CLIMATE METROPOLE+

Cooperation and knowledge exchange towards an integrated and participatory approach to climate change adaptation

Metropolis is the global network of major cities and metropolitan areas.
With more than 130 members and 30 years of history, the World Association of the Major Metropolises (Metropolis) is the leading association that gathers the governments of urban agglomerations worldwide. It serves as the hub for metropolises to connect, share experiences and mobilize on a wide range of local and global issues, in addition to being the focal point of worldwide expertise on metropolitan governance.

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Barcelona, November 2016

Climate Metropole +

Climate Metropole+ is an initiative of the Barcelona Metropolitan Area (AMB) and Metropolis in cooperation with Berlin Metropolis, Lyon Metropole and Liverpool City Region. The aim of Climate Metropole + is to exchange experiences and generate knowledge regarding adaptation to climate change in metropolitan areas. The project was launched in June 2015 and ends in December 2016. The No Regrets Charter is used as the framework for assessing climate change adaptation practices in the various metropolitan areas across the spheres of ecology, economics, politics and culture.

Four workshops were held, one in each of the partner cities, to present the plans, strategies and actions cities are undertaking as they are faced with the challenges of adapting to climate change.

Berlin workshop: 23-24 November 2015
Lyon workshop: 8-9 February 2016
Liverpool workshop: 20-21 June 2016
Barcelona workshop: 17-18 November 2016

Each workshop was structured around presentations by experts from relevant organisations and institutions concerned with climate change adaptation measures, and each featured field trips to gather information about how each city is implementing adaptation measures throughout its urban area.

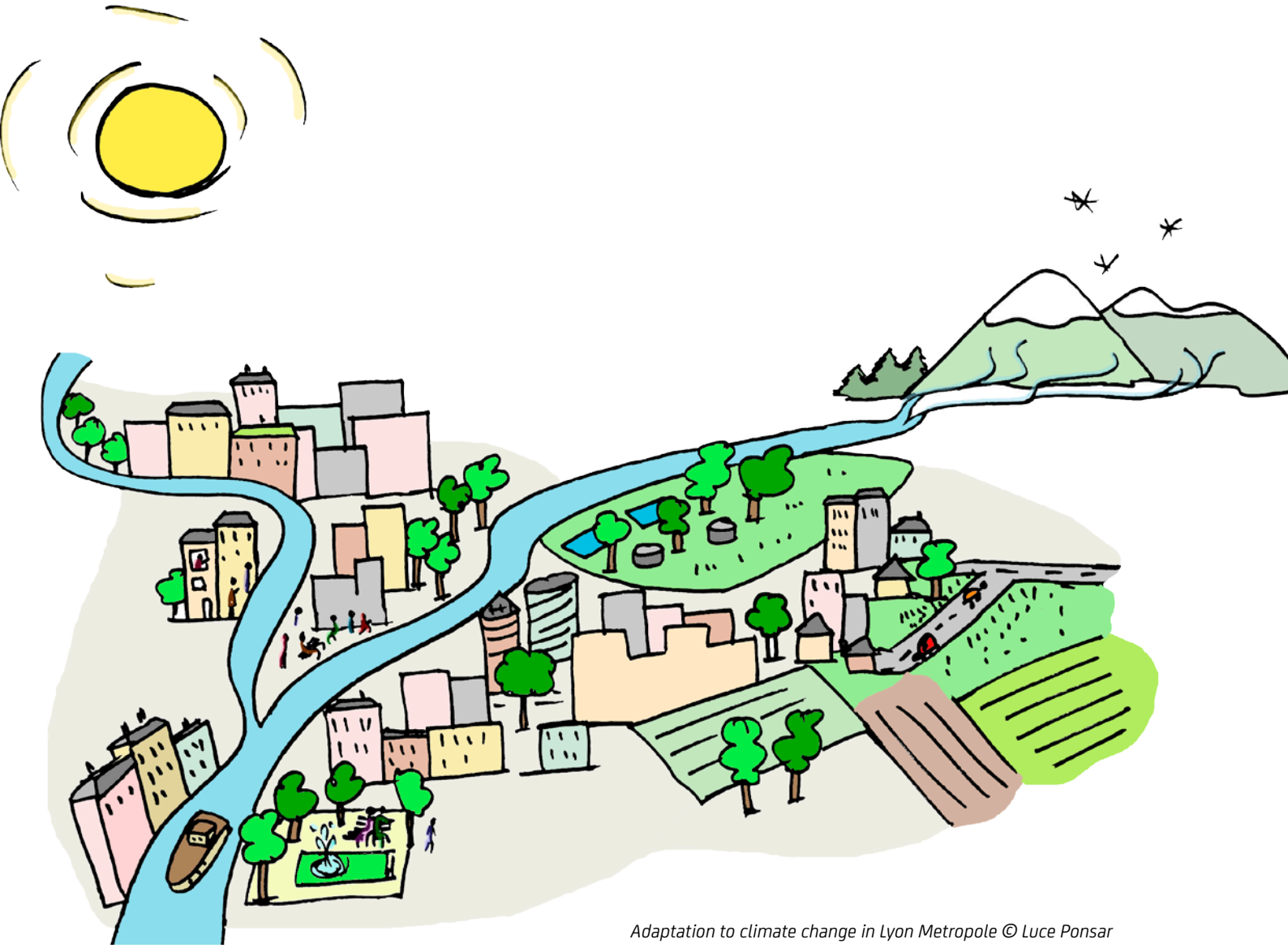
Background

The Committee of the Regions (2013) has pointed out that many cities in Europe are encountering obstacles in their efforts to structure their work on climate change adaptation and struggling to progress beyond the initial steps they have taken in this area to move towards implementing a fully integrated adaptation strategy. Aspects related to management and governance are seen as barriers to urban adaptation, as well as a lack of awareness or understanding of adaptation, a lack of baseline information, and limited funding for adaptation measures.

Adaptation initiatives worldwide

Various initiatives are underway around the world with the aim of advancing the climate change agenda on the local level. Among the primary European initiatives, one which pays particular attention to sub-national governments is the Covenant of Mayors for Climate and Energy, which was launched in 2008. Signatory cities pledge action to support implementation of the EU 40% greenhouse gas reduction target by 2030 and the adoption of a joint approach to tackling mitigation and adaptation to climate change. The EU Covenant of Mayors has joined forces with the Compact of Mayors, a global coalition of mayors and city officials pledging to reduce local greenhouse gas emissions, enhance resilience to climate change and track their progress transparently. The forthcoming Global Covenant of Mayors for Climate and Energy, slated to be launched by January 2017, will be the largest global coalition of cities committed to fighting climate change.

There are other initiatives which call upon local and sub-national governments to commit to accelerating their adaptation efforts, among them the Durban Adaptation Charter presented to the COP 17 meeting in Durban in 2011, the 2013 Bonn Declaration of the Mayors Adaptation Forum and the 2013 Nantes Declaration of Mayors and Subnational leaders.



Adaptation to climate change in Lyon Metropole © Luce Ponsar

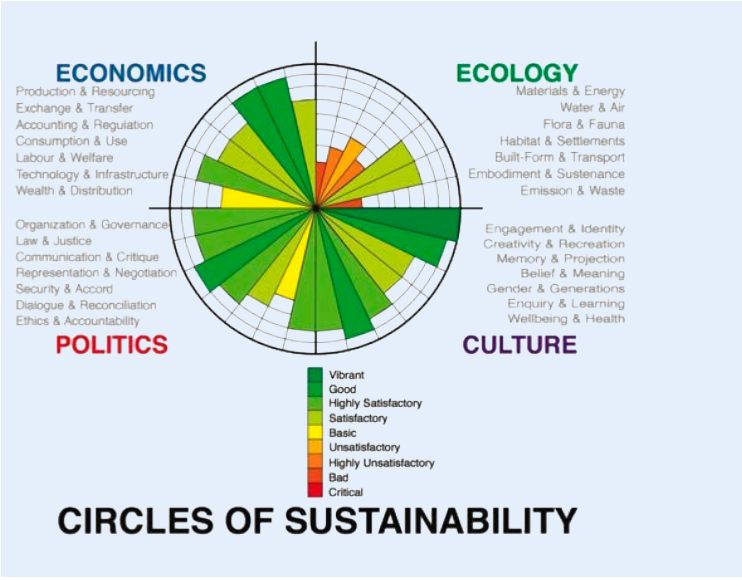
The No Regrets Charter

Cities need to adopt a proactive approach to climate change adaptation, taking a precautionary version of the 'no regrets' approach. The 'No Regrets Charter', chaired by City of Berlin, Senate Department for Urban Development and the Environment, allows cities to assess climate change adaptation implemented so as to cut across all the domains of social life and founded upon the precautionary principle and duty of care. Cities need to begin to respond now to the environmental outcomes of climate change, based on a series of spheres of action:

- Politics: adaptation plans should be embedded in all policy-making decisions, and their development should include both expert deliberation and committed civic involvement;
- Ecology: cities should seek to generate deeper and more integrated relationships with nature, both inside the city and beyond urban boundaries;
- Economics: urban development should be based on an economy that is organised to meet negotiated social needs rather than to pursue the conventional drive towards economic growth;
- Culture: cities should treat the process as one of deep cultural engagement involving broad cultural issues of social learning, symbolism, visualisation, aesthetics and well-being.

The No Regrets Charter provides a very holistic view of adaptation by showing the links with economic and governance models and with culture. The Climate Metropole + project uses the No Regrets Charter as a checklist to systematically assess the extent to which all the different 'principles in practice' identified in the Charter are taken into account as part of the adaptation measures being implemented in the four metropolitan areas of Barcelona, Berlin, Liverpool and Lyon.

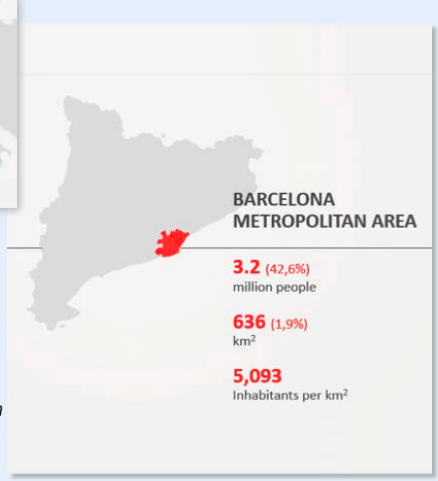
The Table below indicates one example for each of the propositions in each of the domains of the No Regrets Charter and shows the shape they take in the climate change adaptation actions of the four cities.



Further information: http://www.circlesofsustainability.org

No Regrets Charter propositions	Barcelona	Berlin	Liverpool	Lyon
Ecological				
Green parklands and urban woodlands	Adapt vegetation in parks to low water consumption	Systematic transformation from pine trees to more resilient vegetation	Liverpool Strategic Green and Open Spaces Review Board acting to create more green infrastructure	Tree Charter acknowledging the role of trees in cities and the potential impact of climate change on trees
Political				
Governance	Metropolitan Climate Change Observatory	Development of a climate adaptation strategy with broad participation	Local Nature Partnership	83 partners contributing to the Climate Plan. Adaptation plan to be adopted at the end of 2016
Economic				
	Fiscal incentives to promote renewable energy self-consumption	Guiding principle of Berlin urban and spatial planning is the "city of short distances"	Project to develop a decision support tool for identifying adaptation and resilience of coastal energy supply	Chemistry valley transition to a green circular economy based on clean tech
Cultural				
Education and training	University fellowships on climate change awareness to use residual water, and education on water resources	The Berlin Climate Act (2016) makes the study of climate protection and adaptation compulsory in schools	Climate Local Authority Support Programme (CLASP) provides free support for public sector organisations and their partners on dealing with climate adaptation	Education for Sustainable Development Plan (children and adults)

Catalonia, a region in Spain



Barcelona Metropolitan Area within Catalonia

Barcelona Metropolitan Area
AMB (SPAIN)

Population: 3.2 million people (includes the city of Barcelona, with 1.5 million people, and 35 surrounding municipalities)

Area: 636 km²

Density: 5,093 inhabitants/km²

Creation of territorial authority: 27 July 2010 (as a single administration)

Competences of AMB: spatial planning, transport and mobility, environment, economic development, housing, social cohesion

Relevant plans and programmes

Climate Change Adaptation Plan of the Barcelona Metropolitan Area (2015 – 2020)

Sustainability Plan of Barcelona Metropolitan Area (2014-2020), which includes a Carbon Strategy (2011-2015) to be renewed in 2016. The Carbon Strategy also includes an action plan for mitigation.

Metropolitan Education Programme for Sustainability (2014-2020)

Mitigation strategy

Adaptation plan

Education & awareness programme

Good practice example

Improving knowledge of climate change adaptation and resilience through the metropolitan climate change observatory

In 2014 the AMB created the Metropolitan Climate Change Observatory (METROBS), where politicians and practitioners meet together with members of the Expert Group on Climate Change in Catalonia (linked directly to the Intergovernmental Panel on Climate Change).

Over the last two years, METROBS has undertaken 8 studies:

- The **urban heat island** of the metropolitan area
- Effects of climate **change on the coastline** of the Barcelona Metropolitan Area
- Energy characterization of the residential sector
- Effects of climate **change on the water resources** of the Barcelona Metropolitan Area
- Flood evolution from a holistic perspective: past, present and future
- Economy and legislation related to climate change
- Evaluation of green infrastructure and agronomic patterns to boost efficiency in the use of water resources
- Downscaling of global climate models for the metropolitan area

There are three main outputs of these studies:

- Up-to-date available information and knowledge available on the website for experts, universities, etc.
- Downscaled, specific information at the municipal level, allowing municipalities to tailor the design of more realistic actions as part of their Climate adaptation strategies and plans
- Raising citizen awareness through the improvement of contents related to climate change and capacity building of schools, teachers and educators.

Additionally, in the framework of the Metropolitan Area Sustainability Plan, the following two prominent actions were undertaken in 2015:
1. First **Metropolitan Forum on Education for Sustainable Development** "Educational tools against climate change": a one-day meeting for students, teachers, professional schools and researchers. A series of activities were carried out during the 3 months prior to the Forum: micro-interviews, posters from schools, 8 demonstrations of existing practices that are easy to replicate, newspapers, collection of bottom-up proposals for new activities to be incorporated in the formal metropolitan programme, etc.


ara criatures

Educant per a la sostenibilitat

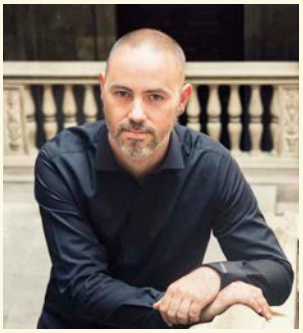
An article in the Catalan press entitled "Educating for sustainability"

2. Improving the resilience of the urban heat island (UHI), with field work studies (temperature measurements campaigns) on the UHI effect in Barcelona and 10 more cities. In addition, new technologies based on ArcGIS, such as the SVF (Sky View Factor), were employed, and indicators were recorded of the air refreshing / renewal potential in a street in terms of urban air canyons and topography.

The results of the eight different studies carried out under METROBS will be disseminated as short leaflets addressed to civil servants, schools and citizens in general, in order to explain to them the effects of climate change on the metropolitan territory, focusing on advice and specific actions that can be taken to increase resilience.

Main strengths in climate change adaptation

- Knowledge and governance through collaboration of AMB with the group of experts on climate change in Catalonia, within the framework the Metropolitan Climate Change Observatory (METROBS) where scientists, politicians and technicians meet
- Networking of municipalities, different administrative levels and bottom-up experiences;
- Coordination activities of the Covenant of Mayors initiative, covering the whole of the 36 municipalities' territory;
- The Metropolitan Education Program for Sustainability, as part of the Sustainability Plan, promotes environmental awareness and tailors activities to different target groups, for example old people, families and leisure education (recreation);
- As a result of studies from METROBS, AMB gained: Knowledge on urban green areas and infrastructure, the downscaling of climatic models, energy efficiency in buildings and water resources;
- Focus on subjects which were traditionally under-evaluated: urban heat island, vulnerability of energy infrastructures, effects of climate change on the coastline, the awareness and resilience of the public in the face of future changes due to the increase of temperatures (from METROBS studies).



Mr. Eloi Badia, Vice-president for Environment, Barcelona Metropolitan Area (AMB)

The metropolitan area of Barcelona hosts a dense population, in some urban areas density is over 6,000 inhabitants/km^2. Although it is one of the most important economic poles in Spain, inequality is a large and prevalent problem. Inequality is likely to increase with climate change. For example, some of the greatest challenges faced will be how to avoid vulnerability due to high temperatures during summer nights (more than 25 ºC or even 30 ºC) and insufficient resources for indoor climate control. It is essential to address the energy transition also in terms of social justice and equality.

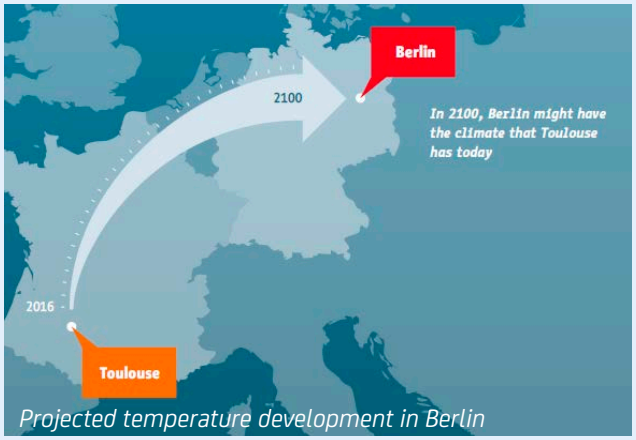
Obviously, drought periods will increase and we have to be more efficient and be prepared to employ water of alternate quality of water for a range of uses, all in the context of water municipalisation.

The data provided by the Observatory allow us to be better prepared and take better decisions in advance. There is no time to lose.

Despite the fact that climate change is often present in the media, we think that there is much work yet to be done to forward our understanding that our lives will change in the near future, and we believe that we need to learn how to save water and energy resources, and even how to move beyond being "consumers" to being "prosumers", who autonomously produce and consume their own energy, for example.

The Metropolitan Energy Operator, created in 2016, is not an end in itself, but a tool for developing an energy policy on the metropolitan scale to both democratise energy and to promote renewable energy. These are both key issues for the energy transition from fossil fuels to sustainable alternatives.

Further information on climate change in the Barcelona Metropolitan Area can be found at:
http://www.amb.cat/en/web/mediambient/sostenibilitat/canviclimatic/adaptacio
(Catalan and Spanish)



Projected temperature development in Berlin

Berlin Metropolis (GERMANY)

Population: 3.5 million people (Berlin)

Area: 891.8 km²

Density: 3809 inhabitants/km²

Source: Reusswig et. al. (2016), "Adapting to the Impacts of Climate Change in Berlin – AFOK. Executive Summary".

Relevant plans and programmes

Adaptation

The Urban Development Plan for the Climate (StEP Klima) was presented by the Senate in 2011 as the first instrument dedicated to climate change adaptation. This plan addresses the special urban aspects of adaptation to the consequences of climate change. In 2016 an updated version was published, focusing on the specific challenges of Berlin's recent growth. **StEP Klima KONKRET** addresses future climate change from a deliberately space-oriented planning perspective.

In 2014, the Berlin Senate Department for Urban Development and the Environment commissioned a comprehensive research study that featured recommendations for a broader adaptation action plan to be undertaken from a sectoral perspective, not only from a special or planning point of view. The **Berlin Concept for the Adaptation to the Impacts of Climate Change (AFOK)** was presented in 2016. It builds on the objectives of the Energy Turnaround Act, calling for improvements in the adaptation capacity of the city's natural, social and economic infrastructures. Together with the StEP Klima/Klima KONKRET, the AFOK provides a powerful framework for an overall climate adaptation strategy for Berlin. The AFOK was developed using a transdisciplinary working process and resulted from a close dialogue between the expert community and the administration. More than 100 people brought their knowledge and experience to bear on the process via stakeholder interviews and workshops, again ensuring a high degree of acceptance for the strategies and measures laid out in the AFOK.

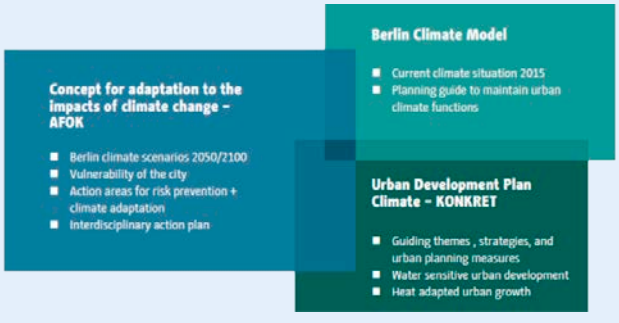
Mitigation

Berlin plans to become climate-neutral by 2050 and reduce its carbon dioxide emissions by 85 percent compared to the year 1990. All of the city's spheres of life are affected, from energy to buildings and urban development, private households and their consumption, to mobility and business. The results of the 2014 **"Climate-Neutral Berlin 2050 Feasibility Study"**, which was commissioned by the Senate Department for Urban Development and the Environment, shows that this goal can be reached if the course is set now. It was also found that significant stimuli for economic growth and employment can be expected as a result of investments in climate protection.

To underline the city's dedication to climate protection, the climate-neutrality target was made legally binding under the **Energy Turnaround Act,** which came into force on 6 April 2016. The act makes climate action mandatory, as also imposing requirements for adaptation planning and monitoring. This is crucial, as it makes climate action a necessary long-term task and facilitates the creation of an environment that promotes the transformation of infrastructure and changes in behavior to move towards carbon neutrality. The monitoring and programme cycle ensures that strategies and measures will be able to adjust to new and to get back on course when mistakes are made. The act assigns a role model function to the Senate and its administration, *inter alia* by making specific plans for the refurbishment of the public building stock or a carbon-free administration obligatory.

The central instrument of Berlin's energy and climate protection policy is the **Berlin energy and climate protection programme (BEK)**. It acts as roadmap towards climate neutrality by describing the relevant measures and strategies. It is scientifically based, as these strategies and measures were developed with the involvement of the administration during a comprehensive research study. Moreover, a broad-based public participation process was conducted in order to ensure the acceptance of the BEK. The BEK contains more than 100 measures that are divided into five fields of action (energy, buildings and urban development, transport, the economy, and consumerism and behavioral change). The measure was passed by the Berlin Senate on 7 June 2016 and will be adjusted in a five-year programme cycle. Its implementation is subject to ongoing monitoring.

The AFOK as part of an overall strategy for adaptation to climate change



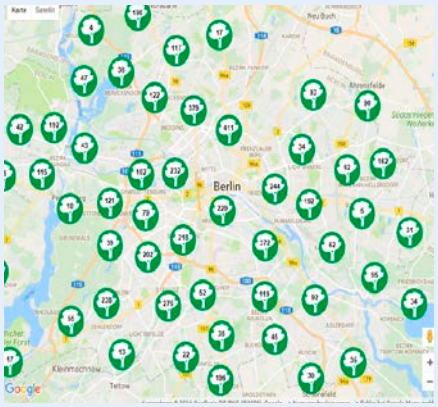
Source: Reusswig et. al. (2016), "Adapting to the Impacts of Climate Change in Berlin – AFOK. Executive Summary".

Good practice example

City Tree Campaign

Planting trees is an effective measure to counteract the heat island effect. Trees provide shade for streets, squares and buildings. They evaporate water and thus have a cooling effect. They produce oxygen, provide habitat and upgrade streets. In order to cope with a decrease in the tree population in Berlin, the Senate launched the City Tree Campaign in 2012. Its target is to plant 10.000 new trees by 2017. By the end of 2015, more than half a million Euros had been donated to plant more than 5000 trees. Their location is published on the website of the Senate Department for Urban Development and the Environment.

Location of City Trees



Source: ©GeoBasis-DE/BKG (©2009), Google

Andreas Geisel, Senator for Urban Development and the Environment

The world's climate is changing. The effects are also being felt in Berlin. They will accelerate, as we stand at the beginning of a profound change. For our growing city, this represents a major challenge. We must find ways to further strengthen Berlin not only as an economic, social and cultural centre, but also to develop it in a carbon neutral and climate-adapted manner. This is the only way to avert or to reduce the damage to the city and its citizens. We will ensure that—even under modified climatic conditions— Berlin's growth will continue to contribute to our goal: maintaining Berlin's qualities as an attractive, efficient and liveable European metropolis.

For this purpose, we will implement the tools we have developed together with the urban community, such as the Urban Development Concept (StEK) 2030, the Berlin Energy and Climate Protection Programme (BEK) 2030 and many other specific plans and projects. With the Berlin Energy Turnaround Act, which went into effect on April 6, 2016, we now also have a legal basis for a comprehensive adaptation process. On behalf of my administration, a 'Berlin Concept for Adaptation to the Impacts of Climate Change' (AFOK) has now been developed. It provides the strategic framework for adapting nature, the economy and society to climate change while at the same time preserving the quality of urban life.

Further information on climate change in Berlin can be found at: http://www.stadtentwicklung.berlin.de/umwelt/klimaschutz/ (German)

Main climate change adaptation strengths

Climate change is already a reality and will significantly worsen in the future. Berlin, with its highly-densified areas, is particularly vulnerable to the expected increase in heat events, more frequent heavy rain periods and periodically occurring dry phases. Particularly vulnerable are the elderly, infants and chronically ill people.

Urban infrastructure is subject to these impacts and requires effective protection. For several years now, the Berlin combined sewer system has been undergoing an upgrade through technical measures in order to reduce the environmental impacts of recurring rainwater overflows. Climate change has the potential to undermine these investments by more heavy rain events. More surface storage capacities have to be created, complementing the subterranean storage facilities. Berlin's city surface has to become more permeable via de-sealing and greening. This will also increase the surface water storage capacity, helping to cool the city during summer heat periods (the 'sponge city' principle). The largely subterranean power grids of Berlin need a continuous climate check, as does the traffic infrastructure. We need to adapt the traffic routing so that the environmental alliance (pedestrians, bicycles, public transport) can continue to function well. Above all, urban nature - forests, parks, public green areas, allotments - need to be better protected against heat, drought and pest infestation.

Under the AFOK, more than 80 measures for all nine sectors under consideration were developed. If they are implemented, our city will be well prepared for climate change. Many of them also have synergies with the Berlin Energy and Climate Programme (BEK), which aims to make the city climate-neutral by 2050. The Berlin Senate has to play a key role here along with the districts, since it has to decide upon and implement many of these measures.[1]

1 Source of the text: Reusswig et. al. (2016), "Draft for an Adaptation Concept of the Impact of Climate Change in Berlin", Brochure page 26.

Lyon Métropole (FRANCE)

Population: 1.3 million people in 2014 (Lyon with 500,000 inhabitants) and 58 surrounding municipalities

Area: 538 km²

Density: 2,383 inhabitants/km²

Creation of territorial authority: 1 January 2015

Competences: employment and economic development; major projects and urban planning; knowledge and culture; energy and the environment; transport; living environment and housing; children and family; solidarity; water and sewage; cleanliness; attractiveness and reputation.

Relevant plans and programmes

Territorial Climate and Energy Plan of Lyon Métropole (*Plan Climat*): adopted in 2012, a local strategy to reduce greenhouse emissions by 20% between 2000 and 2020, thanks to 26 actions. 83 organisations have signed the plan so far (in 2015).

Adaptation strategy: diagnosis of vulnerability published in 2015, action plan to be adopted in December 2016, structured around 5 axes (anticipate water scarcity, limit heat island effect, accompany population, adapt agriculture, improve knowledge).

Energy Master Plan: this project, launched in 2015, will be the core of the new Climate, Air and Energy plan, looking as far ahead as 2030.

Main strengths in climate change adaptation

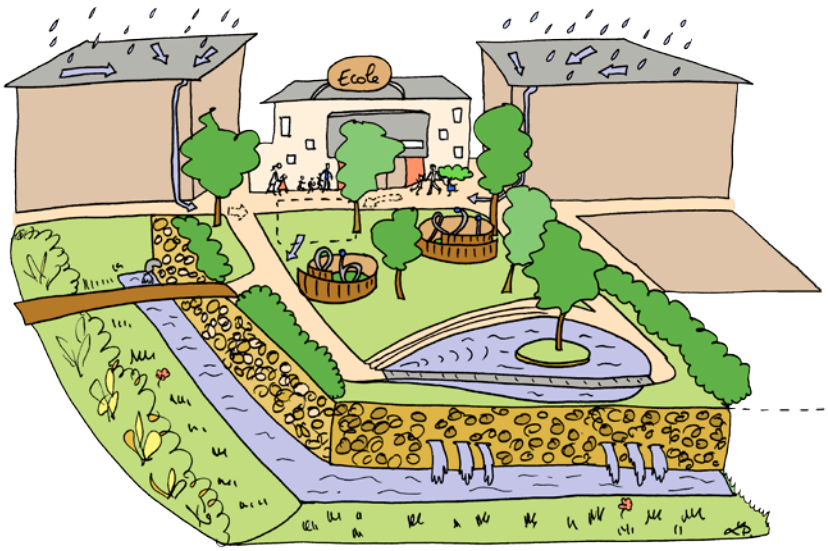
- Early awareness of urban heat island effect through European project AMICA and a student research project which allowed to identify heat peaks as one of the main risks to be addressed;
- On-site experimentation with adaptation measures conducted by private research groups to assess efficiency of certain actions;
- Tree charter (2011) acknowledges the climate role of trees in cities and the potential impact of climate change on trees.
- EPOC research project (2014-2016) to bring local experts together through a permanent local climate observatory which will provide recommendations and involve citizens and public and private actors in the process.

Good practice example

Since the 1990s, all new urban projects have been subject to a rule on storm water management: rainwater must be managed onsite, infiltrated or stored. This measure has several benefits: it limits the environmental impact of storm water released into the sewer network, it avoids treatment costs at the sewer station, it returns water to local resources (water table, rivers), and it provides the city with permeable green spaces that can help mitigate the Urban Heat Island effect.

Kaplan Park, built in 2007, has a surface area of 5,000 m², including a children's playground, green spaces and a fountain. The park was part of a bigger project that created a neighbourhood development zone that is home to 2,800 inhabitants. An innovative proposal was made for collective rainwater management in the area. Instead of each building having its own infiltration device, rainwater is collected by a network connected to the park: some water is stored to water the park's vegetation and run the fountain, the rest is infiltrated.

Several years into the park's existence, locals and workers have made it their own. In terms of governance, an agreement was reached between Lyon city, which manages the park, and Métropole de Lyon, which is in charge of maintaining the hydraulic system. The objective is now to gather feedback on the advantages of this system in terms of improved storm water management (including heavy rainfall), better water quality, social benefits... to help promote these solutions in upcoming urban projects.



Gérard Collomb,
President of Lyon Metropole

In 2100, Lyon may have the same climate as Algiers. By then, heatwave events will have become more intense, more frequent and will particularly affect the most vulnerable. The new "Adaptation" Climate Plan sets 5 strategic priorities and an initial list of actions to help Lyon Métropole work with its partners.

Steps are already being taken to improve water management by modernizing the network and limiting potable water use, helping us preserve this precious resource.

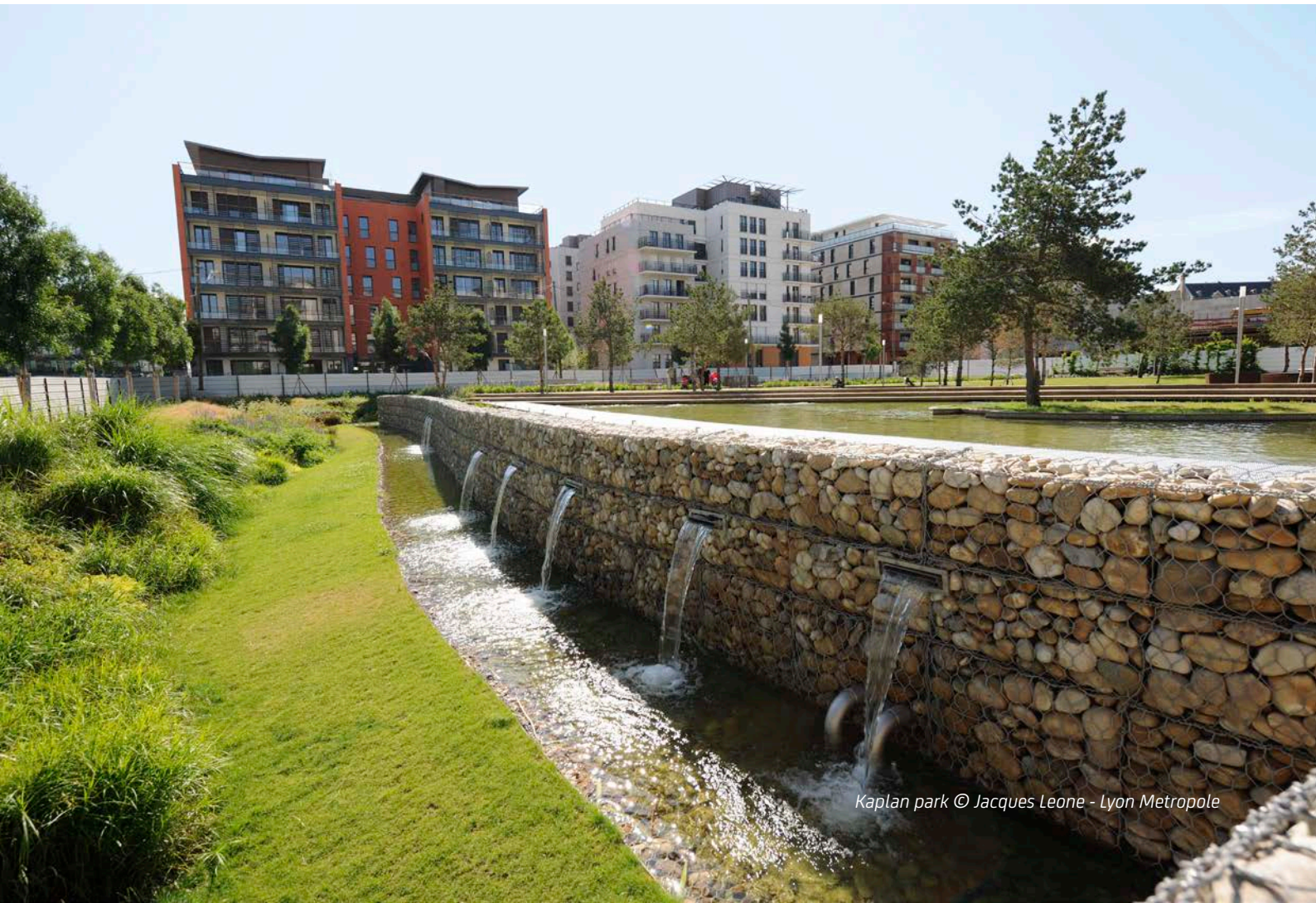
To mitigate heat island effects, we are introducing green and permeable islands in our urban projects to cool the city. Innovation and cleantech can also contribute by developing building materials that keep public spaces at a comfortable temperature in the summer.

During heatwaves, we are helping to protect vulnerable populations (the elderly and very young), as part of the new responsibilities that Métropole assumed on 1 January 2015. Lyon Métropole can support farmers when exceptional weather events occur, and can help the sector continue to robustly adapt its practices to a new climate environment.

And finally, improving knowledge thanks to our local universities and industrial clusters will help in decision making.

Today, the "Adaptation" plan is necessary to make our region one which, tomorrow, under different climate conditions, will continue to be both responsible and attractive.

Further information on climate change in Lyon Métropole can be found at: http://blogs.grandlyon.com/plan-climat/category/adaptation-2/ (French)



Kaplan park © Jacques Leone - Lyon Metropole

Liverpool City Region
LCR (UNITED KINGDOM)

Population: 1.5 million people (Liverpool and 6 municipalities)

Area: 724 km²

Density: 2,061 inhabitants/km²

Creation of territorial authority: the Liverpool City Region Combined Authority (LCRCA) is the Combined Authority of the Liverpool City Region, an area that covers six local authority areas of Liverpool, Halton, Kowsley, Sefton, St Helens and Wirral.

Competences: the LCRCA is a strategy authority with powers over transport, economic development and regeneration.

In 2015 an agreement was made between the government and the leaders of the Liverpool City Region to devolve a range of powers and responsibilities to the LCRCA and to have a new directly elected mayor for the city region.

Liverpool City Region has demonstrated strong partnership arrangements and has articulated a clear and deliverable vision for growth in the area, focusing on four priority areas:

- Creating a Liverpool City Region Freight and Logistics Hub
- Liverpool City Centre
- Low Carbon Liverpool City Region
- Skills and business support to enable growth

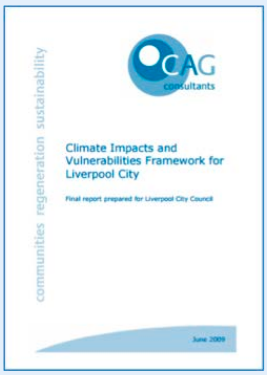
Liverpool City Region has assessed the local significant impacts of climate change, including:

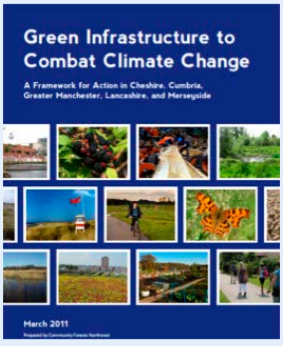
- Impacts of high winds causing power cuts, damage to buildings, trees falling and closure to roads and ferries;
- Summer flash rainfall leading to the flooding of roads, homes and businesses;
- Heavy winter rain leading to homes and businesses being flooded;
- In the longer term, there are risks of health impacts, particularly in areas of deprivation with vulnerable households in our most dense urban areas at higher risk of heat island effects.

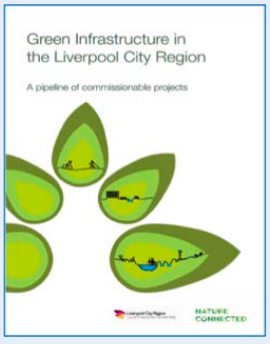
However, not all impacts will be negative, and a number of opportunities have also been identified, for example:

- Economic opportunities arising from warmer weather for increased tourism and development of outdoor leisure services and promotion of a more healthy, active lifestyle;
- Opportunities to develop the low carbon economy around the natural assets of the City Region, for example the supply of renewable energy from offshore wind and tidal power in the Mersey estuary.

Relevant plans and programmes







Good practice example

Wirral Waters – Green Infrastructure, Regeneration and Climate Change

Wirral is a coastal Borough in the Liverpool City Region. It lies on the peninsula between the Mersey and Dee estuaries, strategically located between the economic centres of Liverpool and Chester.

Wirral Waters is a large-scale regeneration programme of national significance, in an area of high levels of deprivation and inequality; an area in need of investment for sustainable growth.

In the course of the 'masterplanning' for the Wirral Waters project, landscape strategy has been a fundamental strand. The developer of Wirral Waters, Peel Group, has been working with partners including the Forestry Commission and Mersey Forest to create 'green infrastructure' that will help to act as a catalyst for economic growth by improving the local environment.

This includes: a community-led programme of urban tree planting along important roads; planting of temporary, fast growing coppice or forest trees to produce a biomass crop in 3 – 5 years; design and implementation of new areas of woodland or other habitats that provide the types of functionality that have been identified as important; and investment in green spaces, including the recently restored Birkenhead Park, as well as several smaller local parks and open spaces.

In terms of climate change adaptation, this Green Infrastructure will provide: evaporative cooling and shading to the area; help to attenuate flood events, by reducing the rate and volume of water runoff; carbon storage and sequestration; filtering of air pollutants; a vegetated and permeable landscape through which species can migrate to new 'climate spaces' and a recreation and visitor resource for a more outdoor lifestyle that will promote more cycling and walking.

Over the past few years there has been a great deal of ongoing work to develop a green infrastructure approach that embeds concerns about the natural environment in decision-making processes. This work has involved a wide range of organisations and has seen the rapid development of a range of policies, research projects, reports and a Green Infrastructure Valuation Toolkit - an easily accessible toolkit to enable valuation of social, environmental and economic benefits of Green Infrastructure. The toolkit and an explanatory guide can be downloaded from www.bit.ly/givaluationtoolkit

Using the Green Infrastructure Valuation Toolkit for Wirral Waters, it has been estimated that for an investment of £2m, economic benefits worth £30m NPV, can be achieved through a mix of: carbon reduction, rising land values, attracting visitors, creating jobs, and improving local health and wellbeing.

Further examples of climate change adaptation in Liverpool City Region

- Awareness raising and behavioural change programmes that reinforce the messages encouraging adaptation to the known impacts of our city's changing climate and spreading knowledge of the linked need to reduce our greenhouse gas emissions – *Example: Climate Local Authority Support Programme Project (CLASP)*
- Planning policy favouring new developments that focus on excellent energy efficiency standards, climate risk planning, and encourage renewable energy initiatives – *Example: Alder Hey Hospital*
- Shoreline Management Plans in place to manage significant erosion influenced by climate change – *Example: Sefton Coast*
- Education resources for schools to help the future generation to understand challenges facing the local environment - *Example: Coast Watch Education Resource Pack*
- Liverpool was one of five global cities involved in the pilot of the City Resilience Index (CRI), an initiative led by Arup with the support of the Rockefeller Foundation to develop a comprehensive set of indicators, variables and metrics that allow cities to understand, baseline and subsequently measure local resilience over time.

Mr. Malcolm Kennedy, Deputy Lord Mayor and Cabinet Member – Regeneration, Transport and Climate Change

The challenges of climate change, population growth, pollution, demographic change, urbanisation and resource depletion mean that the world's great cities need to adapt to survive and thrive in the twenty-first century. Environmental sustainability is a long term-project that stretches beyond political cycles, governments and boundaries. Nonetheless, now is the time to be proactive. We recognise the need to provide a happy, healthy, clean city for current citizens and future generations as well as an attractive place for business. Evidence suggests that green networks, corridors and linkages can play a vital role in supporting urban wildlife and maintaining connections between animal and plant populations. Corridors also have a range of other societal and environmental benefits including providing residents with a more pleasant space for their everyday lives, reducing air pollution, and adapting Liverpool City Region to the effects of climate change.

Key findings of the Project

The four metropolitan areas participating in Climate Metropole + are each at different stages of the development and implementation of their climate change adaptation strategies. Also, their geographical scope, duration and integration with other strategies and plans differ significantly. While Barcelona Metropolitan Area has in place a climate change adaptation plan with detailed specific actions, Lyon Métropole will formalise a strategy over the coming months, and Liverpool does not have a specific strategy per se, but is engaged in several on-going initiatives that include many adaptation actions.

In some cases, actions linked to climate change adaptation are being developed or have been proposed, but they have yet to emerge as clear and visible policies because they are not under the climate change remit. However, policies related to green infrastructure, improving local air quality or increasing tree canopy have clear side-benefits for adaptation.

Mitigation and adaptation are inherently linked, complementary strategies for responding to climate change. However, the benefits of adaptation approaches are local, and this may be used as a significant incentive for individuals, local business and local authorities to invest in adaptation measures in their geographic areas.

Cities view climate change adaptation as a risk (it might involve heavy winter rain, more floods, high winds, etc.) but also as an opportunity to enhance sustainability and quality of life (e.g. increased tourism, promotion of a healthier, more active lifestyle, potential for tidal energy, etc.).

The area of emphasis when it comes to climate change adaptation differs among the participating cities. A significant focus for Barcelona and Lyon is around urban heat island effects, whereas Liverpool's challenges are more centred on extreme weather events such as adapting to intense rainfall and flash flooding events.

The project helped to frame climate change adaptation as a cross-cutting issue. The No Regrets Charter proved to be a useful framework within which to consider different dimensions of adaptation which are generally given less attention than the environmental dimension, mainly culture and the economy. In fact, climate change adaptation actions are seldom linked to economic propositions.

Due to the complexity of climate change, effective responses to ensure adaptation require collaborative approaches to frame the problem and design the right types of options and roadmaps to address it. Some examples of the sort of collaborative approaches that encourage dialogue between the research community, technical city departments and policy makers include the Metropolitan Observatory of Climate Change (METROBS) in Barcelona and the EPOC research project in Lyon. Climate change adaptation is an opportunity to encourage inter-departmental approaches and partnerships between private and public actors, engaging city stakeholders in the process.

Climate shift
The target cities (top of arrows) show a climate which resembles the future climate of their respective counterparts at the beginning of the arrows.

Source: PIK — Potsdam Institute for Climate Impact Research

Challenges of implementing climate change adaptation actions

- Communication of technical-scientific information to politicians, for instance, using clear models;
- Climate adaptation initiatives are often localised and short-term in nature;
- Knowledge of the costs and benefits of adaptation measures;
- Credibility and trust in information provision;
- Lack of high-level leadership and governance to make adaptation decisions, or to revisit previous decisions;
- Identification of useful indicators and quantitative objectives for adaptation;
- The need to raise public awareness of climate change adaptation, rendering the issue in all its complexity (the political, cultural, economic and ecological dimensions) and balancing factual and emotional issues such that behavioural change is achieved;
- Interaction with public departments to promote adaptation actions in an efficient manner, sharing ideas for innovation and improvement;
- Allocation of specific resources for adaptation: not only for technical issues for also for governance aspects.

Statements from participants in Climate Metropole +

Luce Ponsar (Lyon Métropole)

"This project came at the right point in our process of building our Adaptation strategy. The "circle of climate" questioning highlighted the importance of levers we hadn't spotted, like cultural aspects. At the same time, the crossed analysis with the Area Metropolitan de Barcelona cast light upon an opportunity to collaborate: we both have to work on local climate observatories."

Ana Romero (Metropolitan Area of Barcelona)

"The main strength of Climate Metropole + has been the exchange of experiences between different cities, but beyond that, getting to know that very different urban realities share the same needs: more quality data on local temperatures and air pollution, resources for the development of Climate Observatories, studies on social aspects related to the consequences of climate change at the local level, etc. This leads us to renew our commitment to work together on new projects addressing these aspects. Surely this is one of the best outputs of the project".

Vicki O'Kelly (Liverpool City Region)

"Participating in the Climate Metropole project has enabled Liverpool City Region to take a holistic view of the local climate adaptation activities being implemented by many different partners. Most of this activity has not been labelled as climate adaptation activity within the City Region and this project has enabled us to clearly identify how these activities link to one another across the various domains of the' circles of climate' concept.

The field trip aspect of this project has given valuable insight into the activities being undertaken in other cities across Europe, and this good practice has been shared with partners across Liverpool City Region, for example, the Confluence district in Lyon has strong synergies with the development of the Wirral Waters regeneration scheme in Liverpool City Region".

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www.metropolis.org

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www.amb.cat

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GRANDLYON la métropole

www.grandlyon.com

LIVERPOOL CITY REGION

www.lcrbrussels.eu