific information on the costs of adaptation is needed, several sources already indicate that the costs of taking action to address climate change (including mitigation and adaptation measures) will be much lower than the costs of inaction over the medium to long term.”³⁶. However, not every necessary adaptation measure can be win-win-win, or reap co-benefits. Some will require expenditure and be detrimental to some stakeholders; for example, it might be necessary in some cases to relocate populations. Certainly, many will involve weighing the pros and cons of adaptation to climate change versus other environmental damage; for example, will it become necessary to control insect outbreaks using chemicals?
- If, as argued in section 2, the focal point of all urban systems is the preservation of the health and well-being of the urban population, it stands to reason that placing the focus of adaptation on cities will create an adaptation bias towards urban areas – perhaps to the detriment of rural or natural areas. It is therefore very important to maintain a strong national and international overview of adaptation.

Resulting from these thoughts, the following reality check questions can help to guide the workshop’s discussion:

1. Would you agree with the statement that “climate change adaptation efforts in cities cannot follow a generic template and must instead respond to local circumstances”? (Quote taken from Handley, J. and Carter, 2006. Report to the National Steering Group, Manchester, UK)
2. Furthermore, do you believe that a common framework or management system is desirable to support the city’s efforts? Are the instruments and tools available to implement an integrated climate adaptation strategy at city level sufficient? What is missing? Who has to take action?
3. What is the role of European Commission, national and regional governments in the development of adaptation options and strategies for cities, considering the local scale of the impacts?
4. The EC’s White paper on climate adaptation approaches 3 phases of action that should help climate adaptation in Europe 2009 – 2012. “Phase 1 will focus on four pillars of action: 1) building a solid knowledge base on the impact and consequences of climate change for the EU, 2) integrating adaptation into EU key policy areas; 3) employing a combination of policy instruments (market-based instruments, guidelines, public-private partnerships) to ensure effective delivery of adaptation and 4) stepping up international cooperation on adaptation. For phase 1 to be a success, the EU,

national, regional and local authorities must cooperate closely.”³⁷ Is this appropriate to support and guide local adaptation action? What else is needed? To what extent should local expertise (local knowledge) be considered in the planning of local adaptation strategies? And regarding the 2nd point, what should be weighted when considering the degree of integration of adaptation into EU policy areas, and how should this integration be prioritized—eg. economic costs versus uncertainty of benefits; mitigation versus adaptation; sectoral prioritization, etc?

5. How can cities’ adaptation strategies be developed and implemented in times of austerity following the global financial crisis? Is adaptation “expensive” in the short-term and “cheap” in the long-term?

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