National Institute for Public Health
and the Environment
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Key factors for climate change adaptation

Successful green infrastructure policies in European Cities

RIVM Letter Report 270001006/2013
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Rapport in het kort

De klimaatverandering zal naar verwachting de komende decennia in Nederlandse steden meer perioden van hitte en droogte veroorzaken. Ook zullen intensievere regenbuien optreden die wateroverlast met zich meebrengen. Uit onderzoek van het RIVM blijkt dat sommige Europese steden effectief beleid hebben ontwikkeld voor de aanleg van parken, groenstroken en stadslandbouw in de stad om deze effecten te verminderen. Dit beleid wordt echter vaak ‘ad-hoc’ en geïsoleerd geïmplementeerd. Landen en steden zouden meer van elkaars ervaringen kunnen leren. Het onderzoek geeft een overzicht van wat steden zelf rapporteren als lokale en gemeenschappelijke succesfactoren voor groene ruimte en stadslandbouw. Op basis daarvan schetst het RIVM hoe de Nederlandse overheid, lokale overheden, burgers en marktpartijen effectief kunnen werken aan (meer) groen in de stad.

In Duitsland bijvoorbeeld heeft nationale regelgeving voor het behoud van natuur het voor lokale overheden gemakkelijker gemaakt om groenmaatregelen te implementeren. Een goede samenwerking tussen lokale overheid, burgers, en soms ook private partijen, die wordt bekrachtigd door bindende afspraken, blijkt een andere succesfactor bij de aanleg van groen in steden. De aanleg van groen is in Freiburg, Berlijn, Faenz, Malmö, Linz en London gestimuleerd door groenaanleg op te nemen in bestemmingsplannen, de bouw van duurzame wijken of contracten tussen de gemeente en woningbouwcorporaties. In Manchester, Lyon en Parijs is actief ingezet op stadslandbouw, als onderdeel van groenbeleid of om gezond, duurzaam geproduceerd voedsel voor iedereen beschikbaar te stellen. Vaak waren er triggers om deze veranderingen door te voeren, zoals de hereniging in Berlijn, de Olympische Spelen in Londen en de voorspelde toekomstige wateroverlast in Malmö. Overheden kunnen groenbeleid stimuleren door te faciliteren dat partijen die betrokken kunnen zijn bij de implementatie ervan kennis, informatie en ervaringen uitwisselen.

Trefwoorden:
klimaatadaptatie, groen, bodem, waterberging, stad, beleid

Abstract

Key factors for climate change adaptation: successful green infrastructure policies in European Cities

In the decades to come, Dutch cities are expected to experience more periods of prolonged heat and drought as a result of climate change. Similarly, rainfall is likely to be more intense, giving rise to localised flooding. Some cities have already developed an effective strategy which provides for the introduction of parks, open areas and urban agriculture to mitigate these effects. However, such policy is often implemented in isolation and on an ad hoc basis. Countries and cities can learn much from each other's experiences. This report sets out the self-reported local and shared success factors in the introduction of green space and urban agriculture from a number of European cities. RIVM describes opportunities for the Dutch government, local authorities, market parties and individuals which emulation of the successful approaches may represent.

In Germany, for example, we see that national legislation intended to promote nature conservation has made it easier for local authorities to implement 'greening' measures. Good cooperation between local authorities and the general public (and in some instances private sector organizations) is a further success factor, particularly when backed by binding agreements. In Freiburg, Berlin, Faenza, Malmö, Linz and London, the introduction of (more) greenery has been promoted by including minimum requirements for green space in zoning plans, through housing development projects which devote considerable attention to sustainability, and by means of formal contracts between local authorities and housing corporations. In Manchester, Lyon and Paris, urban agriculture has been adopted as a component of green policy and as a means of ensuring a constant supply of healthy and sustainably produced food for everyone. In many cases, such changes were prompted by specific 'triggers': reunification in Berlin, the Olympic Games in London, and the on-going risk of flooding in Malmö. One opportunity for the government is to stimulate the implementation of green space policies by facilitating exchange of knowledge and experiences between different stakeholders.

Keywords:
climate adaptation, soils, water management, policy, green, greenery, city, urban planning

Contents

1 Introduction

Previous RIVM reports have described how urban soils can be used to render cities more climate-proof and to promote human health (Claessens, 2010; Claessens, 2012). These reports focused on climate adaptation policy in the Netherlands. Dutch examples are also presented in the book *Ruimte voor klimaat* (Pater, 2011). Although a number of municipalities in the Netherlands have taken a dynamic and assertive approach to climate adaptation, many have been rather more hesitant. This may be due to budgetary constraints or organizational obstacles. This caution is not confined to the Netherlands but can be seen elsewhere in Europe (European Environment Agency, 2012).

Figure 1.1: A combination of green space and water storage in the neighbourhood Augustenborg in Malmö, Sweden. [Photo: André Vaxelaire]

This research aims to identify further opportunities within climate adaptation policy in the Netherlands. We are primarily concerned with green spaces (in the form of parks and areas given over to grass, trees and other vegetation) and with urban agriculture. The current report examines how various European 'trailblazer' cities have gone about introducing greenery and green space in the interests of climate adaptation. What policy instruments have they applied? Research questions were:

1. What role has European, national and local policy played in the introduction of greenery in the European cities examined?
2. What policy instruments have been (or are being) applied: proscriptive legislation, financial incentives and/or communication?
3. Which actors (public, private or a combination thereof) do most to determine policy at each stage of the policy development cycle?
4. To what extent is synergy sought with other policy objectives such as soil and water management, biodiversity and public health?

A recent and similar analysis examines ‘green roof’ projects in Basel, Chicago, London, Stuttgart and Rotterdam (Mees, et al. 2013). The authors’ conclusions were:

- The initial phase of the policy development process regarding green roofs is dominated by one or more public responsibilities, e.g. the prevention of flooding. Local authorities determine policy and strategy, often following some consultation with private sector parties, with a view to encouraging those parties to take appropriate action. Private responsibility is most visible during the implementation and maintenance phase of the policy cycle.
- The main difference between the cities studied is that although all local authorities have significant responsibility during the planning phase, the degree to which public responsibility is implemented is far greater in Basel and Stuttgart. Both cities have incorporated a legal obligation in their planning directives whereby all new build and renovation projects must include green roofs, and both cities pursue an active enforcement policy. Basel and Stuttgart have the highest implementation level for green roofs, and a well-developed market in terms of pricing.
- Success factors in Basel and Stuttgart are that the introduction of the legal obligation was preceded by a lengthy programme of communication and subsidies, partly in the form of reductions in drainage and wastewater disposal charges to offset the costs of installing green roofs and to promote public engagement and support.

It was recommended to include green roofs in the sustainability norms and ratings for buildings, and for the local authority to enter into formal agreements with the housing corporations in this regard. It was concluded that the advantages of green roofs have yet to be exploited to the full and that assumption of public responsibility is essential if the potential is to be tapped, particularly in the initial phase of the policy development process. This study aims to reveal whether these conclusions are also valid for green space and urban agriculture. In contrast to the study of Mees et al. (2013), who performed stakeholder interviews, we confined ourselves to descriptions of the cities in grey literature.

2 Methods

Grey literature includes many examples of urban adaptation, e.g. the book regarding green and blue infrastructure (Pötz & Bleuzé, 2012), the report of the European GRaBS (Green and Blue Space Adaptation for Urban Areas)-project and the EEA report (European Environment Agency, 2012). The selection criteria for the reference cities were:

1. they should concern green space or urban agriculture;
2. they should represent greatest possible geographic spread;
3. there should be adequate data available to answer the research questions;
4. the findings should complement those of the study examining green roof projects (Mees et al., 2013).

The authors have summarized information drawn from various books and reports in the form of tables, presented in Appendix 1. The success factors reported by the cities themselves have been compared against those cited by the European Environmental Agency in its report 'Urban adaptation to climate change in Europe' (European Environment Agency, 2012); see Appendix 2.

Figure 2.1: Community garden Square Villemin in Paris, France. [Photo: Michel Koening]

3 Results

The table below describes policy measures for the introduction of green space in Freiburg, Berlijn, Faenza, Malmö, Linz, London en Kalamaria. For Manchester, Lyon en Parijs, measures to introduce urban agriculture are described. Also the factors that contributed to the success, according to the literature, are summarized. Comprehensive descriptions of the policy measures and the sources of information have been included in appendix 1.

Agenda-setting

- In many cases there have been 'triggers' prompting the implementation of changes. In Berlin, the trigger was reunification; in Augustenborg and Manchester it was the desire to manage and upgrade deprived areas. London had the Olympic Games, while Linz took action further to an acute housing shortage. 'Local vulnerability assessments' can also form the catalyst for changes: Malmö wished to address the risk of further flooding, while London recognized the problem of urban heat and the potential spread of infectious diseases.
- The initiative is usually taken by the local authority, which maintains a leading role throughout the process (see also Mees et al., 2013).

Table 3.1: Self-reported success factors per city.

City (country)	*Measure*	*Success factors (self-reported)*
Introduction of greenery		
Freiburg (Germany)	City Land Use Plan 2020; smaller built-up area and creation of 'cool air corridors'	- Prioritization of landscape conservation - Public participation in various phases of municipal policy process
Berlin (Germany)	Land use plans including 'Biotope Area Factor', whereby part of each land plot released for development is reserved as a green area	- Legal obligation based on national legislation - Interdepartmental cooperation - Flexibility in implementation - Availability of land usage and climate information (maps)
Faenza (Italy)	Bio-neighbourhood incentive programme; project developers design sustainable districts with a large proportion of open space	- Coordination with Agenda 21[1] - Innovation on the part of developers - Involvement of developers and general public in urban planning and design - Fast-track permit procedures - Synergy with mitigation, noise reduction and heritage conservation policy.

[1] A United Nations action plan, non-binding and implemented voluntarily, addressing sustainable development.

City (country)	*Measure*	*Success factors (self-reported)*
Malmö (Sweden)	Management contract between local authority and housing corporation covering water, greenery and waste	- Cooperation and good communication between local authority, housing corporation and citizens - Funding from local, national and international budgets - Engagement of private sector parties - Synergy with mitigation and education policy
Linz (Austria)	Solar City Project; a model district with low energy consumption and much greenery	- Cooperation between local authority, its official architect and leading independent designers - Funding from local, national and international sources - Synergy with mitigation, recreation and transport policy - A means to reduce or resolve an acute housing shortage
London (United Kingdom)	Green Grid Project, incl. Olympic Park	- Exploiting the topicality and popularity of the 2012 Olympics - Synergy with many other policy domains, including transport, public health and biodiversity
Kalamaria (Greece)	Local climate adaptation plan with a focus on green spaces and water	- Interdepartmental cooperation - Stakeholder participation - Exchanges with other European cities as part of the EU-GRaBS project
Urban agriculture		
Manchester (United Kingdom)	Manchester Community Strategy incl. healthy, sustainably produced food for everyone	- Cooperation between local authority, National Health Service, volunteers and private sector - Synergy with health policy (obesity and health status inequality), socio-economic policy and sustainable food production
Lyon (France)	*Jardin Citoyen*: a community gardens programme	- Cooperation and a clear division of responsibility between the local authority and other stakeholders - Incorporated as a 'designated usage' in regional zoning and planning procedures - Appointment of a project manager/liaison officer - Synergy with education, socio-economic objectives, (human) environment and food production
Paris (France)	*Jardins Partagés*, included in the 'Green Hand Pact'	- Synergy with several other policy domains, including social cohesion, culture and education - Flexibility: exploiting current urban dynamic (disused sites)

Policy design

- A significant success factor in many examples is good cooperation between the local authority and citizens, and in some cases private-sector parties. Responsibilities are often established by means of a formal contract. A project manager or 'pacesetter' may be appointed to liaise between the local authority and others (as in Lyon and Malmö).
- Synergetic links are frequently established between various policy domains. There can be various motives for pursuing urban agriculture, although climate adaptation is not specifically cited by any of the reference cities. Some make a connection between the introduction of greenery and (public) health interests. The importance of open areas is widely recognized in terms of water management, and specifically water retention, while the importance of soil quality is occasionally linked to biodiversity.

Implementation

- In terms of the use of instruments, communication is almost always geared towards promoting public participation (often with good communication platforms), while proscriptive legislation is also sometimes used (and is cited as a success factor, see also Mees et al, 2013)). Financial incentives are relatively uncommon among the reference cities. There have been subsidies for the plan as a whole but not for individuals. Subsidies for green roofs have been shown to be effective (Mees et al, 2013).
- Cities often call upon national and/or European budgets (Berlin did so to fund post-reunification reconstruction).
- National policy and legislation can have a supporting role (e.g. in Germany, where landowners are responsible for the 'social goods').
- It is useful to make information available at the local level (e.g. Berlin, which publishes maps showing land usage and environmental factors) as well as at national level (the German *Stadtklimatlose* and the British UCKIP: see Appendix 2).
- Climate adaptation measures are frequently implemented in isolation and on an ad-hoc basis (see the EEA report, Appendix 2). Kalamaria is the exception; here, the initiative formed part of the larger EU-GRABS project in which cities are encouraged to exchange knowledge, experience and instruments.

Implementation, enforcement and evaluation

- Faenza actively ensures compliance with regulations and directives.
- In many cases, progress is not monitored and results are not evaluated. Exceptions are Berlin, Augustenborg (Malmö) and Linz, where the results are assessed using a set of indicators such as water retention rates and the socio-economic status of a neighbourhood or district.

4 Conclusion and recommendations

Many opportunities for effective policies concerning green space and agriculture in the Netherlands can be derived from the examples described in chapter 3. We describe opportunities for governments and stakeholders below. In addition, recommendations for further research are described.

Opportunities for national governments

- Climate adaptation can be placed on the agenda by the development and implementation of a National Adaptation Strategy (NAS). Governments can usefully draw upon the new EU Adaptation Strategy, published in April 2013. Most of the member states in which the reference cities are located have an NAS or, in the case of Greece and Italy, are in the process of formulating one. The United Kingdom has had a national indicator for some time, intended to encourage towns and cities to place the topic on their respective agendas.
- Provide a policy-framework that enables cities to stimulate the implementation of green roofs or open spaces.
- Climate adaptation should be specifically included in the new Omgevingswet (Planning and Environment Act), e.g. by establishing a mandatory long-term horizon policy for water and soil management.
- Governments should ensure adequate information provision, e.g. in the form of communications or (consultation) platforms.

Opportunities for local authorities

- Local authorities should exchange knowledge and experience with each other, e.g. through the EU CLIMATE-ADAPT platform.
- There must be good cooperation between local authorities, departments, citizens and private sector parties, with their respective responsibilities established by means of formal contracts.
- Wherever possible, local authorities should make use of the funding opportunities provided by EU programmes such as the MFF, Green Infrastructure, the Cohesion Policy, LIFE, Horizon2020, INTERREG and URBACT.
- The introduction of urban greenery should be encouraged by means of financial incentives such as subsidies for green roofs and reduced rates of drainage levies (see examples cited in Mees et al., 2013).
- Local authorities should form new networks, to include private-sector parties who would be able to contribute towards the long-term funding of initiatives (as in the Malmö Green Roof Institute & Car Pool and in the examples cited in Mees, 2013).
- Urban agriculture enjoys much public interest and should be used to bring further the interests of climate adaptation. It is essential to take the opportunities it presents fully into account rather than focusing solely on the risks.
- Measurable performance targets and indicators should be established, with both the short-term and long-term effects of measures evaluated on a regular basis.

Opportunities for the individual

- The insulation provided by green roofs reduces energy consumption and hence household costs and expenditure.
- A green and pleasant human environment.
- Greenery has a favourable effect on house prices.
- More social contact with neighbours, e.g. when managing a vegetable garden or allotment as a group.
- Eating self-grown vegetables will reduce grocery bills.
- More outdoor space for children to play safely.
- Nature and environment education for children.

Opportunities for private sector companies

- New markets, such as that for green roofs.
- Simplified planning permission procedures for new build projects (as in Faenza)
- Innovation in housing design and construction.
- Opportunity to establish a reputation for sustainability.

Recommendations for further research

- The existing communication and information platforms for climate adaptation should be evaluated. Stakeholder interviews will help to establish the extent to which those platforms are used and appreciated.
- The indicators which are of greatest use 'measuring' the results of climate adaptation measures should be identified or, where no such indicator yet exists, developed.
- Information relating to climate adaptation is to be found in many recent and on-going studies in all parts of Europe. This information should be collated and made available to policy-makers and other stakeholders in the Netherlands.
- Further research into the potential of urban agriculture as a component of climate adaptation policy is required. Will urban agriculture also provide health gains? What action should be taken to prevent or mitigate soil contamination? These questions are among those to be addressed by the SNOWMAN project.

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Appendix 1: City examples

	Green space			
City of Freiburg	Legal instruments	Economic instruments	Communication instruments	Results
(Vaessen 2006) http://www.fwtm.freiburg.de/servlet/PB/menu/1174649_l2/index.html visited July 12, 2013	The city's Land Use Plan 2020, which aims to reduce land use as far as possible by focusing on Freiburg's internal development while limiting or controlling development outside of the city center.		Public information Campaign, e.g. with material that served as a basis for the participants in the public dialogue: - a contact person for each issue was assigned; - all specific land areas were described through short fact sheets; - several issues of the local newspaper reviewed land use scenarios - all expert opinions were available on the Internet and; visionary objectives were used in the communication between civil population and local government.	The city's Land Use Plan 2020 is novel in that it prioritizes landscape protection over building. It includes about 30 hectares less building space than was previously available and provided cool air corridors.

City of Freiburg	Motivations	Roles per stage	Rationale
Hierarchical governance	- Open space - High temperatures - Flooding - Percolation water through the soil - Ecological compatibility Social	The Land Use Plan 2020 is regarded as a successful example of civic participation in municipal processes. In 2003, civic groups defined some visionary	

	justice - Economic viability	objectives, which, one year later, were included by the municipal Council as framework conditions of the Land Use Plan 2020, addressing ecological compatibility, social justice and economic viability. In 2005, citizens formed 19 working groups to discuss every potential construction area of the Land Use Plan 2020. Upon defining key points of the Plan, the municipal Council reoriented its decision, based on the outcome of these discussions.	

	Green space		
City of Berlin	Legal instruments	Economic instruments	Communication instruments
(Kazmierczak and Carter 2010)	Biotope Area Factor (BAF); plans for the development of new buildings have to leave a certain proportion of the development area as a green space. The BAF has legally binding force in Landscape Plans for selected parts of the city. Their binding nature as statutory instruments gives Landscape Plans a strong political, administrative and public mandate. An important advantage of the BAF	A system of fees and regulations.	Internet; information is aimed at both the interested layman and the professional public, in several languages and updated on a regular basis. A database of maps presenting environmental conditions in the city and land use characteristics, e.g. climatic zones, air temperature, humidity and soil moisture.

	regulation is that it allows flexibility of the site design; the developer may decide what green space measures are applied, and where, as long as the required green space ratio is achieved. Provision of green spaces is supported by national legislation. In the German constitution, there is a clause about private property owners having responsibilities for promoting social good (Ngan 2004). This means that property owners have a responsibility to the greater community to provide green space.[2]		

City of Berlin	Motivations	Roles per stage	Rationale
Hierarchical governance	- Biodiversity - Open space - High temperatures - Urban flooding	The unique opportunity to develop the vast central area of the city after the reunification of East and West Berlin provided a testing ground for innovative large-scale green infrastructure projects. The Landscape Pro-	The BAF contributes to standardizing and putting into practice the following environmental quality goals: - Safeguarding and improving the microclimate and atmospheric hygiene

[2] In Germany, green space policies can be supported by the 'German Intervention Rule', which is based on sections of the Federal Building Code, along with parts of the Federal Nature Conservation Act. In essence interventions (intrusions) on nature or the landscape require compensation measures (counterbalances). Green roofs and green space are recognized as compensation measures in many municipalities (Ngan, 2004).

		gram for West Berlin was introduced in 1984. At that time, nature conservation was a priority for almost all political parties. The plans responded to the need to encourage more green space areas to be developed in densely built-up urban locations.	- Safeguarding and developing soil function and water balance - Creating and enhancing the quality of plant and animal habitats - Improving the residential environment
Local authorities		Discussions between staff from Berlin's Landscape Planning and Town Planning departments helped to develop new classifications (e.g. for environmental mitigation and replacement measures) in the Landscape Program. Cross-departmental working also helped to develop a better mutual understanding of the various laws applicable to green spaces.	

	Green space			
City of Faenza	Legal instruments	Economic instruments	Communication instruments	Results
(Kazmierczak and Carter 2010)		Bio-neighborhood incentive program ("Municipal Rule of Green") included in Town Planning Regulations; incentive scheme for developers to incorporate sustainable practices in	Negotiations between the developers and the municipality. Promoting of - Water retention by water metering and technical devices reducing the waste of water and re-	As of 2010, two bio-neighborhoods have been developed including a total of 500 apartments in 250 private property units. These bio-neighborhoods meet green

		building design. Developers may create buildings of a larger volume if they minimize land consumption by concentrating the development in one part of the plot of land. It includes flexible rules and cooperation with citizens. The project was funded by Municipal and Regional Funds.	use of grey water. - Systems of rainwater collection, filtering and storage - High quality design of courtyards and communal areas. Engagement of Faenza residents by - "Faenza 2010 - The City We Want", an awareness raising campaign that started in 1998; - Awarding “Blue stickers” for cars and heating systems, which highlights the adherence to fuel- and energy-use standards; - “City Center by bike” transport initiative.	building criteria, requirements for permeable surfaces and rainwater recovery, and the reduction of noise pollution. Due to the improvement in town quality, the population of Faenza has grown by 6%. The lack of set standards encourages developers to search for and implement innovative solutions to the design of the buildings and the surrounding area. Similar incentive systems are now being used in other municipalities in the region. Furthermore, the negotiations between the developers and the municipality based around flexible rules are less time consuming than the process of checking adherence to rigid building standards. Reduced time of obtaining building permits encourages developers to invest in Faenza.

City of Faenza	Motivations	Roles per stage	Rationale
Hierarchical governance	- Urban quality - Urban sustainability - Nature protection	In 1999, the Municipality of Faenza joined the national project “Agenda 21” for urban	Key issues taken into account in the preparation of the 1999 Town Planning Regulations were protec-

	- Archeological site protection - Well-being - Social economic development - Open spaces - Water storage - High temperatures - Microclimate conditions - Energy	areas: a pilot initiative with regard to sustainable development involving some small-medium sized cities in Italy. This helped to promote development rules and practices based on the direct involvement of developers and citizens in the urban design process. The municipal administration of Faenza was the leading actor in the development of the initiative. Main stakeholders are the developers, or groups of individual citizens, who want to construct a bio-neighborhood. The Town Planning Regulations 1999 included an incentive scheme for developers to incorporate sustainable practices in building design. This approach was confirmed and extended by the Municipal Structural Plan in 2009. The municipal Administration of Faenza has the power to assess, upon completion of the development project, whether the developer has actually followed the approved design of	tion of the historic and natural features of the area, protection of archeological sites, protection and creation of open spaces. The incentive program aims to achieve energy savings, promote aesthetic qualities of neighborhoods, and also create better microclimate conditions to prepare for future rising temperatures associated with climate change.

		the plan.	

	Green space			
City of **Malmö**; Augustenborg	Legal instruments	Economic instruments	Communication instruments	Results
(Kazmierczak and Carter 2010) http://www.malmo.se/English/Sustainable-City-Development/PDF-archive/pagefiles/AugustenborgBroschyr_ENG_V6_Original-Small.pdf, visited July 12, 2013.	The Malmo Municipal Housing Company (MKB Malmo Kommunila Bostadsbolag) and the City of Malmö agreed a joint management contract for the waste, water and green space systems. It includes Sustainable Urban Drainage Systems (SUDS) with ditches, retention ponds, green roofs and green spaces and a storm water system.	Around half of the sum was invested by MKB. Remaining funding came from the local authorities, principally the City of Malmö, in addition to several other national and EU sources. Management work is jointly funded through the housing company, which incorporates costs into rents, the water board through the water rates, and the city council's standard maintenance budgets.	The Augustenborg project incorporated extensive public consultation. This included regular meetings, community workshops, and informal gatherings at sports and cultural events. The approach became increasingly open and consultative. Constant communication and in-depth community involvement enabled the project to accommodate residents' concerns and preferences regarding the design of the storm water system. Consequently, the project encountered little opposition. The greatest challenge in involving the public was maintaining continuity, which involved keeping a steady focus on the environmental awareness of the residents and informing the newcomers to the area about what had been done.	The volume of storm water draining into the combined system is now negligible, and this system now drains almost only wastewater. Runoff volume is reduced by about 20% compared to the conventional system. The rainwater runoff rates have decreased by half. There have not been any floods in the area since the open storm water system was installed, which was designed to accommodate a 15 year rainfall event as the baseline. Overall green space has increased 50 per cent, attracting small wildlife and increasing biodiversity by 50 per cent. Between 1998 and 2002 the following social changes have occurred: - Turnover of tenancies decreased by 50%; - Unemployment fell from 30% to 6% (to Malmö's average);

				- Participation in elections increased from 54% to 79%. Augustenborg has a recycling rate of over 50 per cent compliance and includes food composting. As a direct result of the Ekostaden project, three new local companies have started: Watreco (working with open storm water management), the Green Roof Institute and Skåne's Car Pool.

City of Malmö (Augustenborg)	Motivations	Roles per stage	Rationale
Local authorities	Create a more socially, economically, and environmentally sustainable neighborhood and minimize flood risk	The process of creation of Ekostaden Augustenborg began in 1997, and was started by discussions about closing down a nearby industrial area. The Service Department, City of Malmö, suggested that an eco-friendly industrial park opened in the area. The key actors involved in the regeneration of Augustenborg were the MKB housing company and the City of Malmö, represented by the Fosie district and the Service Department . How-	Augustenborg was prone to annual flooding caused by the old sewage drainage system being unable to cope with the combination of rainwater run-off, household waste water and pressure from other parts of the city. The neighborhood of Augustenborg (Malmö, Sweden) has experienced periods of socio-economic decline in recent decades, and frequently suffered from floods caused by overflowing drainage systems. Climate change projections included increased numbers of days with high tempera-

		ever, several individuals were particularly important to the success of the project. The process of creation of Ekostaden Augustenborg began in 1997, and was started by discussions about closing down a nearby industrial area. Someone from The Service Department, City of Malmö, suggested that an eco-friendly industrial park opened in the area. At the same time a former headmaster at the school in Augustenborg, had become one of the coordinators of the Swedish Urban Program in Malmö. He contacted the MKB housing manager for Augustenborg and had the mission to renew the area. The three men gathered a group of senior officers, colleagues and active residents in the area who all wanted to turn the area into a sustainable district of Malmö. A project leader, with experience from Groundwork in England, was hired in 1998. Residents and people working in Augustenborg were involved in	tures and more heavy rains, which were expected to exacerbate existing problems. In addition, waste management and biodiversity improvement were important drivers. This project also involved initiatives aiming at improvement of energy efficiency and energy production, electric public transport and carpooling, and recycling.

		the design of the outdoor environment. Augustenborg school pupils were involved in a number of local developments, for example with the planning of a new community/school garden, rainwater collection pond/ice rink, a musical playground, and sustainable building projects incorporating green roofs and solar energy panels.	
Interactive governance		As the project progressed, local businesses, schools and the industrial estate became involved. The joint management contract is an example of interactive governance. The Botanical Roof Garden was developed in a partnership with several universities and private companies.	

	Green space			
City of Linz	Legal instruments	Economic instruments	Communication instruments	Results
(Treberspurg 2008; Pötz and Bleuzé 2012) http://www.linz.at/english/life/3199.asp, visited July 12th, 2013.			Famous designers were hired and competitions were issued for architecture, energy and water concepts. A book about the project has been published.	Solar City; an urban settlement for 3.000 - 4.000 people in the immediate proximity of a sensitive, unique natural landscape. An attractive open space of 20 hectares parkland with high

				recreational value in and around Solar City has been realized. A sunbathing lawn adjoining a swimming area is realized. The Landscape Park is a transitional filter between the residential area and the natural landscape. This basic structure has been filled with a variety of facilities, such as playgrounds, an area for fairs or other large gatherings, and a constructed wetland for wastewater treatment. The Aumühlbach Stream was completed in 2005. Since April 2004, water has again flowed freely through the 4.2-kilometer streambed. A total of 1500 new trees have been planted in the parkland and along the Aumühlbach Stream.

City of Linz	Motivations	Roles per stage	Rationale
Hierarchical governance	- Biodiversity - Social economic situation - Air pollution - Energy - economic growth - Housing demand	Municipal administrators took the initiative and hired quality design partners. The municipality made the initial investments and controlled the whole process.	The municipal government of Linz, aware of the unquestionably dramatic ecological changes taking place on our planet, decided to embark on new paths by means of concrete projects that would develop and showcase new solutions and

			help them to get accepted. Another reason for focusing on the issue of residential construction was the enormous demand for housing, above all affordable dwellings for low and middle income earners. An estimated 12,000 persons were looking for apartments in Linz at that time. A large number of people working in Linz lived outside the city limits. Therefore, a further aim was more housing inside the city in order to reduce commuter traffic.
Interactice governance		In 1994, the City of Linz, together with four of the most important non-profit-making residential construction organizations in Linz confirmed their willingness to finance the planning and development of a model estate of 630 low energy construction homes in the district of Pichling.	

	Green space			
City of London (Olympic park and Green Grid)	Legal instruments	Economic instruments	Communication instruments	Results
(Greater_London_Authority 2008; Pötz and Bleuzé 2012)	The concept of the East London Green Grid is defined and embed-		Olympic games 2012; The city won the bid in 2005 to host the games	Lee valley park; The park for the Olympics is seen as a cata-

	ded in Local Development Documents. The aim is to connect as many areas of urban vegetation as possible through purchase or zoning changes.		because it submitted an ambitious plan to make the event more efficient and less wasteful.	lyst that will improve the green grids in the Lee Valley. It is a green zone about 40 km and 61 hectares of new parkland. The delivery of the East London Green Grid vision is a complex and challenging task. It will be a long-term and evolutionary process requiring strong political support at all levels, national, regional and local. This can best be achieved through the adoption of appropriate policies by boroughs in their Local Development Frameworks (LDFs).

City of London	Motivations	Roles per stage	Rationale
Hierarchical governance	- Health effects - Dryness, drinking water - Increased risk problems with insects - High temperatures - Air quality - Recreation - Community cohesion - Reduction in local crime and anti-social behavior - Biodiversity - Reduction in local traffic by encouraging pedestrian and cycle	With the publication “A summary for decision makers” in 2006, London put forwarded the concept of heat stress parameter for spatial planning; a starting point of the East London Green Grid project. The purpose of this strategy is to create natural urban systems that support and permit growth. The presence of green structures has been linked directly to the target of healthy urban	Heat waves and their adverse impact on the London economy of the start of 21 century. Prediction is that the heat in 2015 will be the same as in summer of 2003. The green space expansion will improve health and social wellbeing of the residents. Green-blue structures serve explicitly to buffer water, enhance the quality of the air and lower the temperature.

	route use - Flood risk - For Olympic park: climate change, reduce waste, biodiversity, support awareness, quality of life	environment. Investment in the Green Grid plan calls for an investment of 250 million pounds by the authorities.	

	Green space			
City of Kalamaria	Legal instruments	Economic instruments	Communication instruments	Results
(Euroconsultants, 2011; European Environment Agency, 2012)		Kalamaria participated in the Grabs-project, financed by the EU, and developed an adaptation action plan.		The cross-departmental and multi-stakeholder process brought different perspectives and types of experience to the adaptation action plan. They improved the understanding of climate change impacts across stakeholders and, as a co-benefit, helped to established long-term collaboration which otherwise would not have taken place.

City of Kalamaria	Motivations	Roles per stage	Rationale
Local authorities	Climate Change: the use of green and blue spaces as adaptation measures	The city started with an internal SWOT analysis (strengths, weaknesses, opportunities and threats). It involved interviews with personnel of the Department of the Land Registry Office and Municipal Property, the	

		Department of Technical Works, Maintenance and Environment, the Planning Department; the Department of Greenery and the Office of Protection of the Environment. A cross-departmental climate change monitoring task force led to the development of an action plan with clear roles for all stake-holders. The adaptation action plan was also developed in collaboration with a number of external stakeholders. The task force will monitor and evaluate the implementation and then report to the mayor.	

	Urban agriculture			
City of Manchester	Legal instruments	Economic instruments	Communication instruments	Results
(Karner 2010)		Local Exchange Trading Sys-tem(LETS). This provides an indirect barter system for an alternative economy. They are basically social trading net-works, means for people who define networks to exchange goods and services without using cash. There was a big LETS system in Manchester with	Manchester Community Strategy (2006-2015) sets out how public services will be improved, especial-ly a vision for 'making Manchester more sustainable' by 2015. It in-cluded wide social mobilization.	Manchester's agri-food activities are not entirely measurable in terms of conventional 'value chains' or even money. It is seen as providing unique 'community spaces' which con-tribute significantly to the envi-ronmental and economic sus-tainability of the region, espe-cially by recycling money and

		about 600 people trading in it.		human resources for community development.

City of Manchester	Motivations	Roles per stage	Rationale
Local authorities	- A culture of good food in the city; wide access to healthy, sustainably produced food. - Exercise - Social economic situation	Support bodies for food initiatives Manchester Environmental Resource Centre (MERCi) was established with funding from the National Lottery in 1996 with the aim of making Manchester more sustain. Minimal financial support, mainly from local authorities and private foundations, has generated food projects that are dependent on a few paid posts. Public funds support collaborative projects among community groups to develop more allotment sites, some used for training in organic production methods.	Socio-economic inequalities and social exclusion are contributing to rising health problems, including obesity. Some parts of the city are known as 'food deserts', where residents have little access to healthy food. Urban redevelopment favoring supermarket chains has been blamed for these problems. By setting up local food production, it's a way of getting people to have exercise and engage with each other. It's social integration. And they get to grow food and eat healthy food. It's a way for people who don't have very much money to have access to affordable health organic food.
Market governance		Herbie Van's shop Photo: Manchester Food Futures able, and has stimulated many food projects addressing societal problems.	
Interactive governance		Manchester Food Futures (MFF) is a partnership of Manchester City Council, the National	

		Health Service, community voluntary and private sector groups. Manchester Community Strategy (2006-2015) sets out how public services will be improved, especially a vision for 'making Manchester more sustainable' by 2015. It includes local food initiatives, which provide broader access to healthy, fresh food. Diverse actors carry out the initiatives, including for-profit businesses, voluntary (or charitable) organizations, grassroots projects, social enterprises and official bodies.	

	Urban agriculture			
City of Paris	Legal instruments	Economic instruments	Communication instruments	Results
(Jonkhof, Philippa et al. 2012; Pötz and Bleuzé 2012)	Municipality makes available a duration of five years, a period that could be extended according to urban development. The green hand pact ('Main Verte') signed by the neighborhood association and the local authorities , puts in place constraints such as weekly opening, public events organization management plan			70 jardins partagés have been created within 10 years and cover a varied archipelago of individuals as generations, social backgrounds, cultures, and origins.

	creation and communications, and juridical warrants.			

City of Paris	Motivations	Roles per stage	Rationale
Local authorities	- Education - Social connections	Meeting an increasing demand from local citizens, the municipal program of Paris so-called 'Main Verte' (equivalent to Green Thumb in New York) has been set up at the turn of the twenty first century. This new, urban space-sharing form of gardening draws its inspiration from the New York and Montreal 'community gardens'. The Municipality makes available and cleans up plots, guarantees water supply and garden enclosing. Amateur gardeners adhere in return to specific environmental guidelines, rainwater for irrigation, organic gardening and material recycling.	Beyond providing accessible green space in the city and improving environmental quality, jardins partagés provide new social and cultural hubs. Jardins partagés are a tool to transmit knowledge and traditions; some of the gardens integrate social and professional inclusion programs, educational plots reserved for schools and therapeutic gardening. The great enthusiasm of the Parisian reflects the need to provide gardens in urban space remodeling. A way to revent the city and showing that ephemeral actions are crucial for a more sustainable city organization.

	Urban agriculture			
City of Lyon	Legal instruments	Economic instruments	Communication instruments	Results
(Jonkhof, Philippa et al. 2012) http://www.sustainable-everyday-project.net/urbact-	Community gardens in Lyon are part of the green zoning plan of the *Urban Community of the Grand*		Media, local papers and the Internet have been used to attract participants.	Up to 30 gardens across Lyon with varying goals (see below) have been realized. A careful

sustainable-food/2012/09/25/opportunities-and-challenges-5/, visited August 15, 2013.	*Lyon* including the city of Lyon and the 58 municipalities around. Participants have to set up a foundation and make arrangements for maintenance, financing etc. with the local authority.			mapping and analysis of all the different experiences has led to a change in the management support by the city to work on the consolidation of existing gardens (to reach financial autonomy and stable participation) before expanding their number.

City of Lyon	Motivations	Roles per stage	Rationale
Local authorities	- Community spirit - Socio-economic inequalities - Education - Food production - Gastronomy - Sustainability		- jardin familial, family garden: to improve family situations in deprived neighborhoods - jardin communautaire, environmental garden: to improve the quality of the living environment - jardin familial traditionel, allotment garden: social activities in greenery - Jardin pédagogique, educational garden: for education and to improve social, physical and cognitive interactions among children and youth - jardin collectif, community gardens: common activities in regular neighborhoods - jardin collectif d'insertion, social gardens: reintegration of de-

			prived groups of people - jardin maraîchage, food production garden
Interactive governance		The *Urban Community of the Grand Lyon* actively promoted urban agriculture. Participants have to set up a foundation. A project manager / liaison officer has been appointed to link the ideas of the participants to the expertise of local governmental bodies. The salary of this professional is part of the financial plan of the garden. Arrangements are made, in which the local government is responsible for financing, allocation of plots and governmental arrangements and the participants are responsible for continuity of their foundation, engagement and commitment, quality of the design and maintenance schedules. A comprehensive financial plan from both participants and government is obliged, including costs of design, earnings, water and waste services etcetera. The gardens are laid out by the	

		participants, after the definition of the goal and target group of the garden and according to the corresponding typology.	

References appendix 1

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Appendix 2: Role of (inter)national policies

EEA REPORT (European Environment Agency, 2012);

- Urban adaptation relies on action beyond cities' borders' ; e.g. cities facing flooding due to inappropriate land use and flood management in upstream regions.
- **Support from a national and European framework is crucial in assisting cities to adapt.** Cities and regional administrations need to establish grey and green infrastructures and soft local measures themselves. National and European policy frameworks can enable or speed up local adaptation thus making it more efficient. Supportive frameworks could comprise of:
  - sufficient and tailored funding of local action;
  - mainstreaming adaptation and local concerns into different policy areas to ensure coherence;
  - making the legal framework and budgets climate-proof;
  - setting an institutional framework to facilitate cooperation between stakeholders across sectors and levels;
  - providing suitable knowledge and capacities for local action.
- Few European regulations refer to adaptation; e.g. in water and flood risk management, agriculture and rural development, health, and nature protection and biodiversity (table 4.5). A higher potential exists. One proposal linked to the European Union's structural funds for the period 2014–2020 states that project spending requires the existence of disaster risk assessments taking into account climate change adaptation as conditionality. It will ensure that expensive and long-lasting infrastructures are able to cope with future climate changes. In addition the proposal for the Multiannual Financial Framework (MFF) 2014–2020 requests that the budget for climate change is sourced from different policy sectors forcing policy mainstreaming and coherence.
- Most current EU policy strategies only target single or possibly dual policy goals (table 4.5). With a more integrated and holistic approach, many of these policy tools could be adapted to address a much broader range of policy interests. An extensive revision of EU policy in the direction of ecosystem preservation, improvement and creation is needed, according to Ellison (Ellison, 2010). He argues that a EU Climate Change Commission should be installed to coordinate policy goals (1) across issues areas (e.g., energy, agriculture, water and land use) and (2) across individual Member States.
- The European Commission is developing a strategy for an EU-wide green infrastructure as part of its post-2010 biodiversity policy. This would include not only areas falling under the remit of Natura 2000 (EC, 1992) but also urban green areas, green roofs and walls supporting biodiversity as well as climate change adaptation.
- Perhaps the most relevant for urban areas is the EU's cohesion policy with its related structural funds which comprise a substantial part of the EU budget. The funds hold the potential to support specific adaptation projects in cities and regions. For example, urban renewal projects can actively consider climate change by providing sufficient green infrastructure.
  - The development and implementation of the European climate change adaptation strategy for 2013 offers a unique opportunity to create a joint, multi-level approach and reflects efforts cities have made in recent

years to be part of related EU policy. The European Commission started a project in 2011 to support urban adaptation strategies (http://eucities-adapt.eu, Rotterdam as 'peer city', final conference June 3, 2013).

Adaptation policy at national level

EEA report:

- National governments provide the crucial link between EU priorities and local adaptation action, e.g. by providing National adaptation strategies (NAS). Biesbroek concludes in his comparison of NAS (see table 4.5) that in most cases approaches for implementing and evaluating the strategies are yet to be defined (Biesbroek et al. 2010).
- Sometimes a gap between local, bottom-up adaptation and national adaptation strategies exists. In the case of the Finnish NAS, the national focus undermined regional and local perspectives, making the strategy less interesting for local actors (Juhola, 2010). Sweden and several other countries face similar limitations.
- Multi-level governance is required, i.e. non-hierarchical forms of policymaking, involving public authorities as well as private actors, who operate at different territorial levels, and who realise their interdependence. A dialogue between government levels, private actors and citizens is of particular importance.
- Developing multi-level governance approaches for urban adaptation in Europe needs to consider the diversity of formal governmental systems within Europe. In federal states — such as Germany — regional governments usually have strong decision-making rights. Sweden, although an unitary state, has strong municipal governments holding so called 'local planning monopolies' (Keskitalo, 2010; PLUREL, 2011). Because cities can decide, relatively independently, on issues related to adaptation, large differences in adaptation policy between the cities in Sweden exist. In the United Kingdom the previous government developed relatively strong central steering on adaptation. National governments can provide the necessary background information and regional climate data, scenarios and assessments. In Germany, for instance, the 'Stadtklimalotse' (urban climate pilot) was developed for this purpose (http://www.stadtklimalotse.net/stadtklimalotse).
- The United Kingdom Climate Impacts Programme (UKCIP) has often been hailed as a success story in providing support for coordination of climate change action across levels. The UKCIP provides a uniform platform for local authorities and for coordination on adaptation in the English regions. It supports bringing local authorities to certain minimum levels of adaptation.
- In a range of countries, urban adaptation still happens in an ad hoc fashion and in isolation. Table 4.5 shows barriers and possible solutions from a multi-level governance approach.
- Another limitation for implementation at the national level relates to the barriers between policy sectors. Without flexible and cross-sectoral coordinated measures, adaptation efforts may be hampered by sectoral thinking.
- National governments also can play a key role in greening urban finance by re-designing sub-national taxes and grants at local government level (OECD, 2010).

Table A2.1: Key barriers to local adaptation and possible multi-level governance responses.

Barrier type	Barriers at local and regional level →	Possible support from a multi-level governance approach	← Barriers at national and European level
Jurisdictional and institutional	Lack of mandate at the subnational level to address adaptation issues and problems of regional coordination between municipalities.	Clear mandates for local authorities, clarity of responsibilities between local, regional, national and European actors; Acceptance of the territorial cohesion approach and the Territorial Agenda.	Narrow interpretations of subsidiarity leaves little room for flexibility.
	Maladapted institutional designs which hinder coordination across relevant issues (vertical/horizontal).	Ensuring policy coherence, establishing mechanisms and incentives for horizontal and vertical coordination, addressing issues of scale and the problems of institutional fit and interplay; Development of the EU adaptation strategy as an opportunity.	Novelty and instability of the adaptation agenda, the EU's role still being developed.
	National or regional laws, rules and regulations lead to maladaptation and increase vulnerability.	Climate proofing/mainstreaming of local adaptation needs into national and European legislation and budgeting; Policy coherence through procedural integration of adaptation, e.g. in SIA, SEA and policy evaluation.	Sectoral policies with vested interests.
Political	Local authorities influenced by particular special interests.	Enforce the applications of the principles of good and democratic governance; Ensure broad public participation.	Authorities influenced by particular special interests.
	Pressure to maintain 'business as usual' development pathways.	Clear signals, including incentives, from national and European to local policy levels, that change is necessary; Articulate, to national and European level, local demand for change based on local adaptation experiences; Using the momentum of extreme weather events and other crises to forward the adaptation agenda.	Pressure groups and political interests emphasise 'business as usual' development pathways.
	Pressures of short-term electoral cycles on effective risk management and long time-lag to reap full adaptation benefits.	Raising awareness for the challenge and urgent need for adaptation — use local pressure where climate change impacts are felt first; At the local level, use integration into long-term national and European processes; Sustained attention on procedural integration of adaptation in monitoring and evaluation efforts.	Adaptation not a priority at national or European level, rather on mitigation, eco-efficiency, innovation and green growth.
	Lack of willingness to accept costs and behavioural change.	Build clear evidence on costs and benefits of adaptation; Communication about early-adapters and best practice; Exchange European-wide knowledge; good practice and dialogue with stakeholders across all levels; Use local pressure to act.	Lack of willingness to accept costs.

Barrier type	Barriers at local and regional level	Possible support from a multi-level governance approach	Barriers at national and European level
Economic and budgetary	Lack of resources or funding to address problems identified.	Climate proofing the budgets at different levels; Provide guidance and support for applicants to EU and national funds; Support the creation of market demand for adaptation; Establish support for local adaptation policies and measures, e.g. through public-private partnerships.	Lack of resources, including immediate challenges of financial austerity.
	Differences between perceived and real costs and benefits.	Improve, exchange and coordinate knowledge across Europe; Grasp the chance for structural improvements in the context of the financial crisis; Search for solutions across levels.	Uncertainty about the costs of climate change; Problems in determining sufficient level of intervention.
	Difficulties mainstreaming adaptation into different budget lines.	Awareness raising and education of stakeholders in other sectors than adaptation; Exchange knowledge and experience with other regions and other level governments; Establish clear guidelines for systematic mainstreaming.	Difficulties mainstreaming adaptation in different budget lines.
	Inter-sectoral competition over budgeting in view of no increase expected.	Need to make an economic case on adaptation — show economic benefits of multi-purpose adaptation measures; Use good practice from elsewhere.	Inter-sectoral competition over the national/European budgeting — no increase expected.
Technical and scientific	Lack of local scale relevant scientific or technical information.	Collect and summarise knowledge and information via central platforms such as the European platform CLIMATE-ADAPT; National and European research aimed at local vulnerability and adaptation, also with high emphasis on practice-oriented results and tools; Exchanges with regional and local knowledge holders; Establish science-policy organisations (boundary organisations) and networks such as regional climate partnerships; Support European climate research through EU instruments (Framework programmes) and national instruments, including joint programming between Member States; Establish and develop monitoring tools for following progress in adaptation strategies and measures (e.g. national reporting comparable to climate policy in mitigation).	Lack of coherent, comparable, up-to date knowledge on national regional and local vulnerabilities and adaptation.
	Inadequate understanding or ignorance of climate risks.	Develop climate change communications programmes and training tools; Make use of communication efforts at other levels; Use of information and training tools provided at internet portals at national and European level like the European platform CLIMATE_ADAPT.	Challenges in communicating climate change effectively.
	Scientific uncertainty; Lack of technical capacity or access to expertise.	Establish across levels common guidelines for vulnerability assessments; Provide support tools and training from national and European levels; Support practice-relevant and academic research and support by boundary organisations.	

Source: Adapted and expanded from Corfee-Morlot et al., 2009; Corfee-Morlot et al., 2010.

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