ETC/CCA Technical Paper - ETC/CCA 2018/1

Social vulnerability to climate change in European cities – state of play in policy and practice

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Cover photo: © Laszlo Ligeti, My City /EEA

Layout: Margaretha Breil, Fondazione CMCC

ETC/CCA consortium partners: Fondazione CMCC- Centro Euro-Mediterraneo sui Cambiamenti Climatici, Charles University Environmental Center (CUNI), Aarhus University - Danish Center for Environment and Energy (DCE-AU), Umweltbundesamt GmbH - Environment Agency Austria (EAA), Associação para a Investigação e Desenvolvimento de Ciências (FC.ID), Fresh-Thoughts Consulting (FT), Met Office Hadley Centre (MO), Finnish Environment Institute (SYKE), THETIS S.p.A (THETIS), Helmholtz Centre for Environmental Research (UFZ), The Chancellor, Master and Scholars of the University of Oxford (UKCIP), Universidad Politécnica de Madrid (UPM), Wageningen Environmental Research (WER), Zentralanstalt für Meteorologie und Geodynamik (ZAMG)

More information on the European Union is available on the Internet (http://europa.eu).

Doi: https://doi.org/10.25424/CMCC/SOCVUL_EUROPCITIES

Suggested citation:

Margaretha Breil, Clare Downing, Aleksandra Kazmierczak, Kirsi Mäkinen, Linda Romanovska (2018) "Social vulnerability to climate change in European cities – state of play in policy and practice". European Topic Centre on Climate Change impacts, Vulnerability and Adaptation (ETC/CCA) Technical paper 2018/1. https://doi.org/10.25424/CMCC/SOCVUL_EUROPCITIES

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Executive summary

Climate change impacts do not affect all citizens in the same way. Extreme events like flooding from heavy rainfall or urban heat often cause worse impacts on certain vulnerable groups. These groups include people living in areas with low environmental qualities (green space and air quality), people with low socio-economic status, and people with physical conditions that present greater difficulties in preparing for, and in recovering from, climate change impacts. The reasons for these difficulties can lie in the lack of economic resources or, in particular, physical conditions like poor health, or living alone, or suffering from other social disadvantages like being a tenant or not understanding the national language.

Adaptation solutions implemented without involving these groups can exclude them from participating in the decision-making process and may deepen existing inequalities in the distribution of climate change consequences across urban societies. In most European cities, there is still limited awareness about this problem and about the need for assessments and adaptation policy design that targets vulnerable groups.

The aim of this technical paper is to provide the state-of-play in policy and practice for assessing social vulnerability and developing socially just adaptation responses to climate change in urban areas. The paper is organized as follows: It describes how the present-day understanding of social vulnerability and equity in relation to climate change impacts and adaptation options have evolved (Chapter 2) and how this understanding can inform the way assessments and adaptation planning and guidance are designed (Chapter 3). A collection of case studies describes how the principles have been implemented in European cities (Chapter 4). The findings of the paper have been discussed with a group of experts during a dedicated workshop. Chapter 5 summarises these discussions and Chapter 6 draws the conclusions from the paper and the recommendations provided by the experts. The insights provided by this paper can potentially contribute to a discussion about the need for changes in (urban) adaptation policies which aim to decrease the social inequalities and injustice caused by climate change impacts and by creating more just adaptation solutions. Such a debate should inform adaptation planning in cities, and also the on-going process of evaluating the EU Adaptation Strategy and the integration of existing guidance documents for cities.

Understanding social vulnerability

Social vulnerability is part of the wider concept of vulnerability, which measures the potential of adverse effects of climate change impacts on the environment and society. In recent years, different ways of understanding climate vulnerability have been developed and there is as yet no consensus in the scientific community on one single concept, so that knowledge about the distinct definitions is important for understanding statements about who may be vulnerable and why.

The two most prominent definitions come from two different disciplines with different policy backgrounds. The disaster risk management community, which is oriented towards humanitarian assistance, has made use of people-centred, social science approaches for defining vulnerability that focus on present day conditions which determine the way a person or community can be affected by hazards. In contrast, the climate change impacts community has developed its concept of vulnerability on the basis of natural sciences that focusses on quantitative findings and looks at projections of impacts in the future considering the capacities of people and communities to cope with hazards and adapt to them.

Understanding of social justice

There are two interconnected key principles of procedural (who can decide) and distributive justice (how are benefits and burdens distributed) that need to be applied when designing participative processes and for just prioritization of alternative options.

Further details about the concepts, framings, and principles of the terms vulnerability, social justice, and climate injustice can be found in Chapter 2.

How to consider social vulnerability in adaptation planning

The paper reviews guidance documents and tools which address urban adaptation planning and show that there is a wide range of approaches in the guidance documents and that they vary considerably in their level of detail. However, although a few of the guidance documents would be useful for city planners, none of the guidance documents reviewed provide enough information about the methods for identifying and involving vulnerable groups or indicators for monitoring the social outcomes of adaptation actions.

Different understandings of vulnerability and equity lead to different frameworks for assessment and can inform different approaches for identifying vulnerable people and communities. The main approaches use either data driven (top-down) analysis of socio-economic and spatial information, or participative (bottom–up) investigations of local specific contexts, or a combination of the two. However, no methodological 'best practice' has as yet been established for the assessment and mapping of social vulnerability to climate-related events.

Further details about the 30 guidance documents reviewed and approaches for assessment aimed at identifying vulnerable groups are provided in Chapter 3.

Insights from current practice

A number of examples show evidence that experience is growing and demonstrate some practical ways of how social vulnerability to climate change can be assessed, and how options for socially just adaptation can be identified. Chapter 4 describes examples of implementation from Finland, Slovakia, Denmark, France, England, Scotland, and Sweden.

Insights from an Expert Workshop

As part of the research leading to the present paper, an expert workshop was organized with representatives from European local authorities and research institutions that have had some practical experience in addressing social vulnerability. The participants discussed the draft paper, specific challenges and enabling factors they had experienced, and provided recommendations for action to support local policies in addressing social vulnerability and just adaptation processes.

The needs for future actions identified during the workshop focussed generally on enabling activities that could be implemented at various levels to support and promote local action. For example, increasing the capacity of staff to enable potential champions to promote innovative and ambitious action, and encouraging integrated and holistic approaches that involve different departments, agencies, and vulnerable groups to participate in the design of adaptation policies and actions. More information about the outcomes from the workshop is provided in Chapter 5.

The conclusions from the paper and recommendations from the workshop are provided in Section 6.

1 Aims, objectives and rationale for the paper

1.1 Aim and objectives of the paper

The aim of this technical paper is to discuss the concepts of social vulnerability and socially just adaptation to climate change and their practical applications to date in urban adaptation in Europe.

The paper provides input into the EEA 2018 report on social inequalities and environmental hazards (climate change impacts, air quality, and noise). It can also be used as a basis for discussion about the need for changes in (urban) adaptation policies aimed at decreasing social inequalities and injustice, including the opportunities offered by the on-going process of evaluation of the EU Adaptation Strategy.

The paper covers:

- A summary of the evolution, definitions, and frameworks of understanding of the key concepts (Chapter 2);
- Overview of practical approaches and examples of indicators and data that have been used (Chapter 3);
- Selected case studies of social vulnerability assessments and emerging socially just adaptation strategies and solutions in European cities (Chapter 4);
- Insights from the expert workshop (see Annex 1 for more information) that shared knowledge of internal and external factors influencing the consideration of social issues in adaptation planning (Chapter 5);
- The lessons learnt, knowledge gaps, and recommendations (Chapter 6).

This paper is based on a literature review of the concepts of social vulnerability to climate change and social justice in the context of adaptation. Whilst this technical paper is not meant as a comprehensive literature review, it draws extensively on existing reviews and reports on the understanding and use of the concepts of social vulnerability and socially just adaptation. In addition, a review of guidance documents was carried out in order to assess to what extent the inclusion of social issues in vulnerability assessments is required or advised by organisations active in climate change adaptation. Finally, this technical paper draws on the knowledge and opinions of the participants of the expert workshop in September 2017 (see Annex 1).

The added value of the paper is that it shares practical applications and knowledge in this field which has to date been mainly conceptual. The evidence is presented from the urban perspective and deigned for decision-makers at the city level that may need to know who is especially vulnerable to climate hazards and why, and the implications of this for developing policy and plans to adapt to a changing climate.

1.2 Rationale for the paper

The consideration of social vulnerability and its relationship with adaptation is a relatively new field of policy and research in Europe, yet it is very relevant to cities considering that 73% of people in Europe live in cities, and this is projected to increase to 80% by 2050 across the whole of Europe (EEA, 2015). Urban centres often include significant socially vulnerable populations whose demographic and socio-economic characteristics, coupled with the qualities of the environment they live in, can have a significant effect on the susceptibility of the local community to harm from

climate hazards. In recent years, the economic crisis has led to an increase in poverty and exclusion in many cities across the EU. The largest increase in the population living in poverty, at the rate of 5 percentage points or more, happened in the cities of Belgium, Estonia, Greece, Ireland, Portugal and Spain (EC and UN-Habitat, 2016). The current rate of 'severe material deprivation'[1] can be up to 26% (2014 data) of the urban population in EU countries (EC and UN-Habitat, 2016). This situation is exacerbated by the lack of affordable housing in urban areas and increase in homelessness (EC and UN-Habitat, 2016). The share of working age non-EU migrant populations in cities is twice as high as in smaller towns and suburbs, which in turn is twice as high as in rural areas. The city residents born outside the EU have a significantly lower employment and education rates, as they experience integration difficulties due to language barriers, lack of necessary skills, and lack of recognition of their qualifications (EC and UN-Habitat, 2016). Another vulnerable group – the elderly – in 2011 comprised 16% of the population in capital cities and 18.6% in other urban areas, is expected to increase in the future (EC and UN-Habitat, 2016). Further, in cities, groups experiencing socio-economic deprivation tend to live in areas of worse environmental quality, indicating spatial clustering of socio-ecological problems (Aalbers et al., 2014). Various studies conducted in Europe indicate that this is true for the distribution of waste facilities (Martuzzi et al., 2010), air quality (considering particulate matter and ozone see Richardson et al., 2013), or presence of green space (Aalbers et al., 2014). Whilst social vulnerability to climate change can also be pronounced in rural settings (e.g. due to physical isolation and poor access to services (Kazmierczak et al., 2015), the concentration of vulnerable and disadvantaged people in cities warrants closer investigation.

Climate change is expected to adversely impact cities, with extreme events affecting urban infrastructure and living conditions in urban areas (Revi et al., 2014; EEA, 2012b; Carmichael et al., 2017). It is expected that heat related mortality could increase dramatically if no adaptation action is undertaken. In the medium term especially, physically and economically vulnerable sections of the population will experience dramatic health effects (Carmichael et al., 2017). There is little work on the distribution of climate-related hazards in relation to social vulnerability, but research in the United Kingdom suggests that social vulnerability in cities may be spatially associated with the urban heat island and surface water flooding (Kazmierczak and Cavan, 2011; Scott et al., 2016), and that low income groups are disproportionately at risk of coastal flooding (although, according to WHO (2010) the opposite can be true for river flooding.

It is recognised that some groups are much more affected by climate hazards (e.g. flooding or high temperatures) than others, due to their individual characteristics or socio-economic situation (see Section 2.4). The adaptation responses should take the vulnerability of these groups into account to reduce the existing inequalities in the distribution of the climate impacts across society. Social justice is acknowledged as a key component of urban resilience; if we are to accept the notion that "a more resilient city is one with less social inequalities and a fairer distribution of resilience resources" (Jabareen, 2013) then issues of equity need to be embedded in adaptation planning for cities. Climate change can compound poverty and disadvantage, and conversely, poverty increases vulnerability to climate impacts (Preston et al., 2014). Adaptation solutions implemented without proper consideration of social vulnerability to climate change may result in worsening the climate impacts on some social groups and deepening the inequalities in distribution of climate change consequences across urban societies. Conversely, recognising the presence and knowing the

[1] Severe material deprivation is one of three indicators for risk of risk of poverty or social exclusion, describing peoples' living conditions constrained by a lack of resources as measured in terms of being deprived of four of nine items: unable to afford 1) to pay rent/mortgage or utility bills on time; 2) to keep their home adequately warm; 3) to face unexpected expenses; 4) to eat meat, fish or a protein equivalent every second day; 5) a one week holiday away from home; 6) a car, 7) a washing machine, 8) a colour TV or 9) a telephone (including mobile phone). This indicator captures absolute poverty in some degree and is measured in the same way in all Member States (EC and UN-Habitat, 2016, p. 92).

whereabouts of vulnerable groups can support actions aimed at reducing exposure of communities, prioritising particularly vulnerable populations for intervention and anticipating where the future risk 'hot spots' may be located (Preston et al., 2011). As adaptation policies and interventions are being planned and implemented, it is important to consider who has representation (or voice) and is able to take part in adaptation decision-making processes (procedural justice) and who will benefit or experience negative impacts as a result of these decisions (distributional justice).

Social vulnerability and differentiation are key areas that cities will need to look at in the coming years as:

- Demography changes (including migration and climate induced increases of migration (see, for instance, Missirian and Schlenker, 2017), ageing of urban populations, and the growing proportion of single-person households)[2];
- Work patterns, lifestyle choices, and technological advancements cause the disappearance of place-based communities and dissipation of social networks. Social isolation is one of the underlying causes of vulnerability to climate-related hazards (Lindley et al., 2011);
- Many European cities need to regenerate areas constructed in the second half of 20th century, in particular social housing stock. The role of adaptation in reviving depressed urban areas occupied by vulnerable populations is one important area where tangible co-benefits can be found.

1.3 State of play in research

The assessment of impacts of climate change in cities, and planning and implementation of the adaptation responses to date have predominantly focused on the nature of the hazard (e.g. flooding, heat waves, droughts) and the physical manifestation of the impacts (e.g. damage to buildings and infrastructure) or adaptation responses (green or grey adaptation measures). The main reason that climate impacts and adaptation thinking is focussed on the tangible aspects of climate impacts is the origin of adaptation in the realm of natural sciences, specifically in climate science, dealing with long term modelling of physical processes. Social developments are a much more complicated subject to develop long-term projections for, unless they are under the design of "possible futures", or scenarios, or socio-economic pathways that work geographically at a very aggregated level (Kriegler et al., 2012). The natural sciences perspective has dictated to a large extent the understanding of the notion of vulnerability to climate change and provided the conceptual underpinnings for its assessments. In addition, the physical impacts of climate variability and climate change tend to be easier to quantify than the complex effects on health and well-being of people, often involving long-term, intangible issues (such as psychological problems) and requiring qualitative data for assessments (see, for example, McMichael, 2013).

Nonetheless, there is a rapidly growing body of public health and social science research (in the fields of geography, spatial planning, built environment, etc.) focussed on the social vulnerability to climate change impacts and the equitable, or socially just adaptation responses. Much of the literature originates from the United Kingdom (e.g. Kazmierczak et al., 2015a; Lindley et al., 2011), coming from or building on the projects funded by the Joseph Rowntree Foundation (JRF). This body of literature has led to the development of practical tools such as the Climate Just online portal (Climate Just, 2014b) (see Section 3.1.2).

[2] According to EUROSTAT, in 2012, 32% of households in the EU-28 were single person households. Among these, especially the number of persons aged 65 and over living alone is increasing in most EU countries (Eurostat, forthcoming).

There are several examples of local investigations into specific social vulnerabilities to climate impacts, for instance the research aimed at locating especially vulnerable populations living within the Birmingham city area characterised by the urban heat island (Tomlinson et al., 2011), or the investigation into impacts of climate hazard on local livelihoods in the Scottish Border area (Fazey et al., 2017), as well as the case studies provided by the Climate Just online Map tool (Climate Just, 2014c).

1.4 State of play in policy and practice

In policy, a convergence of climate change and social aspects is just beginning. Social issues are being incorporated in climate change adaptation planning and, *vice versa*, climate change adaptation is being embedded into social policies. Opportunities to link the two dimensions exist at all levels of policymaking.

At the international level, the UN Sustainable Development Goals (SDGs) make explicit links between poverty and vulnerability to climate change; e.g. one of the targets for Goal 1 'No poverty' is to 'By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters' (UN, 2018). In addition, other SDGs make the links between Climate Change (Goal 13), Reduced Inequalities (Goal 10), and Sustainable Cities and Communities (Goal 11).

At the UN HABITAT III conference in October 2016, the New Urban Agenda was adopted - a new framework that that lays out how cities should be planned and managed to best promote sustainable urbanization (UN Habitat, 2016). It puts a strong focus both on 'sustainable urban development for social inclusion and ending poverty' and 'environmentally sustainable and resilient urban development' with several statements explicitly linking climate change impacts, resilience, and social dimensions, recognising the social risks of climate change, and the need for adaptation measures to be inclusive (UN Habitat, 2016). It also sees social development and resilience to climate change as intrinsic components of sustainable city development.

The Sendai Framework for Disaster Risk Reduction, adopted in 2015, specifically addresses vulnerable populations. It calls, among others, for "…more dedicated action … to be focused on tackling underlying disaster risk drivers, such as the consequences of poverty and inequality, climate change and variability, unplanned and rapid urbanization" (UNISDR, 2015, p. 10). The framework calls for integration of disaster risk management action with policies for sustainable development and poverty eradication, aiming at community resilience. Its first priority is focused on "understanding disaster risk" and "… understand[ing] the economic, social, health, education, environmental and cultural heritage impacts, as appropriate, in the context of event-specific hazard-exposure and vulnerability information" (UNISDR, 2015, p. 15).

At the EU level the strategy on adaptation to climate change explicitly recognises that "climate change impacts are expected to widen social differences across the EU and encourages that special attention needs to be given to 'social groups and regions which are most exposed and already disadvantaged (e.g. through poor health, low income, inadequate housing, or lack of mobility)" (EC, 2013a). The strategy package also includes EU Guidelines on developing adaptation strategies, which mention the consideration of particularly vulnerable social groups. This has subsequently been picked up and developed further by Mayors Adapt (the latter Covenant of Mayors for Climate and Energy) initiative in their Urban Adaptation Support Tool.

The 7th Environment Action Programme (EAP) to 2020, "Living well, within the limits of our planet" (EU, 2013), contains nine priority objectives, of which Objective 2, "To safeguard the Union's citizens

from environment-related pressures and risks to health and well-being", is particularly relevant for the consideration of social vulnerability in adaptation planning.

The Urban Agenda for the EU was established with the 2016 Pact of Amsterdam. The priority themes that guide the actions of EU Urban Agenda include urban poverty and inclusion of migrants and refugees alongside adaptation to climate change. The agenda promotes integrating different policy aspects to avoid contradictory consequences (EC, 2016).

The European Pillar of Social Rights (EC, 2017) came out in April 2017 and sets out 20 key principles and rights to support fair and well-functioning labour markets and welfare systems. Although the pillar includes social protection and inclusion it makes no connection to 'protection from the effects of climate change' or how the adaptation responses to climate change could be detrimental or, beneficial for social inclusion. However, there is an opportunity to use its principles within climate change adaptation planning in order to achieve the vision of safe, sustainable, and equitable European cities.

The World Health Organisation's health strategy for Europe, Health 2020 (WHO, 2018), considers wellbeing as a possible focus for reorienting 21st century public policy, including its environmental dimension. Through its pan-European Environment and Health Process, it addresses environment and climate-related threats to human health, particularly to children. One of the priority areas is resilient communities, including a focus on urban health. The Declaration of the Sixth Ministerial Conference on Environment and Health (signed in June 2017 in Ostrava) emphasises the awareness of the decision makers that environmental degradation, pollution, environmental changes, climate change, chemical exposures, and destabilization of ecosystems are threatening the right to health, and disproportionately affect socially disadvantaged and vulnerable population groups, thereby exacerbating inequalities. The resolution includes working towards resilience of States, communities and infrastructures to global changes, in particular to climate change and environmental disasters and strengthening adaptive capacity and resilience to climate change-related health risks (WHO, 2017).

At the national level, the consideration of social factors within national vulnerability assessments is rising. According to Boeckmann and Zeeb (2014), in 2014 only six (out of 21) national adaptation strategies explicitly addressed climate change as a social justice issue, while 17 documents showed awareness of migration and demographic changes as risk factors in the context of climate change. However, few or no recommendations were given in the strategies on specific actions to achieve social justice. In 2015, very few countries in Europe had assessed *current* social vulnerabilities (poverty/wealth, education, or social capital) within their national vulnerability or risk assessments, and only 4 countries had developed *future* socio-economic projections (Downing, 2017). However, by 2017, two thirds of countries in Europe (14 out of the 23 who answered the survey) have covered *current* social factors to some extent (adaptive capacity). Approximately half of countries (11 out of the 23 who answered the survey) have covered *future* adaptive capacity and two thirds (14 out of 23) have considered non-climate projections within their assessments (EEA, 2018). Specifically in the United Kingdom, all four devolved administrations have made spatial assessments of social vulnerability and the coincidence with climate impacts (Street et al., 2016), building on the work conducted for Climate Just (see Section 3.1.2). There is some movement in the United Kingdom towards the integration of social and environmental policies, for example, climate change is included in health strategies.

At the city level, in a European city survey conducted by the Mayors Adapt initiative in 2015, 60 of the 85 respondent municipalities stated that their lack of knowledge of climate change impacts on society (the social impacts) is limiting their advancement in the adaptation process. Furthermore, they also indicated that social and economic impacts are the most difficult to assess and that there is

a significant gap in the practical know-how (Romanovska et al., 2015). Usually, it is the environmental, infrastructure, or sustainability department that is concerned with climate change adaptation (Brisley et al., 2012), and frequently they do not communicate with the departments focused on the well-being of people such as social care, health, or welfare (Kazmierczak et al., 2015a). In the Mayors Adapt 2015 city survey, the respondents reported that systematic, holistic, and integrated approaches were largely lacking. In the few cases where social dimensions had been considered in adaptation planning and implementation, it was ad hoc, project based, and focussed on one narrow aspect, such as increasing the resilience of social housing or, one specific vulnerable group (e.g. the elderly population) (Romanovska et al., 2015). This has also been confirmed in the workshop discussion on 'Adaptation and Social Inclusion' at the Open European Day 2017 event where representatives from EU municipalities agreed that the integration of adaptation and social dimension is still fragmented, narrowly targeted, and does not reach all vulnerable groups. They also expressed their need for tools and metrics that would assist them in this task (personal communication ICLEI Open European Day). This lack of consideration for social vulnerability to climate change in adaptation planning and during the implementation of adaptation actions at both national and city levels, must be addressed in order to prevent loss of life and negative health and well-being consequences under the changing climate. However, there are some notable exceptions and these are the focus of the case studies in this report.

It is therefore a good time to take stock of the state of knowledge and emerging urban policy and practice in order to highlight the importance of social vulnerability assessments in the delivery of socially just adaptation solutions, present lessons learnt from some early practical applications and identify the remaining knowledge gaps.

2 Understanding social vulnerability and socially just adaptation to climate change

2.1 Defining social vulnerability to climate change

The term vulnerability was first used in the context of climate change by natural scientists working in the climate impacts arena, and has subsequently entered into both the academic literature and the terminology used by the Intergovernmental Panel on Climate Change (IPCC) Working Group II Assessment reports[3]. Social vulnerability is part of this wider concept of vulnerability to climate change, which is commonly used in the IPCC reports to describe the "propensity or predisposition [environmental, social and economic assets, as well as on complex socio-ecologic systems] to be adversely affected" by climate change (Agard et al., 2014).

The understanding of vulnerability that underlies the most recent definitions provided in the fifth IPCC assessment report (AR5, see Box 2.1) is the result of an extension of the initial consideration of the physical climate change impacts (intensity, frequency, and duration) towards social, economic, and political factors driving vulnerability. As well as the definitions provided by the IPCC report, there are also a number of other definitions and methodologies for assessing vulnerability (Wolf et al., 2013), which are often overlapping. This can cause confusion and make the interpretation of certain statements about vulnerability difficult, as different terms are used to describe similar concepts and the same term is being used to describe different concepts (EEA, 2017b). The two most important framings of vulnerability in the climate change context come from two different communities with different scientific backgrounds: the DRR community has used social science framings for defining vulnerability and the climate change impacts community has used natural science. This has resulted in two distinct understandings of vulnerability, which refer either to **"contextual" or "starting point" vulnerability** or to **"outcome" or "end point" vulnerability** (for a definition of these terms and the concepts connected to them, see Box 2.1).

According to the earlier definitions used by IPCC, vulnerability (to climate change) is understood as an integrated measure of exposure and sensitivity, which together determine the potential impacts of climate change, and adaptive capacity (i.e. the social and economic means to withstand climate change impacts). Vulnerability is therefore interpreted as the final outcome ("outcome vulnerability") of a process that integrates biogeophysical and socio‑economic factors. This concept has been applied in the EU Strategy on Adaptation to climate change package documents (see Glossary in EC, 2013b). In this definition, social factors contributing to vulnerability are accounted for as being part of the sensitivity, that it the "degree to which a system is affected, either adversely or beneficially, by climate variability, and of its adaptive capacity, that is the ability of a system to adjust to climate change …. or to cope with the consequences" (Parry et al., 2007). Societal characteristics used in connection to this understanding of vulnerability, which aims to measure and assess climate impacts, often consist of categories of professions (O'Brien et al., 2007) or social categories which are easy to identify for instance in statistics (e.g. elderly people).

In more recent IPCC assessment reports, from 2012 onwards, starting from the SREX report (IPCC, 2012) and further developed in the AR5 (IPCC, 2014b), the framing of vulnerability has shifted from the former natural science perspective towards a perspective where vulnerability is defined as a predisposing factor determined by the socio-economic, policy, and environmental context in which

[3] For a selection of definitions from the most recent IPCC report see Box 2.1

vulnerability is generated ("contextual vulnerability") (See Figure 2.1). Therefore, vulnerability is the "propensity or predisposition to be adversely affected". Vulnerability encompasses a variety of concepts and elements including "sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (Glossary, Agard et al., 2014). This understanding of vulnerability originates in the disaster risk reduction (DRR) community.

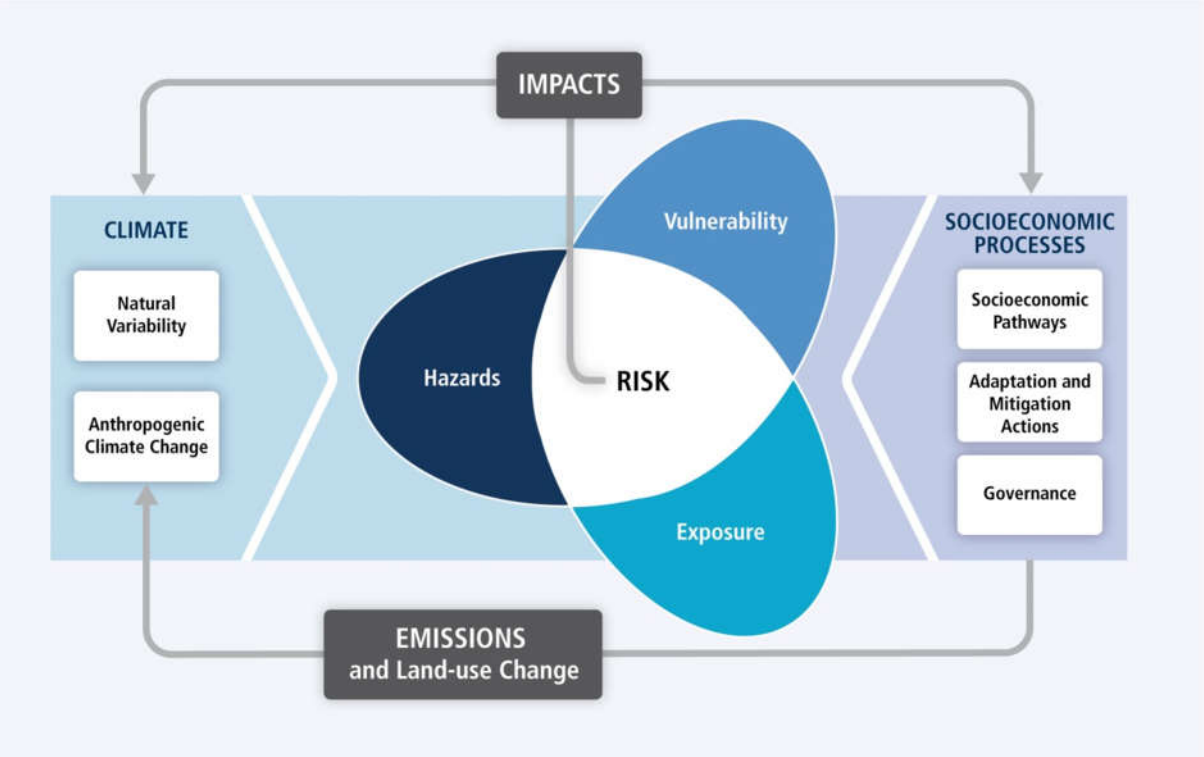

Figure 2.1: Concept of vulnerability and elements defining driving forces. Source: *IPCC (2014a)*

The particular focus on individual or community capacities and vulnerabilities gained attention in the DRR community when the scientific community recognized that vulnerability to natural disasters is also determined by socioeconomic factors affecting community resilience (Juntunen, 2005). While disasters might be of biogeophysical origin, the actual impacts of those disasters and the capacities of the population to resist and recover from impacts are to a large extent determined by individual and external, socio-economic factors (e.g. the choice of constructing housing in flood exposed areas, the attitudes and behavioural factors influencing the preparedness and response to disasters, availability of financial resources for recovery, legal entitlements, etc.) The DRR perspective focuses on short-term (discrete) natural hazards, where climate change is one but not the only driver, and it assumes that hazards are known and current vulnerabilities are static (Downing et al., 1999). The disaster risk approach distinguishes clearly between two determinants of risk to a system: exposure to a hazard (a potentially damaging physical event, phenomenon or human activity which has a probabilistic dimension of intensity and frequency) and vulnerability (which denotes the relationship between the severity of the hazard and the degree of damage caused to an exposed element), while hazard risk is derived from the interaction between exposure and the vulnerability (UN, 2004). In the most recent definition adopted by UNISDR, disaster risk corresponds to the probabilistic function of hazard, exposure, vulnerability, and capacity (UNISDR, 2017b), while vulnerability is defined as "The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards" (UNISDR, 2017c).

The two framings of vulnerability imply different approaches to vulnerability assessment: those based on the contextual vulnerability framing generally follow bottom-up approaches in the assessment of vulnerability. In bottom-up approaches like those which have been developed in the context of natural resource and sustainable management approaches, the focus has been on conservation and development of local livelihood and social capital, especially in a development context. In addition, policies for the management of disaster risk have focussed on flexible local responses that integrate both physical and societal capacities to cope in the short term and adapt in the longer term (Malone and Engle, 2011). Previously bottom-up approaches for social vulnerability assessments prioritised short time frames and small spatial scales, while top-down approaches focussed on long time frames and larger scales determined by climate scenarios. Now, these traditional contrasts between top-down assessments focussing on physical impacts and bottom-up assessments considering adaptive capacities and local resources (see Figure 2.2) is being overcome by the integration of knowledge from different disciplines into top-down assessment approaches (see Section 3.3 on top-down methodologies).

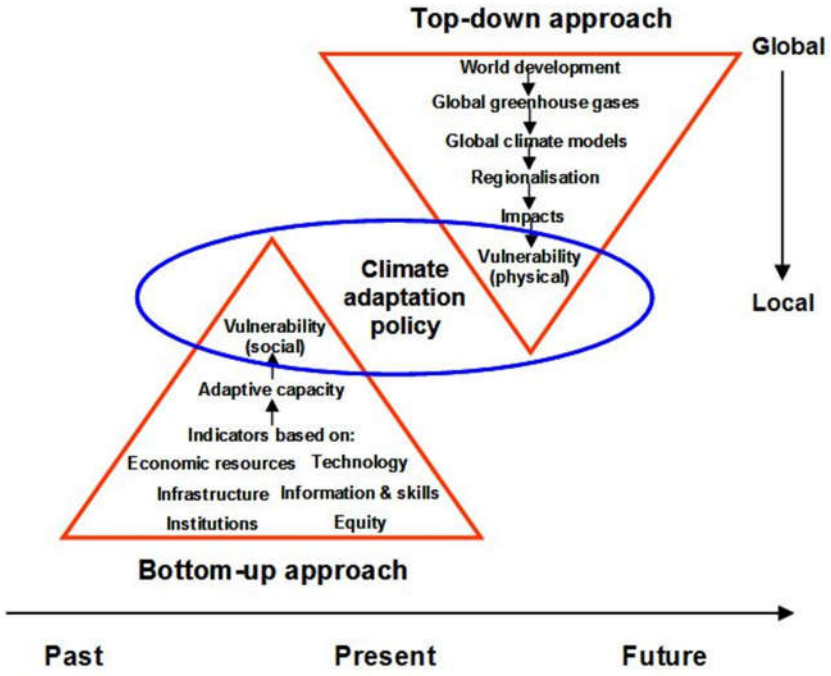

Figure 2.2: Top-down and bottom-up approaches for addressing climate change policy (adapted from: Carter and Mäkinen, 2011; Dessai and Hulme, 2004)

The concepts for the two perspectives discussed above are compared in Figure 2.3 (Downing, 2017). As discussed above, there has been an increasing convergence in the understanding of vulnerability in these two communities (EEA, 2017a).

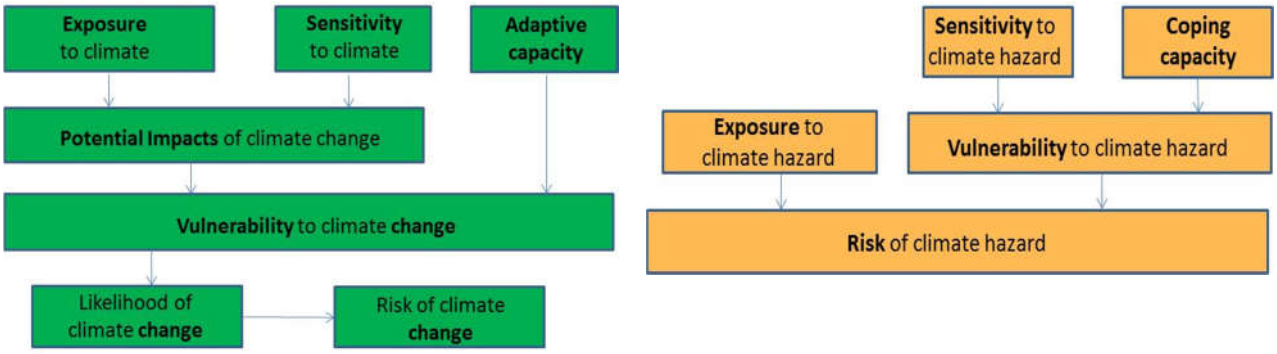

Figure 2.3: Framing of vulnerability from a natural science/climate impacts (left) and risk management, DRR and international development viewpoint– changes in terminology (subset of diagram from EEA (EEA, 2012a)

Differences in understanding of vulnerability among different disciplines continue to exist, so awareness about different framings of vulnerability is important for designing a policy discourse (UNFCCC, 2017; O'Brien et al., 2007). The most important issue is to ensure that the results of the vulnerability assessment are used to prioritise actions on adaptation for the most vulnerable sectors, geographic areas, and disadvantaged groups, as well as for ensuring that the adaptation plans, policies, and measures themselves do not disadvantage certain social groups or increase social disparities.

In this report, we define vulnerability in line with the more recent IPCC reports, thus seeing vulnerability as contextual, i.e. the propensity to be negatively affected, which combined with the exposure to climate hazards results in climate risk:

Social vulnerability: *a state resulting from interaction of socio-economic and environmental characteristics, such as personal sensitivity, economic deprivation or housing conditions, affecting how prone to harm from climate-related events people and communities are (after Lindley et al. 2011).*

The terms associated with this understanding of vulnerability are defined in Box 2.1.

Box 2.1: Definitions of key terms in the IPCC fifth Assessment Report.

Hazard
The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.
In this [IPCC] report, the term *hazard* usually refers to climate-related physical events or trends or their physical impacts.
Exposure
The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.
Impacts (Consequences, Outcomes)
Effects on natural and human systems. In this report, the term *impacts* is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts.
Risk
The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard. In this report, the term *risk* is used primarily to refer to the risks of climate-change impacts.
Sensitivity
The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).
Vulnerability
The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. See also Contextual vulnerability and Outcome vulnerability.
Contextual vulnerability (Starting-point vulnerability)
A present inability to cope with external pressures or changes, such as changing climate conditions. Contextual vulnerability is a characteristic of social and ecological systems generated by multiple factors and processes (O'Brien et al., 2007).
Outcome vulnerability (End-point vulnerability)
Vulnerability as the end point of a sequence of analyses beginning with projections of future emission trends, moving on to the development of climate scenarios, and concluding with biophysical impact studies and the identification of adaptive options. Any residual consequences that remain after adaptation has taken place define the levels of vulnerability (Kelly and Adger, 2000; O'Brien et al., 2007).
Adaptive capacity
The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

Source: (extracted from Agard et al., 2014)

2.2 Selected frameworks for understanding social vulnerability

Following the different perspectives of vulnerability discussed above, there are also different approaches to assessing and understanding the character and (spatial) distributions of vulnerabilities. This Section describes two frameworks, which are particularly useful for the analysis of vulnerability in the urban domain. They can also be helpful in understanding the complex

landscape of drivers of social vulnerability and facilitate the integration of social determinants into urban vulnerability assessments.

A systematic representation of four categories of the factors driving vulnerability has been provided by Blaikie et al. (2003) (Figure 2.4). According to this scheme, drivers of social vulnerability are represented as a gradient of individual characteristics, which range from general systemic issues (distribution of power, and resources in society) to local/regional drivers (including governance, socio-economic situation in the area, and availability of natural resources) to finally socio-economic, institutional, and physical conditions of the individual's living conditions. These factors can contribute to reducing or increasing climate related vulnerability as much as biophysical climate impacts.

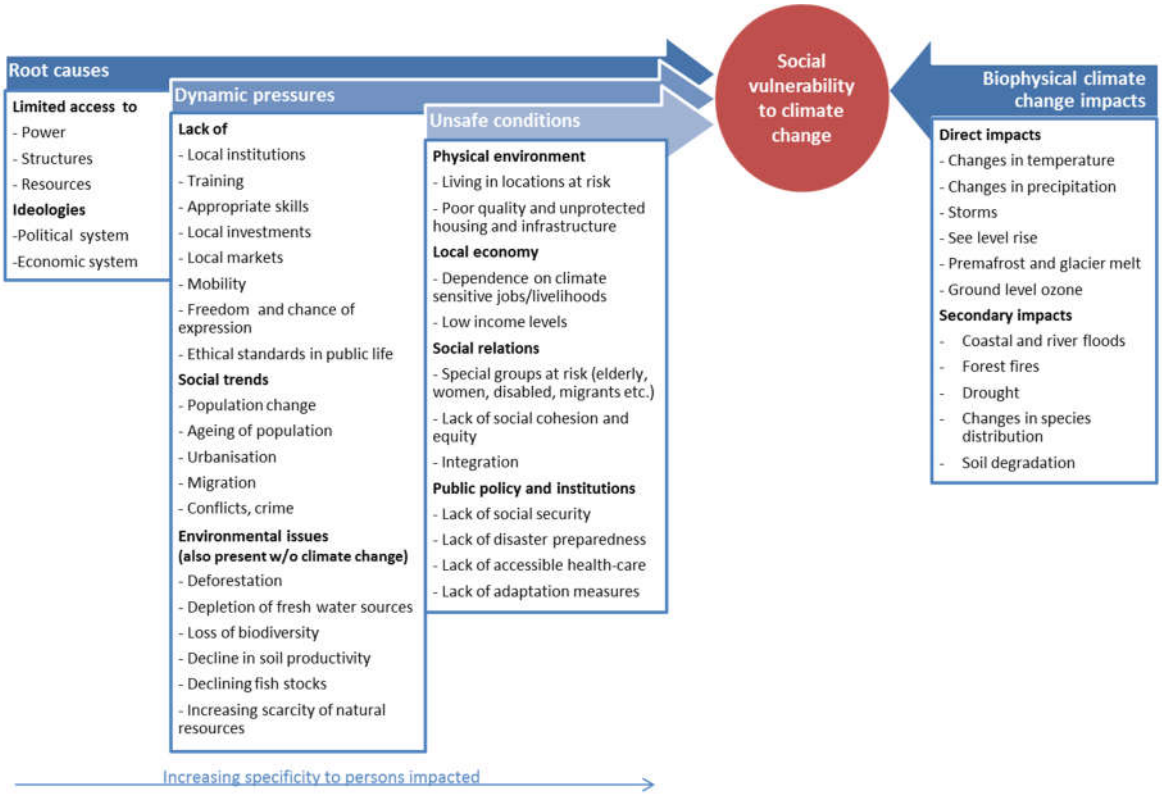

Figure 2.4: The drivers of vulnerability to social impacts of climate change (Romanovska et al., 2012 adapted from: ; Blaikie, P. M. et al., 2003))

In addition to understanding the drivers of social vulnerability to climate change, it is also important to recognise that the biophysical climate change pressures, the social conditions of communities and their adaptive capacity, as well as adaptation policy effects are interlinked in dynamic mutual feedback loops (see Figure 2.5), continuously influencing each other. For example, social change (for instance demographic change or changes in lifestyle) can alter the scale of greenhouse gas emissions and as a consequence, the severity of climate change hazards, which in return have impacts on the social reality and trends in a community. Similarly, both the current social situation and climate change severity affect society's ability to adapt, while in return the adaptive capacity and the resulting adaptation level change the social fabric and can exacerbate or lessen social issues. Altogether eight feedback loops can be identified in the "social realm – climate change" system (Romanovska et al., 2012). These feedbacks and interactions should be taken into account when developing adaptation policies at the local level that successfully address social aspects. Hence the importance of concerted and coordinated adaptation and social policy planning becomes evident.

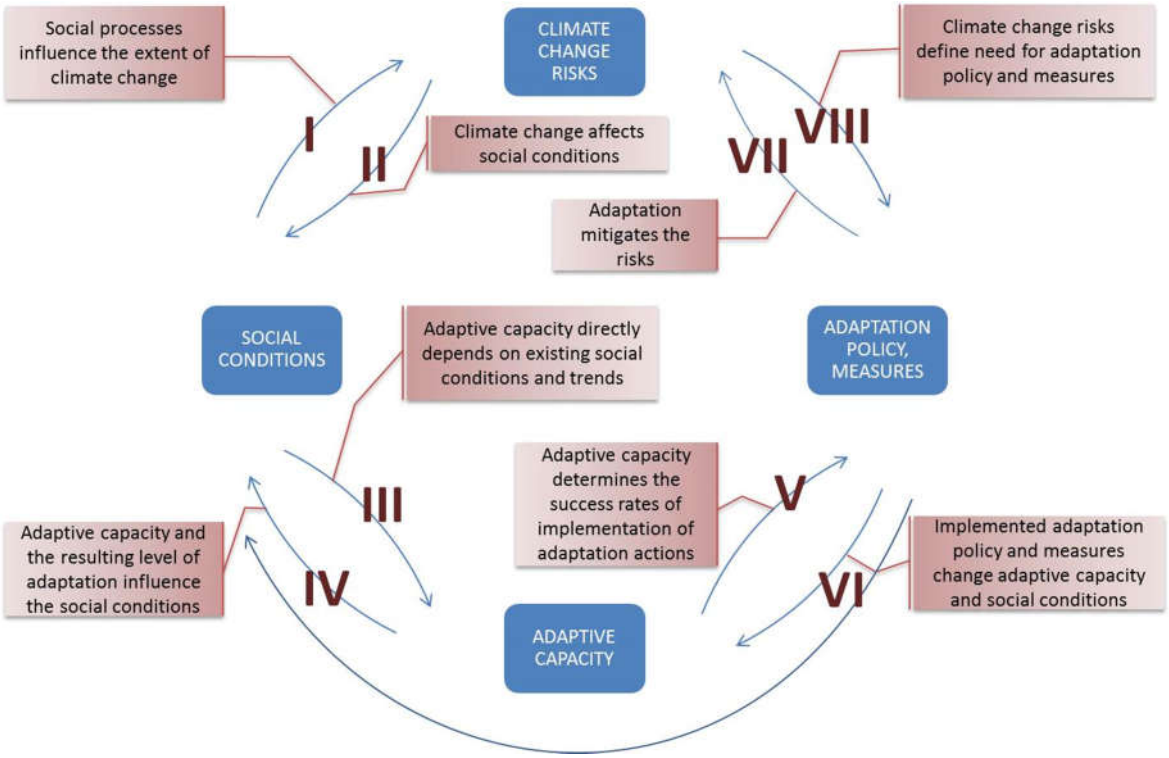

Figure 2.5: Climate, adaptation and social realm interactions (Romanovska et al., 2012)

The spatial dimension of social vulnerability has been explored by Lindley et. al. (2011), who introduced the concept of socio-spatial vulnerability. This framework was developed for a research project funded by the Joseph Rowntree Foundation in the United Kingdom. It is based on the concept of "risk triangle" (Crichton, 1999), where climate disadvantage (understood as the degree to which an external event has the potential to convert into losses in human well-being) is realised when vulnerability of communities coincides spatially with the hazard-exposure (e.g. occurrence of flooding or heatwaves in a given location). Vulnerability according to this framework is assessed at a spatial level of 'neighbourhood', represented by census units used to report socio-economic statistics (Office for National Statistics, 2016).

The concept of vulnerability is disaggregated into sensitivity (personal factors driving vulnerability, such as age and health), enhanced exposure (environmental factors, such as characteristics of housing or presence of green space that can either mitigate or exacerbate climate impacts locally), and adaptive capacity (social factors, such as income level, ability to speak the official language, length of residence in the area). Adaptive capacity in turn is split into the ability to prepare for, respond to, and recover after extreme weather events.

Aggregation of indicators into the domains of vulnerability provides unique neighbourhood-specific 'signatures', which help to explain which factors drive social vulnerability in particular localities, and offers insights into the uneven geographies of various aspects of vulnerability. When the composite socio-spatial vulnerability index is overlaid on to a map of potential hazard-exposure it is possible to assess in which parts of an urban area there is a concentration of residents experiencing major climate disadvantage. Social-spatial vulnerability can be assessed across national, regional and local scales relative to average (mean) values.

This framework is powerful for urban analysis as it brings together characteristics defining individual and social elements of vulnerability with spatial characteristics that define exposure and enabling features of the environment that promote preparedness, response capacity, and ability to recover. It therefore allows consideration of both individual and spatial (physical) drivers of vulnerability. The

diagnostic power of this framework depends on the quality of indicators and their spatial detail. The spatial scale is important because the nuances of social inequality can disappear when aggregated. It produces a form of diagnosis which corresponds to the concept of "outcome vulnerability. Such a view on contextual vulnerability can provide a first step towards the design of specific intervention strategies. However, it is strongly focussed on distributive justice and does not include procedural justice elements.

This approach has been used to map and assess climate vulnerability across the United Kingdom at the detailed spatial resolution appropriate for cities. It has supported two of the examples presented in Chapter 4 (Wigan and Helsinki).

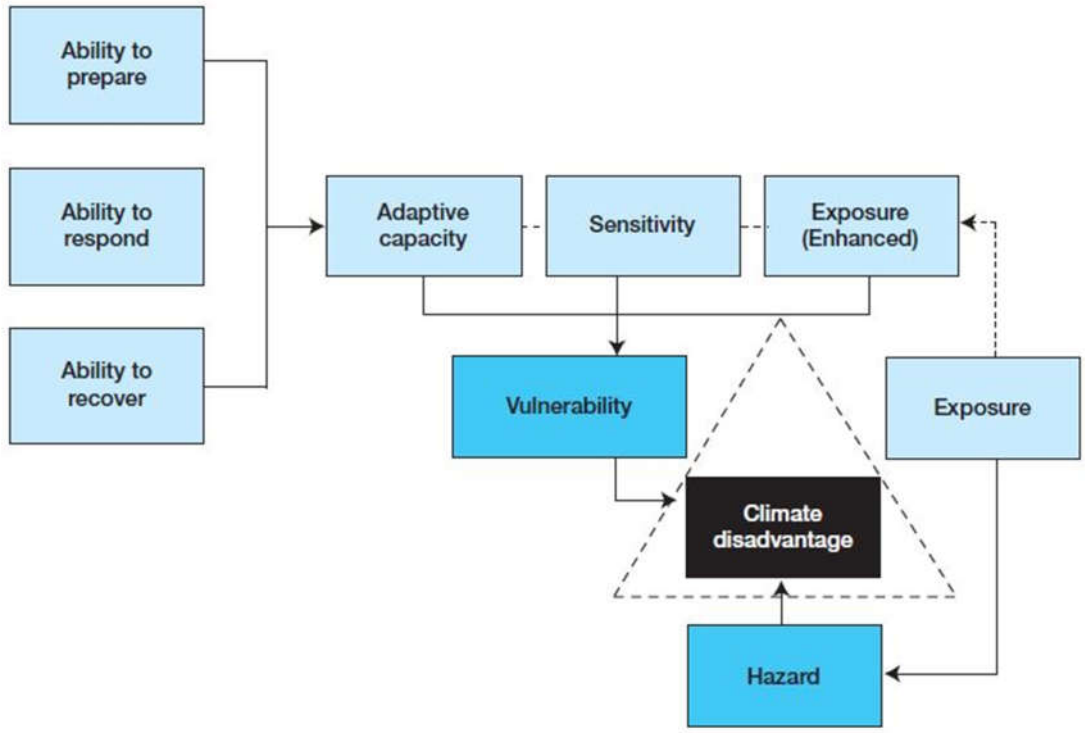

Figure 2.6: Conceptual framework of climate disadvantage and vulnerability to climate change (Lindley et al., 2011)

From the practical perspective, the rationale for splitting the "risk of climate impact" into hazards, exposure and vulnerability (see Figure 2.3) and further disaggregating vulnerability into sensitivity and adaptive capacity helps to identify different pathways of adaptation to climate impacts. Adaptation actions can follow the prevalent strategy aiming to limit exposure to hazards (e.g. through retreat to areas not threatened by flooding, or through physical changes to the built environment that reduce for instance the risk of overheating). However, they could also address the vulnerability through reducing sensitivity (e.g. aiming at general improvements in the health of the population, in particular of elderly people) or enhancing people's adaptive (coping) capacity (e.g. providing information in various formats and languages to the population to inform them how to act in case of an extreme event). Thinking of adaptive actions from these different angles can help policy makers to see the relevance of adaptation to various policy areas and encourage them to mainstream adaptation in different sectors.

The notion of well-being is also an underlying concept of the 'Sustainable Livelihood Framework' (SLF) (DFID, 2000). SLF focuses on people, it seeks to gain an accurate and realistic understanding of

people's strengths or "capitals" and identifies five types of assets or capitals upon which livelihoods are built, namely:

- human capital (education/health),
- social capital (networks/norms),
- natural capital (land/air/water),
- physical capital (infrastructure /economy), and
- financial capital (savings/income/social support).

The SLF views vulnerability as the context that frames the external environment in which people exist. Critical trends as well as shocks (e.g. floods) and seasonality, over which people have limited or no control, have a great influence on people's livelihoods and on the wider availability of assets. Not all of the trends and seasonality must be considered as negative. Vulnerability emerges when human beings have to face harmful threats or shocks without adequate capacity to respond effectively. The difference between risk and vulnerability is of crucial relevance for assessing causes of poverty. Risk is defined as the likelihood of occurrence of (external) shocks and stresses plus their potential severity, whereas vulnerability is the degree of exposure to risk (hazard, shock) and uncertainty, and the capacity of households or individuals to prevent, mitigate, or cope with risk (see Figure 2.1).

This framework covers all aspects of social vulnerability and biophysical impacts, e.g. floods, but currently makes no provision for future scenarios. The framework is intended to be a tool for planning and management to assess the many factors that influence poverty and how it can be eliminated. It is one of the most widely used livelihoods frameworks in international development practice. Among the case studies selected from the European context for this report, the vulnerability assessments in the Scottish Borders case uses an approach that can be related to this framework (see Section 4.5).

Only a few of the existing frameworks have been analysed in detail here. They show some common traits with regards to specific issues related to social vulnerability. The most important one is the distinction between different aspects of social vulnerability, i.e. sensitivity and adaptive capacity. They provide framings for different approaches to vulnerability assessments (see Section 3.2) that focus on vulnerable communities and individuals, the spatial distribution of social vulnerability in urban areas, and interactions between social vulnerability and socio-spatial disparities.

2.3 Who is vulnerable and why?

2.3.1 Vulnerability of individuals, communities and places

There is a considerable consensus in the literature about who is the most vulnerable or the most likely to be affected by currently occurring climatic impacts (Preston et al., 2014). The following groups and socio-economic conditions described draw on existing literature reviews conducted to underpin assessments of social vulnerability to climate change (Lindley et al., 2011; Preston et al., 2014; Kazmierczak et al., 2015a; Otto et al., 2017; Noble et al., 2014; Reckien, et al., forthcoming):

- **Older people** are the group that is consistently listed as vulnerable or heavily affected by climate-related events such as flooding and heat waves due to physiological factors. Future changes in climate are likely to lead to more risks to the ageing society.
- **Children** can suffer from negative impacts caused by flooding, too, due to diseases, increased mental and behavioural problems, whilst heat waves pose health risks to babies.

- **Women** are generally considered more vulnerable than men, because they have limited access to resources, less access to justice, limited mobility, and a limited voice in shaping decisions, and influencing policy (Burns. et al., 2017; EIGE, 2012a; and Reckien, et al., forthcoming), especially in relation to low income countries. Also for Europe, EIGE (2012b based on Hemmati and Roehr, 2007a) identifies a list of factors which make women generally more vulnerable than men, including gender related socio-economic (e.g. education, level of unpaid work), legal (e.g. inheritance rights), and political (e.g. participation in governance) disadvantages, socio-cultural (e.g. use of public services), and physical and biological differences (e.g. life expectancy, ability to cope with high temperatures).
- People in **poor health** are more prone to heat-related mortality and health impacts, especially those with renal or cardiovascular health issues and those who are bed-bound. Flooding may restrict an individual's access to medicine, electrical life support equipment, or affect mobility (lifts, electric wheelchairs). Flood events can also impact health infrastructure (hospitals) and restrict emergency services' access to vulnerable individuals.
- People on **low incomes** are another group that may be significantly affected by future changes in climate as the financial constraints may make it more difficult to prepare for extreme weather events and recover after, e.g. flooding. Poorer communities are likely to live in housing of worse quality, which may be prone to overheating. For some regions in Europe, reduced water availability may lead to increased water prices and potentially 'water poverty' where poorer households spend a considerable proportion of their budget on water.
- **Tenants** in either social or private rented housing have limited rights to make changes to their dwelling that would make it more climate-proof. Fewer tenants than house owners have contents insurance.
- People who are not able to **understand** information about climate-related hazards, e.g. flood or heat wave warnings and instructions about how to behave, may have a reduced individual ability to prepare and respond. Therefore, illiterate groups or those with limited knowledge of the official language, including immigrants and refugees, are also more vulnerable.
- Real or perceived **levels of crime** in an urban area may also have an impact on people's behaviour during extreme-weather events (e.g. the decision not to open windows during the night due to fear of burglary or not to evacuate the house due to concerns about looting).
- **Poor social networks** are identified as a further factor increasing vulnerability (WHO, 2013), as isolated people are less likely to receive information and help. The lack of social networks is particularly frequent among older people, people in poor health or with disabilities, people reliant on social services for home care, people living alone, ethnic minorities, people who are homeless, people who are substance abusers and people living in rural areas. Also areas with a high turnover of population in a residential area may have reduced social network connections.

The above list suggests that vulnerability extends beyond material deprivation and covers a range of interacting factors, which should be recognised in vulnerability assessment and adaptation planning.

What needs to be emphasised is that the above points are drawing heavily on the literature from the United Kingdom, due to the paucity of research in other EU countries. Taking into account the local context is paramount in carrying out a relevant social vulnerability assessment. Therefore, the identification of the vulnerable groups, involving various stakeholders, should be an important step in adaptation planning (see Section 3.1.2).

Further, many of the groups listed above may also be considered "hard to reach" groups in the participatory processes. Groups such the homeless, drug users, Roma, Sinti and traveller

communities may be amongst the most vulnerable to climate impacts, yet the least likely to be given a voice in adaptation planning.

2.3.2 Interactions between social vulnerability and urban development

The physical characteristics of the urban neighbourhood can affect the extent to which people are impacted by a flood or heat wave event or experience other forms of climate impacts. Increased surface sealing by roofs, roads, car parks, walkways, and paved-over gardens reduces the ability of drainage systems to remove runoff created during intense rainfall events. A high proportion of sealed surfaces also raises temperatures in the area. The type of housing also plays a role; houses with the lowest floor at or below ground level are more exposed to flooding than dwellings located on higher floors, whilst single-aspect, difficult to ventilate flats on top floors or in high rise buildings may be prone to overheating.

Practices in urban development may place undesirable, polluting, or hazardous facilities in poor, minority neighbourhoods or relegate disadvantaged residents to low-quality areas where land is cheap (Mohai et al., 2009). Many low-income residents have no choice but to live in informal settlements, public housing, or hazardous and high-risk locations (see, for example Bolte, 2012); suffer from pre-existing health conditions; and have few resources to prepare for, cope with and recover from stresses and shocks (Shi et al., 2016). The WHO Europe review of evidence on social inequalities and environmental risk (WHO, 2010) confirms that people living in adverse socioeconomic conditions in Europe can suffer twice as much from multiple and cumulative environmental exposures as their wealthier neighbours, or even more. Similarly, inequalities in exposure to environmental threats have been identified for vulnerable groups such as children and elderly people, low-education households, unemployed persons, and migrants and ethnic groups.

Some of the urban development paradigms, such as the compact city, may deepen the socio-ecological inequalities. Compact cities have less green space, which may drive those who can afford it to settle down in the more scarce green, open spaces or depart for the countryside or urban fringe, while the low-income groups stay behind in the deprived areas. Kazmierczak (in Scott et al., 2016) found spatial associations among the levels of social vulnerability to high temperatures, intensity of the urban heat island, and the presence of brownfields in Greater Manchester, United Kingdom. Whilst the browfields, if developed into green spaces, could reduce the temperatures in the vulnerable location, the majority of the proposed developments were for housing and commercial uses, potentially magnifying the urban heat island effect.

A more socially just urban development direction in the context of the changing climate has been proposed for the city of St. Niklaas in Belgium with "green wedges", which builds on the "fingers" approach to urban development (Rombaut, 2009). This latter concept was developed in the first half of the 20th century and implemented, among others, in masterplans for Amsterdam, Copenhagen, Hamburg and Cologne. It is based on green spaces penetrating deeply into the urban core, establishing good access to green areas from all parts of the city.

The Urban Vulnerability Map Book (Climate-ADAPT, 2018) on Climate-ADAPT uses the indicator of green space edge density per hectare of urban area, whereby high density indicates a relatively high number of green patches adjacent to built-up parts of the urban fabric, suggesting better proximity to green spaces for urban population than cities with low density of green space edges (Climate-ADAPT, 2014a). The case study of Stuttgart on Climate ADAPT (Climate-ADAPT, 2014b) shows how planning policies can be used to protect the green spaces close to residential and commercial areas, which act as generators of cool air during high temperature spells. A similar principle is in place in England where a recommendation has been made by Natural England (the nature protection agency in England) to ensure that no city dweller should live further than 300m (walking distance) from a

green space (English Nature, 2003). Other equity-related principles for urban planning like equal access to services and good public transport systems provide less direct protection against climate impacts, but are highly relevant for urban climate resilience and energy efficiency.

A main factor driving spatial clustering of socioeconomic deprivation in urban areas are housing markets and housing policies. Adverse environmental conditions may lower housing prices; this has been observed for air quality and green space access (Aalbers et al., 2014). Therefore, negative climate impacts on an area can send it further down the spiral of decline. On the contrary, interventions improving climate resilience can give a neglected area a boost (see case study on Augustenborg in Malmö in Section 4.6). However, without careful consideration of the vulnerable groups, there may be a gentrification effect of urban reconstruction and eco-quartiers, instead of the expected contribution to increased environmental quality for existing residents (Haase et al., 2017; Shi et al., 2016; Wolch et al., 2014).

2.4 Social justice in the context of climate change adaptation

Just as important as the comprehension and common understanding of "vulnerability", is to also understand what "social justice" means in the context of climate impacts and adaptation. It fits within the broader concept of environmental justice, which addresses "the fair distribution of environmental impacts, goods and services within and between generations …" (Mitchell and Norman, 2012, p.44 in Davoudi and Brooks, 2012).

The importance of social or distributional justice and equity have been recognized early in the international climate change discourse, with references to it already found in the first IPCC Assessment Report (IPCC, 1990). This principle also appears in the in the United Nations Framework Convention on Climate Change (UN, 1992). It is mostly used in the context of "inter-generational equity" (referring to the disproportionate share of climate change damage that will be borne by future generations as compared to the current ones) and "intra-generational equity" (referring to the unequal share of climate change impacts, costs as well as mitigation and adaptation burden in between countries and social groups within the current generation) (IPCC, 2014b). Both types of equity are relevant to mitigation as well as adaptation policies. The core equity principles for climate change are defined as: responsibility (for GHG emissions), capacity, and the right to development and equality (IPCC, 2014b). The uneven distribution of vulnerability and of burdens from impacts and costs of adaptation between nations, regions, and social groups is one of the main points of discussion in international climate negotiations. The IPCC AR5 contains a number of references to social and distributive justice in various chapters, where it:

- recommends the selection of decision making principles, which take equity and social justice principles into account (Olsson et al., 2014; Smith et al., 2014),
- highlights specific vulnerability and adaptation needs of poor communities (Noble et al., 2014),
- requests the consideration of equity implications in the assessment of adaptation measures (Jones et al., 2014, p. 206), and
- requests the consideration of justice and fairness in the design of adaptation options, acknowledging that some "individuals, firms, communities, and even countries may be unable to afford adaptation, even if it is in their own interest" (Chambwera et al., 2014, p. 955);

Nevertheless, although the argument is recurring across different chapters and addressed in different parts of the analysis, no coherent definition or conceptualization of socially just adaptation is given throughout the report (e.g. both "equity" and "equitable adaptation" are still missing from the IPCC AR5 Glossary). The closest statement on what "equity" stands for within climate change context is found in the IPCC Third Assessment Report which stresses, in the context of climate

mitigation policies, the need to ensure "*that neither the impact of climate change nor that of mitigation policies exacerbates existing inequities both within and across nations*" (Banuri et al., 2001, p. 87). Although not explicitly addressed in this context, it can similarly be applied to adaptation policies and measures.

The Climate Just portal, a flagship example of a knowledge hub focussed on social justice in the climate change context (described in more detail in Section 3.1.2), defines socially just adaptation as follows: "Adaptation responses which ensure distributive justice in the ways in which different individuals and groups benefit from or are burdened by climate change impacts or policies and procedural justice in the ways in which adaptation policy is made".

Based on the above, for the purposes of this report we define socially just adaptation as follows:

> ***Socially just adaptation*** *is a set of policies and actions responding to current climate variability and anticipating the future climate change and its impacts designed to ensure that neither the impact of climate change nor the policies and actions themselves exacerbate existing or create new inequalities across different groups in the urban society (Climate Just, 2014f).*

2.4.1 Different understandings of social justice and their practical implications

Social justice in adaptation planning and management can be addressed applying the two interconnected principles of *procedural* and *distributive* justice:

- **Procedural justice** is about how decisions are made and who gets involved. It is concerned with making and implementing decisions according to fair processes; it is about the fair distribution of political power. Encouraging and facilitating participation in adaptation planning can help achieve consensus or a better outcome, e.g. through integration of local knowledge. Further, it can also enhance democratic citizenship, which can translate into higher trust for authorities in relation to other subjects. Participants need to be treated and respected as equal citizens (Davoudi and Brooks, 2012; Holstein, 2010). See the case studies on Scottish Borders, Vejle, Liverpool and Timmendorfer Strand in Chapter 4 for the role of participation and co-creation for shaping different adaptation options.
- **Distributive justice** is concerned with the ways in which the burdens, benefits, and responsibilities are allocated between different individuals and groups. In the context of climate change adaptation it includes the unequal impacts of climate change (who is more adversely affected by the extreme weather events that will increase in frequency and intensity) and unequal impacts of policy responses (who benefits and who bears the costs and burdens of mitigation and adaptation policy) (Climate Just, 2014d). Ensuring distributive justice in adaptation planning involves understanding and responding to the varying social vulnerability, ensuring that all communities are effectively protected from the negative consequences of climate impacts, and analysing the distributional consequences of adaptation responses to different groups (Brisley et al., 2012). See the case studies from Slovakia, Helsinki, and the United Kingdom in Chapter 4.

Distributive and procedural justices are not independent of each other; firstly, not being recognised in adaptation planning and decision-making means that a given group is unlikely to inform and

benefit from adaptation actions. Secondly, being disadvantaged in distributive terms creates obstacles for recognition and participatory processes (Brisley et al., 2012).

Whilst policies at various levels increasingly make a reference to social justice or equity, these terms are usually not defined and left open to interpretation. For example, the EU Floods Directive (2007) states that "The solidarity principle is very important in the context of Flood Risk Management … Member States should be encouraged to seek a fair sharing of responsibilities", yet it does not specify what is meant by solidarity and fairness and how these terms should be operationalised (Van Eerd et al. 2015 in Kaufmann et al., 2016). Consequently, the understanding of what is just may differ from person to person and from institution to institution, affecting the way adaptation is planned and delivered, and ultimately how it affects people.

Taking distributive justice in the context of flood risk management under the changing climate as an example, the following understandings of justice could be identified (Davoudi and Brooks, 2012; Defra and EA, 2008; Kaufmann et al., 2016; Sayers et al., 2017):

- **Utilitarian**, whereby "just" means delivering the greatest good for the greatest number of people. This approach recognises public resources are limited and seeks to maximise the return on every unit of resource invested. Flood protection is provided for the ones that are seen to bring the highest benefit for society. Whilst the state is largely responsible for the flood protection, its distribution is based on economic calculations (cost-benefit analysis), which may imply no protection for isolated houses or areas with low property prices.
- **Rawlsian**, "Maximin" rule (Rawls, 1971), whereby resources are allocated so that they provide the greatest benefits to the most vulnerable, understood as either the citizens that lack resilience to flooding (for example financially deprived households) or those who are the most prone to flooding. Whilst the state is responsible for flood protection, the issue of individual responsibility may be considered, i.e. distinguishing between those who actively chose to live in flood risk areas and those who found themselves living in them due to changing climate.
- **Egalitarian**, advocating equality of outcomes. Everyone has the same right to protection, the responsibility for protection against flooding lies firmly with the state and resources should be distributed equally according to risk.
- **Elitist**, emphasising the individual responsibility for flood risk management – in principle, those who can afford it will be protected, and that government should not intervene. This offers room for market actors (insurers) but may result with the poorer people being left with no protection.

Research in the Netherlands and the United Kingdom (Davoudi and Brooks, 2012; Defra and EA, 2008; Kaufmann et al., 2016; Sayers et al., 2017) has generally found a lack of consistency in riverine and coastal flood risk management policies from the social justice perspective. To some degree flood risk management policies across the United Kingdom promote the notion of targeting effort towards managing the risk for the most vulnerable populations, yet there is no routine assessment of the extent to which policies achieve this (Sayers et al., 2017). Nonetheless, there is an example from England where flood risk management explicitly gives preferential treatment to vulnerable people. The formula used to determine to maximum contribution to flood risk management from general taxation gives preferential weighting to schemes that reduce flood risk to deprived households. The value of grants is multiplied by 2.25 for households in the top 20% of most deprived areas and by 1.5 in the 21-40% most deprived areas (Sayers et al., 2017). In the Netherlands, whilst deciding on public spending is guided by utilitarian principles (e.g. cost-benefit analyses), the payment for protection is largely egalitarian (citizens through taxation/insurance premium). However, a more elitist approach to post-flood recovery is present, resulting in losses for those who cannot afford insurance (Kaufmann et al., 2016). This is particularly visible in the case of pluvial flooding

(Kaufmann et al., 2016), which in the urban context increasingly occurs in areas not previously affected by flooding and thus unlikely to have blanket insurance coverage.

Procedural justice can be seen in various policies in the United Kingdom flood risk management strategies; for example, all development policies are subject to the same planning process. However, the experiences from the United Kingdom show that some flood events attract more media and public attention and are thus more likely to receive additional support from the government, resulting in unequal treatment of affected communities (Sayers et al., 2017). Also, promoting procedural justice through participatory processes in the absence of broader reforms may be counterproductive, as individuals tend to prioritise short-term interests over long-term processes with uncertain outcomes (Shi et al., 2016). Further, involvement of only certain communities – those more affluent, educated and already actively involved in planning processes - may result in reinforcing inequalities, e.g. through NIMBY-ism ("not in my back yard") effects which can be enforced by neighbourhood oriented planning processes (Scott, 2011) and lead to location of undesirable solutions in other areas.

In relation to impacts from heat waves, ethnic minority groups have been found, according to United Kingdom studies, to be more vulnerable. Complementary measures such as addressing their specific difficulties in obtaining assistance and services through improved access to social and health services, improved housing and environmental quality and measures to reduce the urban heat island effect at urban or neighbourhood level would be most effective. This is because these groups often contain a high proportion of tenants who lack the right to implement property level measures (Pringle et al., 2013). An example of adaptation measures being prioritised in areas of high social vulnerability to heatwaves, thus applying the 'Maximin' rule, is provided in the case study of Trnava and Košice in Slovakia (Section 4.2).

2.4.2 Recognising and addressing climate injustice

Urban areas that lack climate justice are typically characterized by the overlap of socio-economic disadvantages with climate impacts. These disadvantages can be both a (low) economic and social status and/or a reduced possibility for participating in policy and decision making processes. In the United Kingdom, the Defra PREPARE programme (Defra, 2013; Defra and EA, 2008) and the Climate Just platform (Climate Just, 2014b) show that, from a distributive justice point of view, cumulative effects of social and economic disadvantage occur in parts of the cities where climate impacts add to existing burdens. Damage caused by hazardous events will result in a heavier burden for socially or economically disadvantaged groups than for others as they correspond, in absolute values, to a higher share of the overall resources. In addition to this, some research suggests that areas where socially disadvantaged groups live are more frequently exposed to flood risk (Kazmierczak and Cavan, 2011) as economic constraints created by urban land markets and gentrification processes limit choice of where to live and how to protect themselves against potential risks (see Section 2.3.2). These distributional inequalities are more frequent in communities that are less responsible for the causes of climate change, as their level of energy and resource consumption is lower than that of better off communities (see Section 2.3.1).

In terms of procedural justice, decision-making processes for distributing the burden of adaptation options can be unfair. This is either because the specific needs of deprived communities are considered less important than those of better-off communities, or because the adaptation measures are not tailored to their specific needs (Pringle et al., 2013). The latter is associated with the fact that the disadvantaged people are less likely to participate in decision making processes, and have fewer channels for being heard (Davoudi and Brooks, 2012 adapted and extended from Walker et. al., 2005). Specific action is needed for reducing these disadvantages, Defra and EA (2008)

advocate three principles for a fair and balanced approach. These could also be extended to climate change adaptation planning and implementation:

- **Utility**: "Fair flood risk management [adaptation planning and implementation] that seeks (process) and secures (distribution) the greatest risk reduction per unit input",
- **Vulnerability**: "Fair flood risk management [adaptation planning and implementation] that prioritises the vulnerable in the decision process and targets resources in favour of the most vulnerable",
- **Equality**: "Fair flood risk management [adaptation planning and implementation] decisions are those that provide an equal opportunity for every citizen to have their risk managed in the decision process".

These principles relate to both distributive and procedural principles of justice. Their consideration could lead to greater equity of adaptation measures. Brisley et al. (2012 after CAG Consultants, 2010), Shi et al. (2016) and Pringle et al. (2013) suggest the respect of basic principles for the implementation of climate policies for promoting greater procedural equity:

- Broaden **participation** in adaptation planning across municipal and civil society actors using co-creation. Inclusive planning processes and engaging communities from the beginning can improve immediate climate equity outcomes and enhance long-term stability of adaptation programmes by conveying relevant and culturally accessible climate information to socially and environmentally vulnerable groups, respecting existing cultural knowledge and values. This includes the use of participative techniques and the arts to bridge the gap between policy-makers and citizens;
- Include **justice criteria** into service, infrastructure systems and urban design processes to catalyse equitable adaptation on the ground. This includes socially aware and climate-aware service planning, e.g. recognition of the specific needs of ethnic minorities or other particularly vulnerable groups or dissemination of targeted and tailored advice to vulnerable people and their carers during extreme weather events,
- Adopt **multilevel** and **multi-scalar approaches** to planning, funding, and implementation of adaptation actions. This includes the integration of bottom-up strategies into spatial planning, health, and social care policies identifying opportunities for climate-aware community development, for instance in flood community groups (see example of Liverpool in Section 4.1);
- **Monitor** social impacts of climate change in order to support identifying specific vulnerabilities and equity gaps in communities and facilitate the design of new and improvement of existing mitigating strategies.

Whilst cities increasingly recognize the need to reduce social vulnerability by enhancing access to infrastructure, public services and awareness of climate impacts for marginalized groups (Shi et al., 2016), it remains difficult to monitor and evaluate the fairness of adaptation solutions, or any environmental policies for that matter. It has been observed that "no reliable and definitely no single measurement existed for assessing environmental justice ... and furthermore, no single method for assessing environmental justice existed, or is ever likely to exist" (Rhodes, 2005, p. 120). Brisley et al. (2012) emphasise that there are no specific metrics available to assess the socially just outcomes of adaptation policies. However, the following list could be useful to assess whether adaptation responses are socially just (Brisley et al., 2012):

- Understanding the different factors that contribute to vulnerability (see Section 2.2);
- Identifying the distribution of the vulnerable groups likely to be affected (see Section 3.2.1) and recognising that vulnerability is dynamic and changes over time (see Section 3.2.3);

- Involving the communities most likely to be affected in developing and delivering adaptation plans (see e.g. the case study of Timmendorfer Strand in Section 4.8);
- Assessing the potential adverse implications of climate change to vulnerable groups and identifying targeted adaptation activities to address vulnerability;
- Developing responses which build adaptive capacity, support adaptation actions, and consider both physical infrastructure and service delivery;
- Being aware of the trade-offs that can arise in striving to achieve socially just adaptation and minimising the negative impacts for vulnerable communities as far as possible; and
- Considering and assessing all adaptation options to ensure that the most beneficial are taken forward.

Research assessing the social justice of adaptation responses is still in its infancy. However, a number of initiatives at the local level are beginning to address questions of climate justice in adaptive planning, offering valuable lessons for socially just adaptation ,and these are described in Chapter 4.

3 Inclusion of social issues in guidance documents and assessment approaches

Social vulnerability is a multi-dimensional concept, and its assessment requires knowledge of various specific aspects of communities' and individuals' personal, social, and environmental situations. To date, no methodological "best practice" has been established for the assessment and mapping of social vulnerability to climate-related events (Preston et al., 2011).

To assist decision-makers and planners with working out how to do such assessments, decide on the purpose of their assessment, and determine appropriate indicators, there are a number of guidance documents available. This Chapter provides a review of guidance documents (Section 3.1) and an overview of approaches with examples of related data that can be used for vulnerability assessment (Section 3.2).

3.1 Social vulnerability and social justice in guidance documents for urban adaptation

A review of the guidance material that is available in the Climate-ADAPT portal was carried out. Only guidance documents that target local level adaptation were considered and the Climate-ADAPT database was chosen because it is systematically updated and quality-checked by a team of experts. The review looked at the extent to which the adaptation guidance documents available to European municipalities address social aspects in urban vulnerability assessments and in designing "just" adaptation options. Thirty guidance documents were identified in the database by November 2017 (Climate-ADAPT, 2017b), and reviewed according to criteria below:

- Is it advised (i.e. suggested) or required (i.e. mandatory) for social vulnerability to be considered?
- Are any specific potentially vulnerable groups recommended to be addressed in the vulnerability assessment?
- What methods are suggested for identification of vulnerable groups?
- Which vulnerability /impact indicators are suggested?
- Is the inclusion of social aspects in the selection of adaptation options addressed?
- Is the involvement of vulnerable groups in adaptation planning addressed?
- What methods are suggested for involving vulnerable groups in adaptation planning?
- Are specific actions or adaptation measures listed for addressing social issues and reducing social impacts of climate change?
- Are indicators for monitoring social outcomes of adaptation actions listed?

The documents considered were predominantly in the English language, which implies a certain language bias in the selection of guidance documents. This arises from the requirement of the Climate-ADAPT portal to include only English language sources in its database. Seven of the guidance documents are geographically targeted to Europe, 7 others are national level, there is 1 regional level guidance resource, and 14 have a global coverage. See Annex 2 for a list of the guidance documents reviewed and how they meet the assessment criteria.

3.1.1 Summary of review of guidance documents that cover social aspects

There is a diverse landscape of approaches with a wide variety of levels of detail and each guidance document has their specific focus and even their own vocabulary. It is evident from the review (Annex 2) that all the guidance documents consider social vulnerability assessment and socially just adaptation to some extent, even if it is a mere mention. Most of them follow a stepwise approach, breaking up adaptation planning into phases of an ideal planning process (See the Urban Adaptation Support Tool (UAST) steps 1-6). The process starts from the identification of the issues, through the implementation of the measures to the monitoring of outcomes, this eventually leads to a cyclical approach where subsequent planning uses the results from monitoring (and experience from previous planning) for learning. Social aspects of urban adaptation to climate change in most guidance documents are considered in two different steps: in the context of the general vulnerability assessment as part of the assessment of the specific local climate risk (e.g. Step 2 of the UAST), and as a criterion for the assessment and choice of adaptation options (e.g. Steps 3 & 4 UAST). The procedural justice considerations also appear in steps dealing with stakeholder engagement (e.g. mainly in Step 1 of UAST and continue throughout the process).

However, even though all of the guidance and tools reviewed include at least a generic statement that "vulnerable groups" or "social aspects" need to be considered, in most cases they do not provide specific guidance on how to identify them or how to reduce the impacts.

The focus on social vulnerability is stronger in guidance documents issued by international organisations, which often address urban adaptation with the focus on the global south. In fact, the issue of social forms of vulnerability is a crucial part of most urban planning debates in international development work and is usually assessed through qualitative approaches, rather than quantitative ones (Otto et al., 2017). The guidance documents that focus on broader urban resilience, as for instance the UNISDR Handbook For Local Government Leaders (UNISDR, 2012), tend to consider social issues in more detail.

Even those guidance documents that highlight the necessity of considering social vulnerability in adaptation planning do not always provide the methodological support: only around one third of guidance documents suggest at least one specific method for the identification of vulnerable groups. A similar share of documents address the issue of procedural equity in adaptation decision-making, suggesting at least one specific method for engaging vulnerable groups in adaptation decision-making.

The choice of indicators is supported by a limited number of the documents. Fewer than half of the guidance documents suggest specific indicators for the identification of vulnerable groups or for assessing social vulnerability. One fifth of the guidance documents suggest specific indicators for monitoring how adaptation implementation addresses social impacts, while monitoring of procedural equity in decision-making processes received slightly more attention with approximately one quarter of the documents suggesting indicators for monitoring the involvement of vulnerable groups in the decision making process.

Most guidance documents identify the individuals and groups that are potentially vulnerable as follows: the elderly and very young people, the physically impaired, care-dependent, and socially isolated people. Socio-economic drivers, such as tenancy status and lack of economic sources are identified as potential drivers of vulnerability at both individual and community level in several documents. In some cases, also indicators related to cultural resources are identified, for instance, lack of knowledge of the official language amongst immigrants. Gender is identified as a potential factor exacerbating vulnerability, mainly in the guidance documents focussing on the global context. However, women are also seen as more vulnerable in the European guidance documents, for

instance, in the Urban Climate Guidebook of the German state of Nordrhein-Westfalen. Other documents specifically identify single mothers as vulnerable. This shared understanding of who is potentially vulnerable emerging from the guidance documents reviewed can be a useful starting point for greater focus on social issues in adaptation planning. However, as vulnerability is highly context-specific, for policy-relevant identification of vulnerable groups in a given city there may be a need for a more in-depth assessment (see 3.2) including bottom-up approaches (see 3.2.2).

Overall, even though some of the guidance documents cover the majority of aspects reviewed, none of the guidance documents included in the review cover all aspects in the necessary detail to provide a comprehensive guidance for local level decision-makers to ensure that social issues are fully considered in adaptation planning. The main gaps in the guidance documents include the paucity of indicators for monitoring the social outcomes of adaptation actions. There is also an absence of suggestions for specific methods for the identification of vulnerable groups and methods for their involvement in adaptation decision-making.

As it currently stands, practitioners in European cities would need to sift through a range of resources (often targeted to contexts outside of Europe and borrowing from the broader disaster resilience literature) in order to construct a fully comprehensive approach on socially just adaptation to climate change.

Future work on the EU level could usefully look to develop comprehensive guidance (or a synthesis of existing guidance) on this topic, potentially as part of the possible revision of the EU Adaptation Strategy. There could also be a role for the Covenant of Mayors to facilitate the exchange of knowledge between cities and utilise their platforms to support cities that wish to address these issues in the future.

3.1.2 Details of selected guidance documents

A selection of guidance documents which are particularly relevant for EU practitioners looking to consider social factors of climate change are summarised in this Section. These include guidance materials issued by EU institutions or initiatives and/or those with a strong focus on social aspects that were identified in the review.

The two selected guidance resources issued by EU institutions and initiatives are:

- Urban Adaptation Support Tool – Covenant of Mayors for Climate and Energy guidance hosted on Climate-ADAPT portal, and
- EU Guidelines on developing adaptation strategies.

The following resources stood out in the review as those providing the most comprehensive, practical advice on integrating social considerations in adaptation or resilience planning and implementation[4]:

- Climate Just portal by the Joseph Rowntree Foundation;
- Climate-Friendly Cities: A Handbook on the Tracks and Possibilities of European Cities in Relation to Climate Change by the Hungarian Presidency of the Council of the European Union;
- How To Make Cities More Resilient: A Handbook For Local Governments by the UNISDR;

[4] Based on the aspects addressed in the review listed in Annex 2

- Disaster Resilience Scorecard for Cities by UNISDR;
- Guide to Climate Change Adaptation in Cities by the World Bank; and
- Guidelines for Resilience Systems Analysis - How to analyse risk and build a roadmap to resilience by the OECD.

Urban Adaptation Support Tool

The aim of the Urban Adaptation Support Tool (UAST) (Climate-ADAPT and Covenant of Mayors, 2016a) is to assist users in developing climate change adaptation strategies and plans for cities and urban areas in Europe by providing guidance, links to relevant sources, and dedicated tools. It was developed as a practical guidance tool specifically for the municipality level to assist signatories of the Mayors Adapt, and later the integrated Covenant of Mayors for Climate and Energy initiative (Covenant of Mayors, 2018) – the key EU initiative on urban adaptation[5] – in planning and taking adaptation action at the city level. The steps and recommendations of the UAST are aligned with the contents of the guidance for adaptation planning, issued as part of the EU strategy on adaptation and climate change package.

Within the UAST, social vulnerability is addressed first in step two (of six) of the adaptation cycle. When "assessing risks and vulnerabilities to climate change" the UAST - following IPCC AR5 (2014) - suggests as a minimum to assess "expected (direct and indirect) impacts (threats, opportunities) by identifying the most relevant hazards as well as, the areas of the city that are at most risk given an overlay of spatial distribution of total population, vulnerable populations, economic activities and economic value".

In addition, UAST advises that "the ability to adapt to and cope with climate change impacts is a function of wealth, technology, information, skills, infrastructure, institutions, equity, empowerment, and the ability to spread risk. A city can answer the questions posed in step 2 of UAST by conducting an assessment of vulnerability, risk, and adaptive capacity in city operations, specific sectors, and different communities". It also explicitly recommends that one of the vulnerable sectors that needs to be assessed is "Social well-being (including: poor populations, elderly, the disabled, gender issues, migration, social services, food security)" (Climate-ADAPT and Covenant of Mayors, 2016b).

In the 4th step of assessing and selecting adaptation options, UAST also stresses social considerations (equality, social inclusion, and cohesion) and a strong emphasis is laid on the necessity of involving stakeholders in the process, yet without providing details on the specific challenges connected to the involvement of disadvantaged groups and communities.

While UAST includes social well-being among the sectors potentially impacted and to be included in the assessment of vulnerability and adaptation options, the guidance does not provide detailed advice on methodology, but instead points to a series of reports and other resources that can help with the task. True to its intended purpose of being a "guide to existing knowledge" rather than representing a tool, which directly supports specific consideration of social vulnerabilities in urban adaption planning, it provides an entry point for the mainstreaming of social vulnerability assessments and socially just adaptation planning into urban adaptation practice. Therefore, UAST draws the attention of practitioners to the social issues in adaptation; however, the sheer amount of resources in UAST can make it difficult for city practitioners to identify the most relevant ones.

[5] The Mayors Adapt initiative has been merged with Covenant of Mayors initiative into the integrated Covenant of Mayors for Climate and Energy in 2015.

EU Guidelines on developing adaptation strategies

The EU Guidelines on developing adaptation strategies (EC, 2013b) provide a step-by-step approach and are intended to provide a common understanding of the important aspects of an adaptation process. They also seek to aid adaptation practitioners to overcome barriers in the adaptation process. This guidance was targeted towards national vulnerability strategy development, but both the steps and suggestions for strategy contents are applicable at any governance level, including local municipalities. The step-wise approach proposed by the guidance makes explicit reference to "vulnerable populations most at risk" (step 2) and to spatial overlay between "most relevant hazards and areas of the country, region, or city that are at most risk given an overlay of spatial distribution of total population, vulnerable populations, economic activities, and economic value" (EC, 2013b), which, as evident above, has been directly taken over and developed further in the UAST.

Climate Just Tool

The United Kingdom-based Climate Just portal (Climate Just, 2014b)[6] presents comprehensive guidance for designing socially just responses to the impacts of extreme events. It is the most comprehensive and detailed tool currently existing in Europe for the planning and implementation of socially just urban adaptation. It combines diagnostic maps with guidance documents and the presentation of case studies, aimed at supporting policy makers in the United Kingdom with developing responses to climate change at the local level, which take into account social differences and social vulnerabilities.

The factors affecting vulnerability are defined by indicators for spatial reference units used to report statistics. The indicators representing various aspects of social vulnerability – e.g. unemployment, tenure, age, and local knowledge (see also Section 3.2.1) – are combined in an index of social vulnerability utilising the framework developed by Lindley et al. (2011) (see Section 2.4). Socio-spatial vulnerability, when overlaid with climate hazard information, allows for an assessment of the level of climate disadvantage (Climate Just, 2014c).

The mapping can be used to prioritise areas for further investigation at the local level, e.g. to reach the individuals that need help during an extreme event. The spatial mapping has been used in the United Kingdom in various local contexts (see Section 4.4 for examples). It can also potentially be used to prioritise interventions at a higher (national) level (England and Knox, 2015).

Although the Climate Just tool is clearly targeted at municipalities within the United Kingdom and thus is geographically limited, it is a prime example of a methodology for mainstreaming social considerations into local adaptation planning. It has also inspired other approaches to mapping social vulnerability (case studies of Helsinki, Košice and Trnava in Chapter 4).

Climate-Friendly Cities: A Handbook on the Tracks and Possibilities of European Cities in Relation to Climate Change

The handbook Climate-Friendly Cities (Ministry of Interior, Hungary and VÁTI, 2011), published in the context of the Hungarian Presidency of the Council of the European Union, remains the most detailed European guidance on social aspects of urban adaptation to climate change. It has a strong focus on the social impacts of climate change and the social consequences of adaptation actions and includes a dedicated chapter on supporting vulnerable groups. It provides the most comprehensive information with regards to almost all aspects reviewed: providing guidance and suggestions for

[6] The Climate Just platform has been created by University of Manchester with support from the Joseph Rowntree Foundation, the UK Environment Agency, JBA Consulting, Centre for Sustainable Energy and Climate UK (Climate Just, 2014b).

identifying and monitoring specific vulnerable groups, and advice on the consideration of social justice in adaptation action assessments. It is one of the few documents that proposes specific indicators and actions for social vulnerability assessment, social engagement, and socially just adaptation outcome monitoring. Examples of indicators for monitoring involvement of vulnerable groups include the number of partners (individuals or organisations) involved in climate planning actions and the number of inhabitants reached by shaping social attitudes towards the environment. An example of an indicator for monitoring action outcomes includes the change in the size of green areas. It does not explicitly cover which vulnerable groups should be involved in adaptation planning but there is a general list of those groups that should be part of the assessment.

It serves as a reminder that earlier guidance resources can still be of great value for local practitioners and should be judged by their content and quality rather that the publishing date.

How To Make Cities More Resilient: A Handbook For Local Governments

The review suggests that in many cases the guidance resources provided by international organisations active in development work tend to pay special attention to the issues of social vulnerability and justice in adaptation and resilience-building. The handbook for Local Governments How To Make Cities More Resilient (UNISDR, 2012) is one such example, and is especially useful for socially just adaptation planning and implementation. It considers social aspects as one of four key components of building resilience and promotes an integrated, gender-sensitive, and pro-poor approach based on participatory planning and inclusive governance. It provides a range of suggested actions for engaging vulnerable groups.

Disaster Resilience Scorecard for Cities

The Disaster Resilience Scorecard is another tool developed by the UNISDR in the frame of the Make My City Resilient campaign, updated in 2017 (UNISDR, 2017a). The scorecard is a tool for an assessing progress and challenges in the implementation of the Sendai Framework for Disaster Risk Reduction, and assessing city disaster resilience in general. As such, it has a broader thematic scope than adaptation to climate change. It is structured around UNISDR's Ten Essentials for Making Cities Resilient, and for each Essential a detailed list of aspects to be assessed is provided, along with measurement scale and notes on methodologies and approaches. The output of the assessment is a numeric score, which illustrates the overall resilience level achieved by the city.

Although it is not a guidance tool *per se*, it encourages cities to evaluate various social aspects of resilience building, increases awareness of the importance of taking social justice into account; as well as it indirectly encourages local practitioners to improve their performance on these aspects to achieve a higher scorecard score.

The Essentials addressing social issues are mainly Essential 2 "Identify and Understand Risk" and Essential 7 "Strengthen societal capacity", nevertheless the considerations of the special needs and rights of vulnerable populations permeates throughout the whole scorecard. By following the scorecard, a local decision-maker would find useful information on vulnerable groups to consider, how to engage them into adaptation planning, as well as how to counter-act the social impact of climate change. By definition being a monitoring tool, it provides a very specific list of relevant quantitative indicators to be applied.

Guide to Climate Change Adaptation in Cities

The guide (World Bank, 2011) is targeted towards a broad audience that is active in local level adaptation planning and implementation, especially in the development context and provides a classic and comprehensive step-by-step adaptation guidance. It outlines practical perspectives and links climate change to local priorities and other important city issues, including social ones.

Although it is seen as primarily targeted towards cities in the global south, the guidance is rather universal and applicable in any context, including Europe. Its particular strengths are the comprehensive list of potentially vulnerable types of populations, specific social issues (building conditions and poverty), and indicators for the identification of the groups most at risk (although the indicators stop short of being quantitatively defined). The guidance goes on to also offer concrete ideas on specific actions to promote procedural justice, inclusive participation, and ways to address the social impacts of climate change.

Guidelines for Resilience Systems Analysis - How to analyse risk and build a roadmap to resilience

The Guidelines for Resilience Systems Analysis (OECD, 2014) present a detailed hands-on methodological guide for systematic analysis of resilience proposes an approach called Resilience Systems Analysis. Its primary target are organisations that are working in the development context, however the methodology is context-independent and can be applied anywhere. The approach is characterised by focusing on the systems, not on the risks; aiming to strengthen the systems that people use to support their well-being in the community, no matter what risks they face, building on existing capacities. Thus, it aims to build the base resilience of social groups, including increasing social capital as one of the key elements of resilience; and provides a mechanism for systematically understanding and addressing root causes, dynamic pressures, and unsafe conditions that are at the root of social vulnerability, according to Blaikie et al. (2003) (see Figure 2.4). These aspects are collected together to draw a "risk landscape", and the guidance suggests that risk landscapes need to be considered for each vulnerable group to ensure that solutions for managing risk and boosting resilience address the specific risks for each vulnerable group. The methodology strongly promotes participation of the community in the process and gives specific advice on whom to involve and how to achieve it. It also provides guidance on how to develop a set of indicators for progress monitoring. The process results in the identification of the current gaps in resilience systems and construction of a roadmap towards increased resilience.

3.2 Approaches to social vulnerability assessments

It is important to identify the vulnerable groups and locate them in order to be able to plan for their needs and involve them in the planning process. Some of the guidance documents reviewed above make suggestions for methods to assess vulnerability and consider adaptation options, including a variety of quantitative and qualitative methods. These methods are often combined and linked to a particular framing or perspective and this mix has been termed an "approach" in this report.

There are many different approaches to vulnerability assessments and each one has its benefits and limitations. This Section discusses the different approaches and provides some examples of how they have been used in practice. It is important to understand the differences in approaches because they have major implications for policy-making and adaptation responses.

The approaches covered are:

- Top-down,
- Bottom –up,
- Household- and individual-oriented, and
- With a present or future focus.

Some approaches are more suitable for informing large-scale policies in terms of identifying vulnerable groups, e.g. top-down approaches can be used for national health care policies or urban strategic planning. Some are more suitable for informing small-scale (local) policy and involving

vulnerable groups in the planning process, e.g. bottom-up approaches can be used for building community resilience to extreme weather events and identifying individuals for emergency planning.

3.2.1 Top-down approaches

Top-down approaches are typically quantitative and historically have focused on large scales and long-term timeframes linked to modelling of global climate change and impacts (future biophysical factors) (see Figure 2.2 in Section 2.1). Some of the benefits of the top-down approach are that, if robust, the use of quantitative data is considered scientifically objective and appropriate for decision-making. It is also considered efficient in terms of time and resources (assuming existing data) compared to qualitative data collection (e.g. through interviews or workshops). The top-down approach has been criticised for treating vulnerability as what remains after adaptation action (for more on outcome vulnerability see Section 2.1), for over-simplifying the role of adaptation in responding to multiple stresses, and for focussing mainly on quantifiable biophysical impacts. In the past, socio-economic impacts were treated as "higher order" or "secondary impacts" and addressed only if quantitative models were available to link them to the biophysical effects (Carter and Mäkinen, 2011). However, this is now changing and more recent approaches address some of these criticisms. More detailed data is now available allowing greater mapping resolution more appropriate to the small, local scale (See practical examples below); there is a stronger focus on consideration of social factors (see Climate Just Tool Section 3.1.2); and assessments aim to address both current and future situations (see Section 3.2.4). The greater spatial resolution now available makes a top-down, spatial approach suitable for an initial identification of vulnerable groups. This change in practice has run in parallel with the shift in framing of vulnerability by the IPCC since 2012 to "contextual vulnerability" (see Section 2.1), the rise in the use of spatial mapping, and links to the concept of socio-spatial climate disadvantage discussed by Lindley et.al. (2011) (see Section 2.2).

Whilst the underlying causes of social vulnerability to extreme weather events (such as age, health, or living conditions) are well-recognised (see Section 2.2), the selection of indicators of vulnerability, methods for combining them into indices, and their spatial representation may vary considerably (see the vulnerability map book and socio-spatial mapping examples below). The way these issues are dealt with has important implications for the weighting of single factors included in the analysis and the interpretation of the overall results (see Carer and Mäkinen, 2011, p. 15 for Hinkel's critique on vulnerability indices). The assessment could be focused only on people who are vulnerable in a crisis (an emergency services or disaster risk reduction perspective), or it could also take into account the vulnerability affecting the ability to prepare for or recover after the extreme weather event (Kazmierczak et al., 2015a) (a climate impacts and adaptation perspective). These different perspectives are dependent on how vulnerability is defined (see Section 2.1).

Practical examples of quantitative data on social vulnerability to climate change across Europe derived from the top-down approach

Urban vulnerability map book (currently under revision)

The urban vulnerability map book (Climate-ADAPT, 2018) aims to provide a Europe-wide overview of the potential vulnerability of major cities to climate change and is available from Climate-ADAPT. The maps present indicators of vulnerabilities of major European cities (i.e. those covered in the Urban Audit or a subset of them) to climate change, specifically to the threats of heat-waves, water scarcity and droughts, floods, and forest fires. The indicators relate to exposure, sensitivity (understood as the susceptibility of cities to climate impacts, via population characteristics, but also physical conditions), and response capacity (characteristics of cities that can help to reduce the severity of impacts). The indicators related to social vulnerability that are available through the portal at the city-level (extracted from: Eurostat, 2018a) are as follows:

- Sensitivity:
    - Proportion of population aged 65 and over [%] (See Figure 3.1)
    - Proportion of lone-pensioner households [%]
    - GDP of the region (NUTS3) per inhabitant at current market prices [EUR per inhabitant]
- Response capacity:
    - Proportion of working age population qualified at tertiary level [%]
    - Share of survey replies that most people can be trusted[7] [%]
    - Unemployment rate [%]

Assessments of social vulnerability to climate change at the European level go beyond cities and as such it may be helpful to describe the context in which the cities are located. The Urban Vulnerability Map Book presents some data for NUTS3 level (Nomenclature of Territorial Units for Statistics; 150,000 – 800,000 people). The JRC Urban Data Platform presents indicators on socio-economic and physical conditions at three different levels of aggregation: cities, functional areas, and metropolitan regions (EU, 2018).

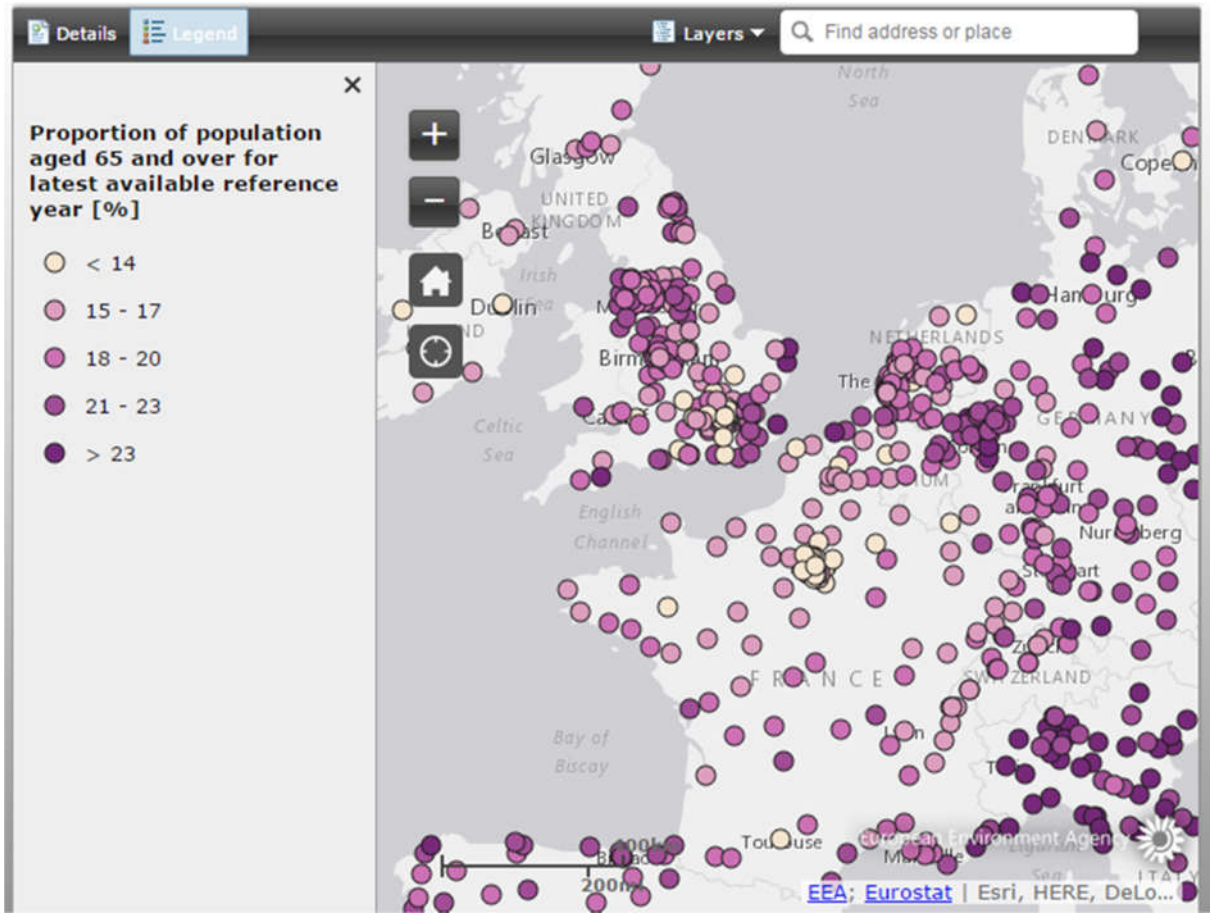

Figure 3.1: Proportion of people aged 65 years or older in the Urban Vulnerability map Book of Climate-ADAPT. (Climate-ADAPT, 2018)

[7] This information is based on several EUROSTAT Surveys on the Quality of life in Cities, (Eurostat, 2018b)

Urban Audit data

Tapia et al. (2017) within the RAMSES project have provided a vulnerability analysis of 571 European cities based on Urban Audit data. The study used a set of urban vulnerability indicators, which cover different aspects of vulnerability, including social vulnerability. The aspects of social vulnerability covered include the proportion of children and of non-EU residents in the population, as well as the proportion of one-person and lone-parent households.

The information described above offers opportunities for comparison of cities or analyses of regional differences, and therefore it is useful from a national or European policy-making perspective. However, it is important to remember that the statistics for the whole city may mask large inequalities present within cities.

Mapping social vulnerability within cities

At a city level, if the information about social vulnerability is to be used to support decision making about targeting resources to different areas, finer-scale information about the variability in social vulnerability to climate change is needed.

One of the main approaches in assessing social vulnerability is through mapping of various indicators for spatial units used in statistical reporting. This is possible in countries where socio-economic information is collected regularly. For example, the United Kingdom has a comprehensive system of presenting census information for a hierarchy of spatial units, with the lowest level as small as 125 households (Output Areas) (Office for National Statistics, 2016). The socio-economic information available for such units can be presented spatially and combined into indices of social vulnerability.

Social vulnerability is a multi-dimensional, complex issue that requires drawing on information from a variety of sources. For example, the Mapping Flood Disadvantage in Scotland 2015 project drew on the framework for assessment of vulnerability by Lindley et al (2011; see Section 2.3.2) and involved combining 34 indicators into an index of vulnerability (Figure 3.2). A similar exercise in the Helsinki Metropolitan Region was based on 23 indicators (see Figure 4.1 in Section 4.1). Such lists of indicators are limited by the data availability, but at the same time they are grounded in scientific research and discussed with the local stakeholders to validate their applicability in a given location (see Section 4.1 Helsinki).

Domain	Indicator	Dimension of vulnerability				
		Sensitivity	Ability to prepare	Ability to respond	Ability to recover	Enhanced exposure
Age	% people under 5 years old	y				
	% people over 75 years old	y				
Health	% people whose day-to-day activities are limited	y				
	% households with at least one person with long term limiting illness	y				
Income	% people in routine or semi-routine occupations		y	y	y	
	% of long term unemployed people		y	y	y	
	% households with dependent children and no adults in employment		y	y	y	
	Number of Income Support claimants		y	y	y	
	Number of Job Seeker Allowance claimants		y	y	y	
	Number of Pension Credit claimants		y	y	y	
	Number of families receiving tax credits		y	y	y	
Information use	% people with <1 year residency in the UK		y	y	y	
	% people who do not speak English well		y	y	y	
Insurance	% new addresses located in flood risk areas		y	y	y	
	Number of historic flood events		y	y	y	
Local knowledge	% addresses in Flood Warning Target Areas		y	y		
	% new residents (< 1 year) arriving from outside the local area		y	y		
Tenure	% social rented households		y			
	% private rented households		y			
Mobility	% of Incapacity Benefit/Severe Disablement Allowance claimants			y	y	
	% people living in medical and care establishments			y	y	
	% households with no car or van			y	y	
Social networks	% children of primary school age			y	y	
	Number of voluntary organisations focused on local community			y	y	
	% single pensioner households			y	y	
Physical access	% people working further than 30km from home			y		
	Road density			y		
Crime	Number of domestic breakings			y		
Access to health services	Travel time to GP surgery (private transport)				y	
	Travel time to GP surgery (public transport)				y	
Housing characteristics	% households with the lowest floor level: ground floor					y
	% households with the lowest floor level: basement or semi-basement					y
	% caravans or other mobile or temporary structures					y
Physical environment	% urban land cover					y

Figure 3.2: List of indicators used in Mapping Flood Disadvantage in Scotland 2015 (Kazmierczak et al., 2015a)

Figure 3.3 shows the map of social vulnerability in the city of Dundee, Scotland, using the indicators listed above which have been mapped at the Data Zone level (Scottish census unit of 500-1,000

residents). In Finland, the socio-economic information is available for a grid of 250 by 250m (see Section 4.1).

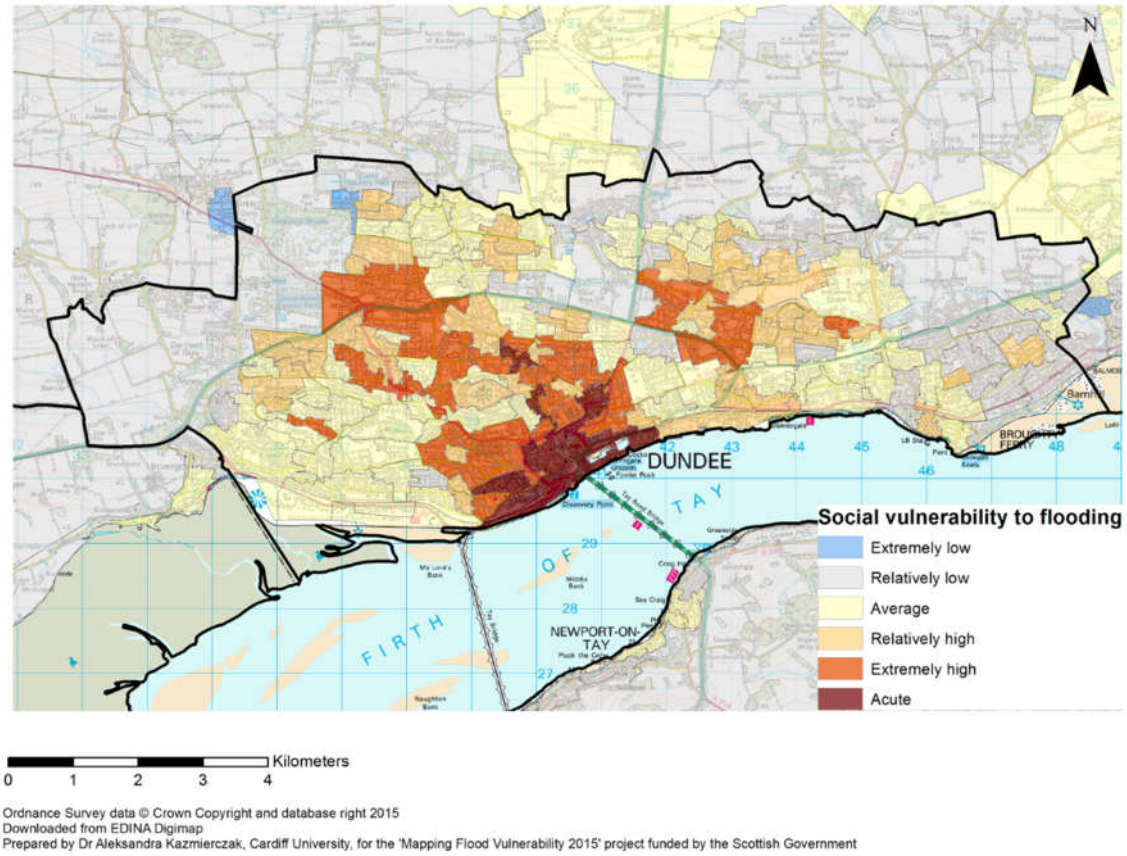

Figure 3.3: Map of social vulnerability to flooding in Dundee

Vulnerability indicators presented in this manner are expressed in relation to the area (e.g. percentage of population in the area characterised by a certain feature - percentage of the spatial unit area characterised as urban).

The benefits of mapping the indicators at the level of spatial units (adopting an area-based approach) include (Kazmierczak et al., 2015b):

- Minimising the issues of data protection and confidentiality as it enables the generalisation of personal, social, and economic data from census units.
- The possibility of presenting the results on maps. This can be used to highlight areas where climate related risks coincide spatially with social vulnerability, and can be used to guide the efforts of local authorities and other local service providers to prioritise areas for action. It may also ensure the preventative measures and response to flooding taking into consideration the characteristics of the community in their location.
- In comparison to data on vulnerable individuals, mapping provides a broader picture that makes the outputs suitable for strategic spatial planning, which is appropriate both from a conceptual (vulnerability being defined also by space) and a practical point of view addressing (partially) spatial drivers of vulnerability. This is because it may support decisions when developing adaptation measures for areas of known exposure to climatic events (e.g. through appropriate planning or neighbourhood design that reduces exposure; through actions targeted at raising

awareness of the risk of flooding or heat waves (behaviour change), and local authority's actions to reduce that risk across the community).

Nevertheless, the area-based approach also has some drawbacks (Kazmierczak et al., 2015b):

- It offers a snapshot of information collected at the time of the census (collected every 10 years). Data may get out of date quickly, especially in cities undergoing rapid development or re-development.
- Vulnerability maps do not offer detailed information about the particular vulnerabilities of individual people and households (information that is available to public health services and social care departments of local authorities). Thus they may not be sufficiently detailed to guide the action of the emergency services in the event of extreme weather. Previous research observed that spatial vulnerability assessments were seen by emergency services as meaningful for prevention, planning, recovery, and training (see also the use case in Climate Just from Leeds, United Kingdom) (Climate Just, 2014e), but as having a limited role during the immediate response phase of a flood incident (Alexander, M., et al., 2011).
- Low overall vulnerability at the census unit level may conceal the high vulnerability of a small number of individuals or households living in that area. Similarly, not all people living in an area classified as highly vulnerable would necessarily have high vulnerability.
- There are various ways of transforming, standardising, and combining the indicators into the overall index (adding, multiplying, weighting, or not weighting) (Carter and Mäkinen, 2011). This means that the overall vulnerability index may be somewhat abstract and far removed from the individual indicators. To address it, the spatial representation should allow disaggregation of the final index into its original components.
- Extraction of information, collation of indices, and their presentation on maps requires GIS expertise.

Due to these limitations, top-down social vulnerability assessments drawn based on census data and resulting in maps should be considered as an initial indication of areas affected by social vulnerability to flooding and flood disadvantage (i.e. Step 2 of UAST assessing vulnerability). One of its main uses has been identified as a tool to start the cross-departmental and multi-stakeholder discussion about the appropriate responses to flood disadvantage (Kazmierczak et al., 2015a) (Step 3 UAST, identifying adaptation options). It is recommended that in the decision-making phase (Step 4 UAST) that the local authorities and other end users supplement area-based datasets with more detailed (and up to date) knowledge related to the specific aspects and levels of individuals' vulnerability and exposure to flood in a specific location (see for example Newcastle in Section 4.2).

3.2.2 Bottom-up approaches

Bottom-up approaches focus on short to medium-term timescales, are generally qualitative, and have a strong focus on assessing social vulnerability. Bottom-up assessments of vulnerability provide in-depth local information about specific places, communities, and individuals based on their characteristics or their specific experiences of climate impacts. The emphasis is more on current time scales, where vulnerability to current climate variability serves as a starting point for understanding potential aspects of vulnerability to future climate conditions. They are useful for considering interventions that deal with individuals who are vulnerable in a heat wave and individuals who may need evacuation in a flooding event. One of the framings that covers this approach is the Sustainable Livelihoods approach (see Section 2.2) and takes account of social capital (social networks, norms, and culture).

Whilst top-down mapping can offer an overview of the geographical patterns of social vulnerability to climate change, it cannot represent all aspects of vulnerability and this is where bottom-up approaches may be needed. Some of the most vulnerable groups cannot be mapped, for instance, the homeless, or to a certain extent migrants and refugees. The vulnerability of other groups or individuals may not be recorded in the health and social care system if the people fall through the system safety net or choose not to use the health/social care services. Therefore, the top-down assessments of vulnerability offer only a partial picture as they can address only those aspects of vulnerability which are connected to socio economic dimensions recorded in the administrative systems. Local knowledge on impacts and social resources can be integrated into a bottom-up assessment using participatory processes. This type of vulnerability assessment is mainly based on qualitative data and is difficult to be applied at larger scales, yet it provides a good evidence base for planning integrated (spatial and non-spatial, e.g. community resilience) adaptation and non-adaptation (e.g. sustainability, biodiversity, well-being) measures.

The majority of assessments that follow this bottom-up approach are found in developing countries, where vulnerability research tends to be focussed on the short- to medium-term, and often in response to immediate risks presented by current climate variability in the context of existing vulnerabilities. In contrast, developed countries are often regarded as resilient to variability, and historically their assessment have used the top-down approach and largely ignored social factors in their vulnerability assessments. This is changing with more countries in Europe using bottom-up approaches (e.g. O'Brien et al., 2007; Fazey et al., 2017; EEA, 2018) (see for example the Scottish Borders case study, Section 4.5).

3.2.3 Household- and individual -based approach to vulnerability

Another approach to assessing vulnerability involves a top-down approach in that it is using existing data that is centrally-gathered, but it is also bottom-up in that it links with qualitative data from the local level that identifies individuals. This approach is not specific to climate-related emergencies but any crisis and aims to identify vulnerable individuals.

This approach addresses also the temporary and transient vulnerability of individuals, not captured in mapping based on statistical information. For example, otherwise not vulnerable individuals may suddenly be more sensitive or have lower adaptive capacity due to advanced pregnancy, short-term illness, or being a visitor to an unfamiliar city.

An example of this approach is the 2008 United Kingdom Cabinet Office publication "Identifying People who are Vulnerable in a Crisis: Guidance for Emergency Planners and Responders". It is intended to guide the development of local action plans for identifying groups of people who may be vulnerable in an emergency. The guidance advocates working with those organisations who are best placed to have up-to-date records of vulnerable individuals and who will be aware of their needs. The advice is to create a list of lists – given the impossibility of maintaining a central up-to-date list of vulnerable people, lists of organisations and establishments who can be contacted for relevant information in the event of an emergency should be made. Figure 3.4 presents the types of vulnerable people to be considered in relation to emergency situations.

Table 1. Identifying Vulnerability and Communicating Through Other Organisations

Potentially Vulnerable Individual/Group	Examples and Notes	Target through the following organisations/agencies
Children	Where children are concerned, whilst at school the school authorities have duty of care responsibilities. Certain schools may require more attention than others.	LEA schools through Local Authorities, and non-LEA schools through their governing body or proprietor. Crèches/playgroups/nurseries
Older People	Certain sections of the elderly community including those of ill health requiring regular medication and/or medical support equipment The "oldest-old" (aged 80 or over) are more likely to be widowed women, which may impact upon your planning.[6]	Residential Care Homes[7] Help the Aged Adult Social Care Nursing Homes
Mobility impaired	For example: wheel chair users; leg injuries (e.g. on crutches); bedridden/non movers; slow movers.	Residential Care Homes[7] Charities Health service providers Local Health Authorities
Mental/cognitive function impaired	For example: developmental disabilities; clinical psychiatric needs; learning disabilities.	
Sensory impaired	For example: blind or reduced sight; deaf; speech and other communication impaired.	Charities eg the Deaf Council Local groups
Individuals supported by health or local authorities		Social services GP surgeries
Temporarily or permanently ill	Potentially a large group encompassing not only those that need regular medial attention (e.g. dialysis, oxygen or a continuous supply of drugs), but those with chronic illnesses that may be exacerbated or destabilised either as a result of the evacuation or because prescription drugs were left behind.	GP surgeries Other health providers (public, private or charitable hospitals etc.) Community nurses
Individuals cared for by relatives		GP surgeries Carers groups
Homeless		Shelters, soup kitchens
Pregnant women		GP surgeries
Minority language speakers		Community Groups Job centre plus
Tourists		Transport and travel companies Hoteliers
Travelling community		LA traveller services Police liaison officer

Figure 3.4: Vulnerability screening for emergency situations (Source: Cabinet Office, 2008)

This approach is related more closely to disaster risk management than long-term adaptation planning. The lists are live and updated constantly. They take into account temporary vulnerability; for example they include pregnant women and people who are temporarily ill among the vulnerable. They also involve organisations concerned with the well-being of, for example, homeless people or drug users that allows consideration of the "unmappable" groups that could be overlooked if only the area-based approach was used. The identification of the location of individual vulnerable people, and the knowledge of the exact reason for their vulnerability, allows them to be helped in the correct way in the event of emergency, e.g. flooding or heat wave (see example from Paris in Section 4.3).

At the same time, the live character of the lists poses difficulties with regards to analysing the data and using it for planning purposes. In addition, confidentiality issues are present and the data usually

cannot be accessed by research organisations who could offer an analysis of vulnerability, for which the local authorities may not have the capacity. Hence this approach is not ideal to use for strategic planning to prepare to and recover from extreme events.

3.2.4 Present versus future vulnerability

One aspect of social vulnerability assessment that needs to be transparent is to distinguish between "current" and "future" situations. The PROVIA guidance (PROVIA et al., 2013) builds on research conducted within the project MEDIATION: Methodology for Effective Decision-making on Impacts and Adaptation (funded by the EC, FP7). This framework explicitly covers the social factors within vulnerability and differentiates between current and future vulnerabilities. It can be applied at any level including cities. The guidance is structured along a five-stage iterative adaptation learning cycle. The first stage of this process is "Identifying adaptation needs" and includes assessment of impacts and vulnerability, and the guidance uses decision trees to support the selection of methods. Within the description of the methods, the framing of vulnerability is discussed and is shown in Figure 3.5. It shows how biophysical and social factors combine to shape vulnerability. It distinguishes between "current" and "future" states. An assessment of *current* factors would provide vulnerability to climate *variability* and an assessment of *future change* factors would provide vulnerability to *climate change.* This avoids using the term *present vulnerability*, given that vulnerability refers to potential harm in the future, but still recognises that there are two different time horizons of interest in framing vulnerability.

Whilst the future biophysical factors are well-explored in climate science through climate modelling and projections, there is less future work on the socio-economic side. The global socio-economic scenarios were developed as input for estimating greenhouse gases emissions to model the future climate; however, they are not widely available for individual countries or cities. The lack of understanding about socio-economic trends was recognized as a major knowledge gap in the impact assessment for the EU Adaptation Strategy (EC, 2013c). While the future non-climatic aspects are covered in many national climate change impacts and vulnerability assessments in Europe (see Section 1.4), the extent to which social factors were covered within these national assessments was not explicitly covered in the survey underpinning the climate change impacts and vulnerability 2018 report (EEA, 2018). Hence, it is unclear whether the assessment considers only one factor, such as population growth, or comprehensively covers social factors. Further, even where future scenarios are covered at the national level, no socio-economic projections may be available at sub-national or local level.

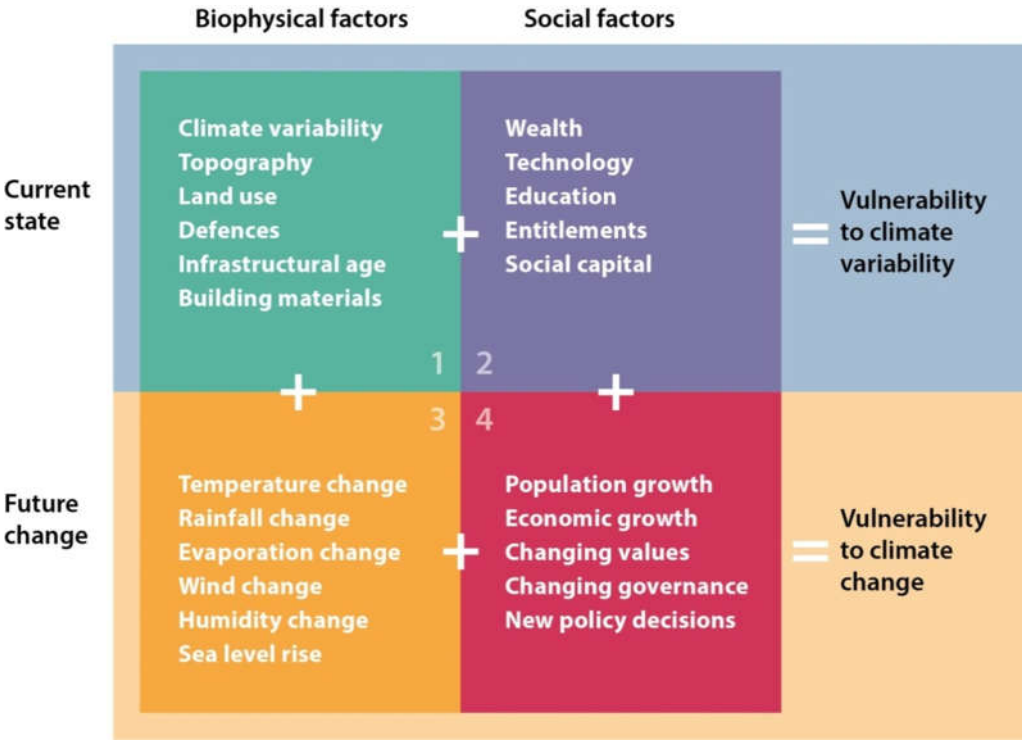

Figure 3.5: Framing of present and future drivers of vulnerability in the PROVIA guidance (PROVIA et al., 2013)

Narrative futures including social vulnerability (to an extent) were created at the European scale by Kok et al. (2016). They comprise four qualitative stories for Europe downscaled from the global SSPs. These European SSPs (Eur-SSPs) include trends for key elements up to year 2100, with a starting point in so-called CLIMSAVE scenarios that exist up to 2050. Similar to the global SSPs, the Eur-SSPs cover a wide range of dimensions of sustainability and development, also social aspects.

Quantified futures of social vulnerability, again, based on and extending from the global SSPs, can be found in Rohat et al. (forthcoming). These internally consistent extended SSPs contain detailed and highly quantified narratives and a selection of ten key factors of social vulnerability. More detail on the interplay between demographic characteristics and education, i.e. key factors of resilience against social vulnerability, can be found in KC and Lutz (2017).

Existing socio-economic scenarios provide a good starting point in considering, mapping, and analysing social vulnerability. Care must be taken, however in the interpretation of the pathways, as alternative quantifications are possible, and may not be equally fit for purposes across desired geographical scales or timelines. An increased understanding of local vulnerability may then require a) projections of sufficient spatial resolution at appropriate time scales; b) inclusion of a range of factors of social vulnerability; and c) linking of those factors to the more widely available projections of, for example,. population structure and climate variability. Currently available evidence often lacks in one or more of these aspects. Hence there is still a knowledge gap in this area and more comprehensive information on future socio-economic projections (at national and sub-national levels) would be helpful for improving assessments.

There are some country-level studies that have considered a variety of future social factors within their vulnerability assessments. For example, Oven et al. (2012) mapped demographic projections available at the local level up to the early 2030s for England against the future climate threats, discovering that some of the areas with the highest increase in older populations often coincide spatially with zones of increased risk of flooding and extreme temperature events. In the Nordic

region, Carter et al. (2016) describe, map, and project the vulnerability of the elderly to a range of weather-related hazards such as heat waves, icy conditions, and cold periods. Some of these hazards are expected to change in frequency and intensity in the Nordic region, while at the same time large increases are projected in the proportion of elderly population. An interactive web-based tool was also developed for mapping and combining indicators of climate change vulnerability of the elderly, by municipality, across three Nordic countries: Finland, Norway, and Sweden (SYKE, 2018).

Mapping the potential future shape of cities, which may either limit or exacerbate the impacts of climate on vulnerable populations is also underdeveloped. At the European level, the LUISA Territorial Modelling Platform is primarily used for the ex-ante evaluation of EC policies that have a direct or indirect territorial impact, including urban areas (EU, 2015). Attempts at understanding how cities change over time at a finer scale are being made for example with the use of the Metronamica tool, which models future urban development based on changes in land use and some socio-economic data (population density and occupation) which can be used for assessing future adaptation needs. This tool has been applied to the cities of Manchester (Carter, 2012) and Hamburg (Kaveckis, et al., 2013). Land use change is also projected together with explicit, age specific sub-national population by Terämä et al. (2017), with a distinction between urban, peri-urban, and rural settlements. The projections benefit from the shared socioeconomic pathways (SSP) framework (Moss et al., 2010; van Vuuren and Carter, 2014; O'Neill et al., 2014; and Kriegler et al., 2014) that the climate change research community has adopted to facilitate the integrated analysis of future climate impacts, vulnerabilities, adaptation, and mitigation globally.

4 Case studies - Implementation of vulnerability assessment and equity in adaptation planning

This Chapter presents examples of how cities have identified vulnerable groups and found out where they are within their assessment stage and how they have involved them in the adaptation planning stage. The case studies have been identified using the Climate-ADAPT database, following the suggestions of the expert workshop participants and through a literature review.

The case studies presented cover various climate impacts: heatwaves (Paris, Košice and Trnava), river flooding (Scottish Borders, Liverpool), sea level rise/coastal flooding (Vejle, Timmendorfer Strand), and intense precipitation (Malmö), and relate to urban areas of different dimensions (from big cities like Paris or London to very small towns as in the Scottish Border case).

The facets of social aspects of vulnerability emerging range from material deprivation (e.g. the United Kingdom case studies and the Scottish Borders case) and the need for protecting local economies (Timmendorfer Strand) to protecting those that are vulnerable to heat in the Paris and in the two Slovakian cases.

Examples for top-down assessments are presented: in Helsinki, Wigan, and in the two Slovakian case studies. In contrast, Liverpool, London, the Scottish borders case, Paris, and Vejle have used bottom-up strategies for the identification of social vulnerabilities

Timmendorfer Strand provides an example of procedural justice in planning and implementation with a strong focus on participation of the local community. In this case, the participation of local stakeholders has led to changes in the design of coastal flooding protection measures. Community involvement activities described for some of the United Kingdom case studies (e.g. Liverpool) show how residents have tackled flood risk and articulated their specific needs for protection measures leading to increased overall resilience of the community.

The case studies selected show a strong bias towards North Western Europe. This is due to the north-western European cities being more advanced in their adaptation policies, and having a longer tradition of citizen engagement. The consideration of social vulnerability in urban areas by some local authorities in the United Kingdom reflects the research led by the Joseph Rowntree Foundation that has now been included in the United Kingdom Climate Change Risk Assessment. This demonstrates the need for interaction between local and national policy levels. Finally there is a language bias, as those examples published in English are more accessible than those described in other European languages.

4.1 Mapping social vulnerability to climate change in the Helsinki Metropolitan Area, Finland

In 2015, the Helsinki Region Environmental Services Authority (HSY) commissioned a data study and mapping exercise to identify the spatial distribution of social vulnerability to climate change impacts (high temperatures and flooding) in the Helsinki Metropolitan Area. The analysis was based on the approach developed by Lindley et al. (2011); for the Climate Just tool (see Section 3.1.2), i.e. a spatial analysis of social vulnerability determined by adaptive capacity (ability to prepare for, respond to

and recover after extreme weather events), sensitivity (related to age), and enhanced exposure (type of housing and presence of green space).

Code[3]	Indicator	Aspect of vulnerability	Weight in vulnerability to flooding	Weight in vulnerability to heat	Sensitivity	Dimensions of social vulnerability to flooding				Dimensions of social vulnerability to heat		
						Ability to prepare	Ability to respond	Ability to recover	Enhanced exposure	Ability to prepare	Ability to respond	Enhanced exposure
i_1	Location within 1km from a railway station	Access	0.25	0			Y					
i_2	Accessibility zone	Access	0.25	0			Y					
i_3	Percentage of households with no car	Access	0.25	0			Y					
i_4	Access in case of emergency	Access	0.25	0			Y					
i_5	Percentage of people with basic studies	Information	1	1		y	y	Y		y	Y	
i_6	Percentage of children 0-6 years old	Age	0.5	0.5	Y							
i_7	Percentage of people over 75 years old	Age	0.5	0.5	Y							
i_8	Percentage of unemployed in labour force	Income	0.25	0.25		y	y	Y		y	Y	
i_9	Percentage of economically inactive people in the population	Income	0.25	0.25		y	y	Y		y	Y	
i_10	Percentage of long-term unemployed in the labour force	Income	0.25	0.25		y	y	Y		y	Y	
i_11	Median household income	Income	0.25	0.25		y	y	Y		y	Y	
i_12	Occupancy rate	Overcrowding	0.5	0			y	Y				
i_13	Percentage of households containing 7 or more people	Overcrowding	0.5	0			y	y				
i_14	Percentage of dwellings in flats	Housing	0	1								Y
i_15	Percentage of water area in the grid cell	Physical environment	0	0.33								Y
i_16	Percentage of total green space area in the land area	Physical environment	1	0					y			
i_17	Percentage of low vegetation area in the land area	Physical environment	0	0.33								Y
i_18	Percentage of area covered by trees in land area	Physical environment	0	0.33								Y
i_19	Percentage of students in the population	Social networks	0.33	0		y	y	Y				
i_20	Percentage of single person households	Social networks	0.33	0.5		y	y	Y		y	Y	
i_21	Percentage of school age children in the population	Social networks	0.33	0.5		y	y	Y		y	Y	
i_22	Percentage of rented households	Tenure	0.5	0.5		y		Y		y		
i_23	Percentage of dwellings rented from ARA	Tenure	0.5	0.5		Y		y		y		

Figure 4.1: List of indicators used in mapping social vulnerability to climate change in Helsinki Metropolitan Area (Source: Kazmierczak, 2015)

When applying this method of analysis it was necessary to identify suitable indicators reflecting social vulnerability in the Finnish capital. This was done collaboratively by the HSY and the consultant. The indicators, available for 250 x 250 grid[8] (see the list of indicators in Figure 4.1) were analysed statistically to eliminate redundant data, combined into indices and presented spatially (see the map for social vulnerability to heat in Figure 4.2). In a final step, the maps of social vulnerability were overlaid with spatial distribution of climate hazards (Kazmierczak, 2015).

[8] Each grid cell represents thus a spatial unit which is slightly larger than a building block in the centre of the city of Helsinki.

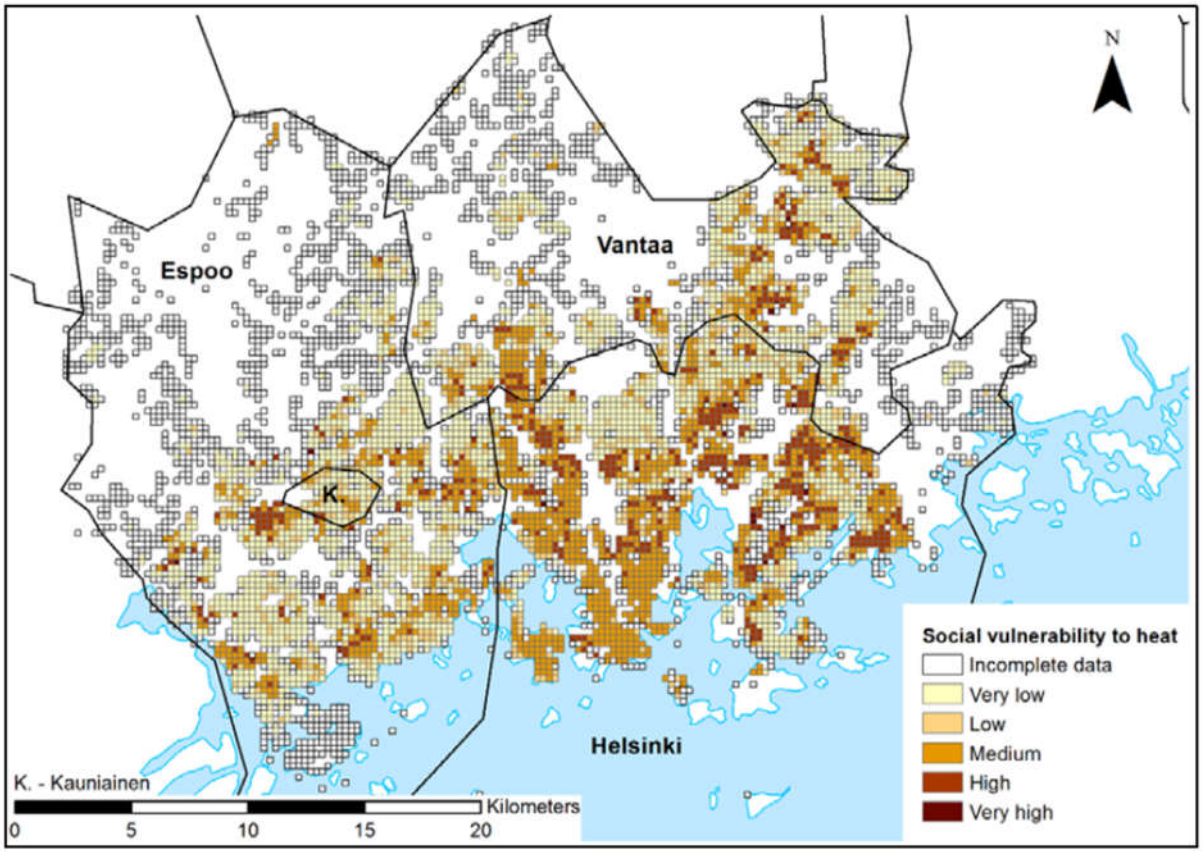

Figure 4.2: Social vulnerability to high temperatures in Helsinki, Finland (Source: Kazmierczak, 2015)

The result of the analysis presents a spatially detailed distribution of social vulnerability across the urban area, which may be used to support the prioritization of interventions to reduce climate-related risks to vulnerable communities (Kazmierczak, 2015). The complexity of the data poses challenges for its practical use. Hence it demonstrates that there is a need for technical expertise within municipalities to enable the interpretation of such data before it can be used for policy and planning purposes.

Source: Susanna Kankaanpää, Municipality of Helsinki, personal communication, September 2017.

4.2 Inclusion of social factors local climate vulnerability assessments in Slovakia (Košice and Trnava)

Slovakia is currently revising its National Adaptation Strategy, but has not yet developed a national adaptation action plan. Despite social inequalities present in Slovakia (with regards to income, educational attainment, and employment), the notion of social justice in the context of climate adaptation is still in its infancy. At the local level, only four cities (Bratislava, Košice (one city borough), Trnava, and Kezmarok) have developed an adaptation plan.

An organisation working in the field of climate adaptation is the Carpathian Development Institute (CDI), which carried out an assessment of social vulnerability to heat waves and high temperatures in the cities of Trnava and Košice, and contributed to the design and implementation of adaptation measures using nature-based solutions.

The pilot area was located in the Zapad borough of Košice. The area was selected due to a high density of population, living mainly in prefabricated buildings with poor insulation, and a relatively high number of vulnerable facilities (hospitals, nurseries, schools, and care homes for the elderly). An enabling factor was the support from the local mayor who was interested in the adaptation agenda. The following vulnerability and exposure indicators were collected and analysed for 200m x 200m grid cells to identify hotspots of vulnerability and risk in relation to heatwaves:

- Percentage of people over the age of 75 and below 4 years,
- Percentage of people living in top-floor flats,
- Location of vulnerable facilities,
- Thermal insulation of prefabricated apartment blocks,
- Extent of paved areas with no shade,
- Level of knowledge about behaviour that reduces risk during heatwaves (based on a survey),
- Presence of air conditioning on the city transport,
- Availability of medical assistance during heatwaves,
- Coverage of green areas, and in particular availability of green areas with a tree crowns coverage over 60% and with surface over 2 ha,
- Surface roughness (height and orientation of buildings),
- Temperature distribution pattern (based on measurements during heat waves), and
- Circulation of cooling air and katabatic wind (i.e. downslope, cool wind).

The analysis allowed the identification of areas that are particularly vulnerable from the social perspective and exposed to high temperatures (see Figure 4.3). During the project, the local citizens were consulted (through a survey) on their perceived need for the adaptation planning in their area, as well as on the preferred type of adaptation measures. The analysis and results of the survey informed a local government-led programme of cooling both outdoor and indoor public spaces (through green infrastructure, artificial shading, shading of windows, and use of reflective surfaces), with a particular focus on vulnerable facilities. It also included a programme focussed on the behaviour of residents during heatwaves (information and educational activities for citizens). In addition, a “climate-correct decision-making” programme was established to build the capacity of the public administration and introduce mechanisms to ensure that climate concerns are taken into account in planning and issuing of construction permits. The physical measures implemented involved planting additional trees in parks to provide the 60% crown coverage and establishing a public green space in a disadvantaged area to provide respite from heat. The measures have been introduced recently and their effectiveness has not been monitored yet.

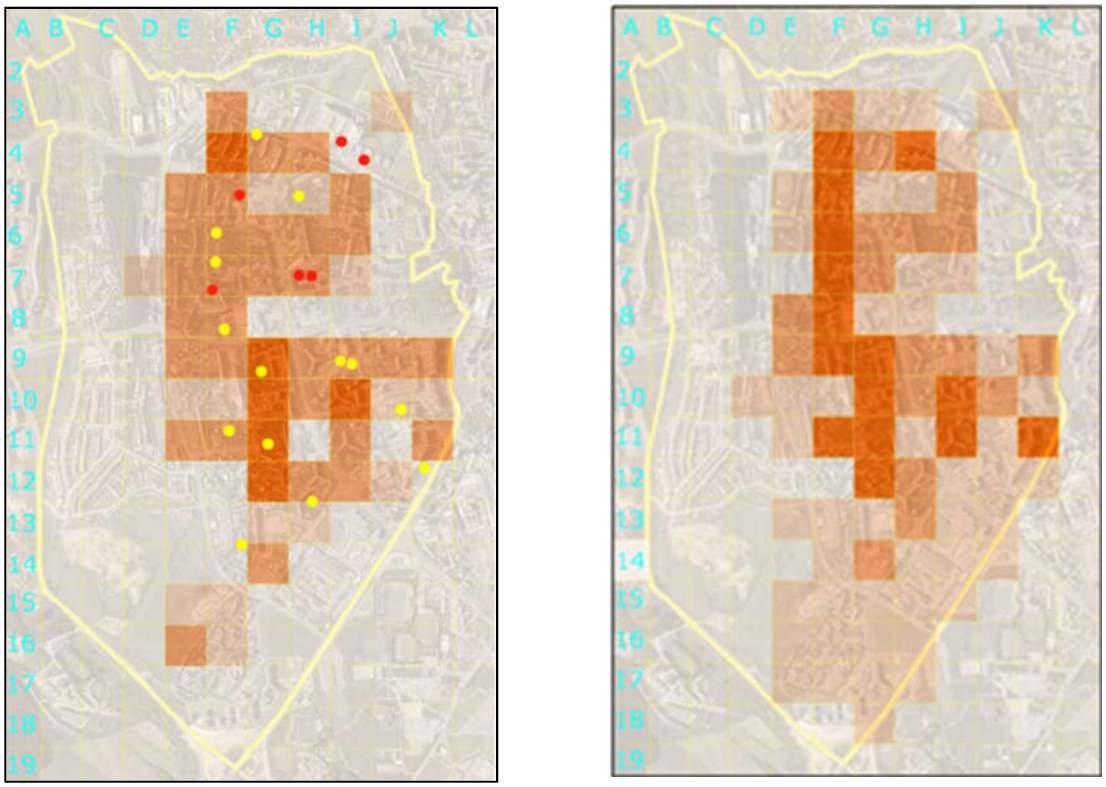

Figure 4.3: Vulnerability to heatwaves, Košice a) concentration of vulnerable people and facilities (represented as yellow and red dots); b) summary map of all weighted factors

In Trnava, a similar approach to vulnerability assessment has led to the prioritization of interventions in a residential area, focused on urban greening (Figure 4.4). The planning and implementation of the greening was carried out by the local authority. The design was agreed in consultation with the district committee and involved local residents. The new layout of the site includes tree planting for shading as well as sustainable urban drainage systems. The evaluation of the effectiveness of the measures is planned for 5 years after completion of the project (in 2019).

Source**:** Personal communication from Andrej Steiner, CDI, September 2017

Figure 4.4: Pilot urban greening project in Trnava a) site's location in relation to vulnerable facilities; b) before the intervention; c) after the intervention

4.3 Vejle Resilience Strategy: building social and climate resilience

In 2016 the city of Vejle, Denmark developed the Vejle Resilience Strategy building on the city's participation in the 100 Resilient Cities network. The vision of resilience promoted by this network focuses on "… helping cities around the world (to) become more resilient to the physical, social and economic challenges that are a growing part of the 21st century" (100 Resilient Cities, 2018).

The Vejle Resilience Strategy responds to current and future social, economic, and environmental challenges. Social challenges described in the resilience strategy include the increasing risk of polarization, loss of social cohesion, and growth of vulnerable groups (including the elderly, people with mental health issues, and immigrants). Climate-related risks include river flooding, surface water flooding (due to location of the city at the bottom of a steep valley), and sea level rise. The city's resilience is seen as a combination of 4 principles of social resilience, climate resilience, co-creation of strategies with citizens, and technological advancements (smart city). The individual actions described in the strategy sit at the cross-section of these principles (Figure 4.5). The Vejle Resilience Strategy offers a vision for the city where by all new development is delivered with the four principles of the Strategy in mind.

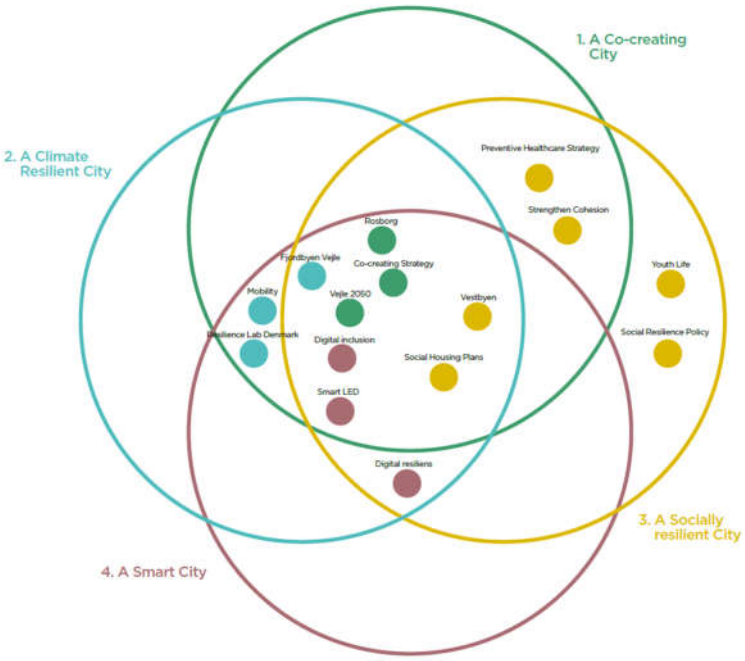

Figure 4.5: Four principles for framing actions in the Vejle Resilience Strategy

The strategy aims to promote social inclusion and community cohesion through establishment of social networks. Increasing social networks is seen as a necessary step in developing communities' capacity for self-help in the event of flooding. For example Vestbyen is an area at risk of flooding and inhabited by low-income residents in social housing. Social networks are built through participation of the residents in urban food growing and engagement in developing recreational green spaces including rainwater management solutions. In one street particularly affected by flooding, a local self-help group distributes sandbags in an event of a flood and helps elderly people to protect their properties.

Whilst Vejle has not carried out a mapping exercise, it has identified the most vulnerable groups as the elderly, people on low incomes, and people with mental health issues. A particularly vulnerable group identified by the city are home owners in areas located at or below the sea level, thus exposed to coastal flooding. The city's approach to identifying the most vulnerable people relies on the local social networks and individual contacts. City-funded actions include nursing home workers reaching out to elderly and disabled people in the city to find out about their circumstances and enquire whether they may need assistance.

An important aspect of the strategy is the emphasis on co-creation. It is a city's standard practice to engage citizens in workshops related to the planning of new development and investment for local areas. Further, Vejle aims to empower its citizens to plan and design their own areas. Several community councils operate in the city and they are democratically elected bodies consisting of local residents. The city encourages the community councils to propose projects for their area (the city can fund projects of value up to 400,000 DKK). Whilst the proposed projects mainly relate to infrastructure, a couple of projects related to urban adaptation have also been suggested and are currently being implemented. These include urban farming and planting of trees, as well as extending an existing green space.

Another example of encouraging various groups to participate in the decision making was the 24-hour Climathon event organized by the city and Climate KIC, in order to develop innovative responses to the problem of river and coastal flooding in Vejle. The event was open to those with a

desire to create new solutions (especially engineers, designers, business people, software developers, data people, social scientists, and legal or financial people). The attendees pitched their solution to a panel of experts, including city representatives. The idea that won developed a technical solution to solve surface flooding by replacing a standard pavement with a partly glass covered underground concrete stream: Transparent Urban Waterway. The winning team established the Climate Change Consulting DK (Climate Change Consulting, 2018). The idea of Transparent Urban waterway is currently awaiting development of a prototype and testing. The City of Vejle is identifying the area where it could be installed once the product is developed, potentially including the Rosborg area as a living laboratory.

Sources: Vejle's Resilience Strategy (2016). Personal communication from Lars Kastberg and Jette Vindum, Department of Technology and Environment, Municipality of Vejle (14th December 2017).

4.4 Paris climate adaptation plan

The city of Paris addresses social aspects of vulnerability within its climate adaptation plan mainly in connection with the hazard of high temperatures. It was developed as part of the obligations of the national heat wave plan, which is in operation every year between June and August. The Paris adaptation plan describes measures which address the vulnerability of elderly, very young, and socially marginalized people.

Like all cities in France, Paris is obliged by the national heat plan to create a register of people vulnerable to heat waves. This registration is made at the neighbourhood (*arrondissement*) level. Inhabitants can voluntarily sign up, so being included depends essentially on the initiative of individuals, although health care professionals can also propose individuals for the register. In addition, the Paris Adaptation Plan calls for increased social cohesion within neighbourhoods and the development of stronger social networks. It calls for shopkeepers[9], pharmacists, and medical practitioners to identify people who are particularly vulnerable to high temperatures due to poor health, social isolation, or homelessness, so that they can be included in the local registers.

People who are on the register are taken care of in the event of heat waves. This is done by regular phone contact, home visits and facilitating access to "cooling rooms", including transport to these places. Cooling rooms are part of the physical structures offered by local authorities for all inhabitants.

The plan also covers improvements of public spaces, including creation of green and blue spaces, nightly opening of parks and green areas during heat waves, and the use of water sprinklers and water curtains in public spaces.

[9] Shopkeepers caring for socially disadvantaged people are not unfamiliar to the Paris' practices as a bottom-up initiative providing elementary services to homeless people shows (City Lab, 2018).

Box 4.1: Paris adaptation strategy – targeting vulnerable individuals (Mairie de Paris, 2015)

PROTECTING PARISIANS AGAINST EXTREME CLIMATE EVENTS

Heatwaves

Populations, infrastructures and natural environments are very sensitive to extreme heat.

The effects of extreme heat are compounded in Paris due to the urban heat island phenomenon: the density of buildings and artificial materials that retain heat cause an increase in the temperature in the city reaching up to 5 or 6°C more than in a natural environment. These effects are also compounded by the particular vulnerability of certain populations (the elderly, isolated…) and infrastructures (the sensitivity of rails to heat, potentially leading to disruptions in public transport systems, the vulnerability of the electric networks under the pavement where temperatures can reach 70°C, etc.).

With climate change, the summers are hotter in Paris, and heatwaves more frequent. The summer of 2003 could very well become a «normal» summer in 2050, with extreme situations further increasing compared to what has been experienced up until now.

In light of this change, the challenge is to both sustainably cool Paris down, while also protecting the populations that are most vulnerable in the event of extreme heat.

Every year, from 1st June to 31 August, the Heatwave Plan is in effect in France:

- Level 1 consists of ensuring weather, atmosphere and health monitoring, used to estimate whether or not a heatwave risk is present.For Paris, the weather alert threshold is defined as soon as the weather forecast predicts an average temperature of 21°C for 3 consecutive nights, and 31°C on average for 3 consecutive days.
- Once this threshold is surpassed (level 2), prevention messages (stay hydrated, cool off, close shutters or curtains during the day…) are disseminated through the media (television and radio messages, newspaper articles) and in public places.
- Furthermore, the Prefect of each département, in conjunction with the Regional Health Agency, can declare level 3, "the heatwave warning". Paris City Hall then implements a specific organisation with available personnel and means: making cool rooms available for vulnerable individuals, contacting individuals who voluntarily registered with the CHALEX directory, making home visits and bringing individuals to the cool rooms as needed, deploying police patrols and emergency workers to find individuals who are isolated in the street…
- Finally, level 4 maximum mobilisation is for an exceptional recognised heatwave that is extremely intense and persistent. The State then activates the Inter-ministerial Crisis Unit, which brings together all the relevant ministries and decides to implement any measures necessary.

Adaptation Strategy 15

4.5 Local initiatives in the United Kingdom

The recent United Kingdom Climate Change Risk Assessment (Committee on Climate Change, 2017) has a chapter dedicated to the assessment of distributional and health effects in urban areas both of climate impacts and of adaptation actions reflecting the findings by JRF(Climate Just, 2014c), Houston et al. (2011), and Lindley et. al. (2011) indicating that more deprived populations more frequently live in places exposed to one or more climate impacts than the average population, that poorer households will bear a disproportionate burden from future macroeconomic impacts (e.g. rise of food and energy prices), and that future health impacts will be exacerbated, further to raising temperatures, by the increasing share of old and very old inhabitants (Street et al., 2016).

Liverpool. In 2013, the Liverpool city council was invited by the Department for Environment, Food and Rural Affairs (DEFRA) to participate in the national pathfinder project for increasing community flood resilience. The project built on previous activities for increasing resilience to flooding in one of the city's most deprived neighbourhoods. To address the difficulties of understanding among residents with non-English speaking backgrounds, information about individual options for flood risk preparation was distributed in several languages. Economic disadvantages were tackled by providing information about flood insurance for their premises. Additional resources were raised for flood proofing a number of individual households with decisions on which premises to improve taken at community level. A flood action group was set up and the local authority in collaboration with national and local agencies provided the community with both infrastructure (monitoring and communicating of flood levels and blockages in surface water drains) and knowledge for the management of flood risk (supporting community action). The process of knowledge transfer was bi-

directional; proposals were put forward by community representatives for interventions to increase the local community's capacity to manage flooding, these were implemented by the local authority, and the residents' association were supported in accessing further funding for flood risk management. These measures, alongside some targeted initiatives with school children, increased the awareness about climate change risk and about the possibilities existing within the community to prevent damages and to recover after a hazardous event. The inhabitants consider that the increased awareness, preparedness, and adaptive capacity was more important than the application of physical measures for flood proofing of buildings and the surroundings (Brooks et al., 2015).

The **Wigan** council (United Kingdom) used the mapping of flood disadvantage accessible via the Climate Just tool (Climate Just, 2014c) to inform actions for improving service provision for vulnerable communities and to increase their resilience. The spatial data was used to provide an initial overview of the geographic distribution of social aspects of vulnerability and the location of local emergency and community services in relation to climate hazards. The tool and the information on social disadvantage, generated in a top-down and quantitative manner, have been used as a catalyst for a debate among different service providers on their different agendas. It has served as "food for thought" on how to refine the underlying indicator framework and to integrate the mapped indicators with detailed knowledge provided by the service providers (Brooks et al., 2015).

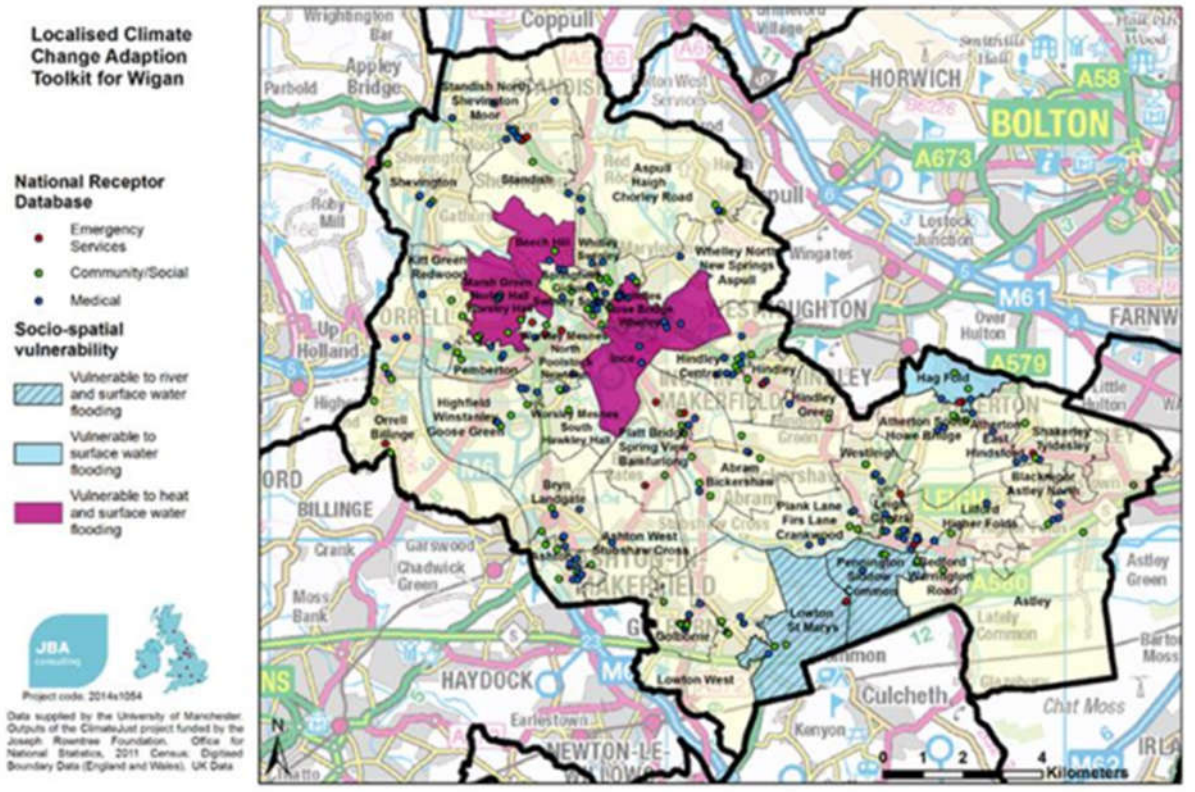

Figure 4.6: Socio-spatial vulnerability to flood and heat risks and critical community infrastructure (Source: Climate Just Case studies (Climate Just, 2014a))

London has been identified in several studies as one of the areas in the United Kingdom where the socio-economic deprivation and climate-related hazards tend to coincide, resulting in pronounced 'climate disadvantage' (Lindley et al., 2011; Street et al., 2016). In the London Borough of Hammersmith and Fulham the Climate-Proofing Social Housing Landscapes project (funded by the EU LIFE + programme) developed a holistic package of climate change adaptation solutions in three social housing estates. The project implemented green and blue infrastructures in the three estates

to improve drainage capacities and reduce soil sealing. The measures consisted of light-engineering solutions, including small basins, rain gardens, and green roofs. These measures provided multiple benefits: they improved of the overall quality of these urban areas, addressed climate threats such as flood risk, water scarcity and overheating, and contributed to local environmental quality such as biodiversity, air quality and water quality. The physical transformations were accompanied by socio-economic improvements, such as soft landscaping elements. The implementation was integrated with accredited apprenticeship and employment programmes for local people as part of Groundwork London's Green Teams therefore creating local jobs. It involved many people who had been out of work for long periods of time. Hard landscaping elements were delivered by externally appointed contractors. Residents were key stakeholders in the project, closely engaged throughout in order to secure their support for the interventions and giving them the opportunity to design the open space improvements on their estates. This was done through meetings with Tenant and Resident Associations, as well as engagement with the wider resident population through events, door knocking and activities such as gardening groups. This engagement helped to promote greater awareness of the implications of climate change for London, and the actions that residents can take themselves to contribute to adaptation and resilience.

Social vulnerability was an indirect criterion for the design of the intervention, as social housing residents are typically more vulnerable to the impacts of climate change, often living in urban environments that are subject to an increased risk of surface water flooding and the urban heat island effect. The project also addressed socio economic disadvantage by improving the quality of the residential environment and creating ownership with respect to the outside spaces in a multi-storey estate and provided employment (Climate-ADAPT, 2016a).

In 2014, **Newcastle** applied the JRF Climate Just framework to map social vulnerability and its coincidence with pluvial flooding in the city. The set of maps produced provided evidence of communities that were vulnerable to flooding and heat across the city. The study revealed that climate disadvantage in Newcastle is driven by social vulnerability (due to enhanced exposure relating to the local built and natural environment, population sensitivity, and adaptive capacity) rather than by the hazard of surface water flooding. A key learning outcome from this project was that adaptation responses must be designed to acknowledge that residents can experience profoundly different impacts from weather events and climate change as a result of their socio-economic situation. In practical terms city planners envisage that prioritisation of flood risk management will now take account of (Climate-ADAPT, 2017a; Climate Just, 2014c) both environmental hazard and social vulnerability. In addition, linkages between socio economic activities and future climate impacts will receive greater consideration by city services than previously, and that tailored community resilience approaches will be defined based on a greater understanding of risk, enhanced exposure, sensitivity and adaptive capacity.

4.6 Scottish Borders: building community Resilience on community livelihoods

The project focused on three small towns (Hawick, Peebles and Newcastleton) and explored the impacts of different forms of social disadvantage on the building of community and household-level resilience in order to identify policy implications for improving resilience in the communities. This community resilience project was part of a larger suite of climate resilience projects in the Scottish Borders focussed on partnership working between public agencies, including emergency services, and the Scottish Border Council, aimed at improved coordination for disaster response (Fazey et al., 2017, p. 12). A university researcher was seconded into the council for the duration of the project that was funded by the Joseph Rowntree Foundation (JRF) and this altered the dynamics of the interactions between the residents, researchers and council.

The concept of vulnerability in this project included both the impacts from present-day climate variability (extreme weather events), and the long term impacts of climate change as well as the capacities of members of the communities to sustain their livelihoods under changing climate conditions. The identification of disadvantaged groups and of specific drivers of social vulnerability were analysed in relation to the need for increased maintenance of houses under more frequent extreme events, interruption of essential services and psychological impacts and their interaction with disadvantaged socio-economic situations.. Although the identification of potentially vulnerable groups was determined mainly by their social and economic resources spatial aspects for determining vulnerability were also considered; for instance, in Scotland social housing is frequently located in flood plains due to lower land values (Fazey et al., 2017, p. 11).

Six key groups were identified as disadvantaged through a number of interactive workshops with the communities (see Box 4.2). Increasing numbers of extreme events in the long term will increase the economic burden for these groups. It was also recognised that stress can exacerbate physical or mental health issues and contribute further to a reduction of the physical and economic resources needed for building resilience.

The results of the project highlight the importance of integrated long term and holistic approaches that capture all possible opportunities to increase household and community resilience. The study addresses three main goals in relation to the three communities involved in the study:

- Identify types of community members which are disadvantaged with respect to climate change and the processes contributing to these disadvantages
- Describe the interactions that produce vulnerability to short and long term impacts and the implication for understanding of community resilience
- Describe potential activities at national level for better supporting community resilience to address issues of climate disadvantage (Fazey et al., 2017, p. 17).

The range of social disadvantages identified through this approach is mostly the same as those identified in other studies (see Box 4.2). Also the approach of viewing the long and short term impacts through the livelihood lens provides a different perspective which may help to bring in solutions that cross policy boundaries.

Box 4.2: Key groups identified as disadvantaged community members

- **Elderly and people with existing health issues**: Limited physical and mental wellbeing interact with visible, immediate impacts from extreme weather and indirect impact from climate change that influence access to and need for essential aspects of life, such as food, energy and water.
- **Families with young children**: Access to essential goods an services can hinder the ability of some families to continue daily life, e.g. access childcare and school. Increases n the cost and availability of food and energy can be particularly challenging for families with young children with specific nutritional needs.
- **People on low incomes**: The consequences on daily life from extreme weather may be more severe and longer lasting if financial resources are limited. In addition less visible climate related challenges may also add further pressure to household budgets and reduce the capacity to adequately meet basic needs, for example to access food, energy and maintain a home.
- **Local businesses**: The ability of local businesses to trade in the short and longer term support local livelihoods and continue to provide important goods, services and facilities within communities is influenced by the consequences of extreme weather and less direct impacts from climate change, for example relating to energy systems.
- **Tenants**: Tenant's lack of power / rights and often resources to take action to improve household level resilience to climate change. The level for action to improve household resilience is also influenced by the behaviour of landlords. Moving locations also reduces their knowledge and likelihood of contributing to wider community resilience activities.
- **Essential Infrastructure users**: Infrastructure is essential for people's daily lives to access goods, services and maintain livelihoods. The greater the damage, the longer the disruption and the more widespread the consequences the worse the consequences may be felt across the community.

(Source: Fazey et al., 2017, p. 23)

4.7 Regeneration of Augustenborg neighbourhood in Malmö, Sweden

The neighbourhood of Augustenborg in Malmö, southern Sweden, demonstrates that investments into flood-risk reduction can generate multiple co-benefits in urban areas. A major renovation programme in the area in 1998-2002 targeted the primary problem of frequent flooding due to overflow of the urban drainage system, and also delivered multiple social and economic benefits to the area and its residents.

The neighbourhood of Augustenborg contains a high proportion of social housing that was built in the 1950s. The area had experienced social and economic decline in the 1980s and 1990s resulting in high levels of unemployment, high turnover of tenants and a high percentage of immigrant population. The neighbourhood was suffering from annual flooding events as the old drainage system was unable to cope with pressures of increasing municipal wastewater and storm water runoff. Adaptation to climate change was not an explicit driver at the time of project planning and implementation in the late 1990s, however the project aimed to address the issue of urban flooding in combination with other environmental objectives such as reducing CO_2 emissions and improving waste management.

The broad aim of the Ekostaden Augustenborg project was to create a more socially, economically and environmentally sustainable neighbourhood. One of the key drivers of the project was active leadership of local partners, including the local city district (Fosie), the municipal housing company MKB, and technical departments of Malmö City. Local residents, community organisations and NGOs also played an integral role in the design and implementation of the regeneration project. Nearly 400 people participated in the first public meeting on the project (Climate-ADAPT, 2014c), and overall approximately 20% of the area's residents were involved in dialogue meetings during the project. (World Habitat, 2017).

The design of the Sustainable Urban Drainage System (SUDS) featured green roofs and a range of landscape features including a network of open channels, ditches, wetlands and retention ponds. The design baseline for the open storm water system was a 15-year rainfall event. However, the SUDS has proven resilient in much more severe conditions including floods caused by heavy rain in July 2007 (50-year rainfall event) and August 2014 (100-year rainfall event). The improved storm water management system in the area resulted in significant environmental and economic benefits as the problems with flooding were eliminated.

In addition, notable positive social changes were observed in the area. These include a 50% decrease in tenant turnover as well as an increase in voter turnout at elections from 54% to 79% between 1998 and 2002. Between 1997 and 2007, the share of residents with higher education increased from 15% to 28% and unemployment fell to 6%, which is in line with the average unemployment rate in Malmö.

The Ekostaden Augustenborg has provided an inspiration both locally and internationally for those looking to create sustainable urban development. Based on the positive experiences with participation of local residents in Augustenborg, the independent Commission for a Socially Sustainable Malmö included in its recommendations in 2013 work with the Building Regeneration Dialogue (Bygga om dialogen). According to the leader of the Augustenborg Eco-City project, this is a direct result of the desire to encourage more holistic regeneration programmes in the city in which physical investment and environmental measures can be used to support increased social inclusion, and employment opportunities.

While the area has proven resilient to flooding to date, the long term sustainability of its social benefits is less guaranteed. To ensure continued engagement of local residents and other actors, it is important to continually work with new residents to support their integration and respond to their changing needs for their living environment (Elkhazzar and Nilsson, 2016).

Source: personal communication with Trevor Graham (project leader of Augustenborg Eco-City)

4.8 Co-designed adaptation solutions preserve local resources at Timmendorfer Strand

Large parts of Timmendorfer Strand (Germany), located on the Baltic Sea, are threatened by storm surges because it lies no more than 3 m above sea level. Studies based on projections of sea level rise (40-60 cm in 100 years) showed that the previous flood defence in form of a beach ridge was insufficient to ensure the safety of the population and protect its economic assets. The local population was sceptical about coastal flood defences because the last catastrophic storm surge happened 130 years ago. Further, Timmendorfer Strand relies on tourism, with its main attraction being the local broad, scenic beaches. Thus, it was clear that local community buy-in was needed to plan and implement an appropriate solution and to achieve this the authorities used a participatory approach.

An innovative process, spanning 13 years (1999 to 2011) was used to ensure community participation. Firstly, a socio-economic assessment revealed the potential damage to people and assets in a flood event and highlighted the need for improved coastal flood defence. In a second step, stakeholder workshops were held to discuss possible coastal defence measures under different sea level rise scenarios. The outcome of these workshops formed the basis of the third step - an ideas competition to select the measure. The measure that was chosen was a sheet pile wall integrated in the natural beach ridge but it was a compromise in that it was lower than the one initially proposed and had sections of glass walls. . The solution chosen ensures that tourists and citizens can still enjoy the sea views whilst walking behind the wall and the glass sections allow a view from nearby cafes. A more traditional form of coastal protection would have obstructed the scenic views and threatened the essential pull factor of this seaside resort (Climate-ADAPT, 2016b; Hofstede, 2008).

5 Insights from Expert Workshop

An expert workshop was organised to discuss the topic of assessing social vulnerability to climate change and socially just adaptation responses and to review the first draft of the present paper. The group of experts shared their experiences and the approaches that they have used to date in Europe. Participants represented local authorities, research organisations, intermediary organisations and international organisations who have experience with assessment of social vulnerability to climate change in European cities (See Annex 1 for participants and agenda). The challenges and enablers for encouraging greater consideration of the social drivers of vulnerability and equity in adaptation planning were discussed in an interactive session during the workshop. Participants also discussed the context of the issues and whether they were internal to the city or influenced by wider issues from outside the city, such as national policy and budget setting.

5.1 Enabling factors and challenges within the city

The workshop highlighted that cities generally have control of factors within the city, such as links to communities and local leadership, but if they have limited resources (capacity, funds and knowledge) they cannot use these key enabling factors.

It is often the case that what was discussed as the 'enabling factors' are the flip-side of the 'challenges' such as:

- Leadership through a champion drives the process forward. But a lack of leadership means there is no champion and potentially little progress on addressing groups that are vulnerable to climate change.
- The availability of knowledge, data and expertise supports the development of responses tailored to vulnerable groups. Whereas a lack of expertise and data means that the development of tailored responses is less likely to happen.

When the institutional and governance systems are in place this provides a significant boost for developing socially just adaptation solutions. By institutional and governance systems we mean local policy and voluntary requirements, existing processes and places that have community participation already embedded and a willingness to engage flexibly to address conflicts and synergies.

Community links and local knowledge

In most cities there is limited expertise and knowledge in the social aspects of climate change, assessment of social vulnerability, prediction of impacts on vulnerable groups, methods of selection of appropriate adaptation responses and lack of knowledge about how to deal with long-term issues. There are also limited data due to the inability to identify and target vulnerable individuals, e.g. the homeless or, capture changes in vulnerability over time. In many cases there are no fora (places or processes) for engaging with communities. These conditions make the integration of specific local communities needs into adaptation planning more difficult.

City governments have a closeness to their communities and existing fora (methods and locations), that enables them to engage in co-creation, they can understand the communities needs and they recognise the value of their local knowledge including experience of past disasters and impacts. Where this knowledge is linked with local fine-resolution data that is available for communities or even, vulnerable individuals it can support the development of responses that are tailored to the local context and vulnerable groups.

Two level Leadership (local government and community)

Where there is no leadership and no champion within the local government it is a challenge to get these initiatives off the ground. When the communities are disengaged and disempowered they lack a voice and agency.

In direct contrast, a key enabling factor is the availability of strong leaders in municipalities to champion the issue, such as the Mayor of London. When this is linked with an active community or voluntary organisations e.g. rescue services that could be engaged on the issue and have a strong voice, progress can be made.

Local Regulations and institutions

Where there is no requirement (regulations) for vulnerability assessments, lack of resources (capacity and funds) to collect data and undertake assessments and a lack of ambition and legal powers within local governments, the likelihood of initiatives that take social vulnerabilities into account is thin. In addition, Departments within the local government tend to work in silos, have conflicting interests (e.g. environmental, social and economic goals) and a lack of appetite to engage with other agendas, such as sustainability, or energy poverty. There may also be organisational resistance and lack of funds to re-organise the structures and these challenges mean that social vulnerability to climate change will be low on the list of priorities.

Cities tend to have a mandate for social care, health and wellbeing and can link to other agendas and between different departments that could support adaptation responses by potentially gaining new knowledge, sharing resources and co-benefits. Cities can also use existing participatory tools, for example within the planning system, to engage communities in developing adaptation responses, as well as, powers to control land use planning within an area that is at a suitable scale for adaptation.

5.2 Enabling factors and challenges from outside the city

The workshop also highlighted that there are many areas outside of the city where cities do not have control. There is also a recognition that cities cannot address adaptation in isolation from the wider hinterland (e.g. catchment) and country context (national institutions, regulations and governance). One of the governance links between cities and the national level is through politicians that by representing the needs of vulnerable people it gives them a voice and voting power. In addition, the increasing frequency or, magnitude of recent natural hazards may bring climate risks within the short political timeframes and drive a stronger signal for urgency in dealing with these issues.

The provision of policy frameworks (either national or international) along with resources (funding sources and staff) and capacity (knowledge of topics, skills to engage at all levels) would help to support city level development of socially just adaptation responses. Finally, the generation and access to data, research (e.g. future socio-economic trends), along with facilitating the sharing of best practice and peer to peer learning e.g. via networks, within and between countries, would allow cities the best chance of developing climate adaptation strategies and plans that support vulnerable groups.

Policy and politics – Where there is a lack of national leadership on the issue of social justice in adaptation e.g. unsupportive National Adaptation Strategies or other national frameworks this is limiting cities' ambitions. Another challenge for cities is that the budget streams are often predefined and tend to be top-down from the national level providing cities with little flexibility to decide where they spend it. Budgets are also often determined based on macro-economic indicators which can mean budget cuts in areas such as, climate change, sustainability, social housing and

social services departments if it is not seen a political priority. The reliance on economic cost-benefit framings for allocating actions and policy can also be a block to focusing on those most in need or, vulnerable groups.

Cities consider that the existence of policy frameworks national and international levels (ISO 14080, EU Adaptation Strategy, EU Urban agenda, Sustainable Development Goals) that address the social agenda would enable cities to link their vision and plans to a wider agenda. The presence of funding at the national, EU (Life, ESIF, Interreg for knowledge exchange) or international level would help the plans to become a reality.

By ensuring that the vulnerable groups have voting power gives politicians the opportunity to show that they care about the future of the vulnerable groups. The priorities for developing urban policies are often driven by economic growth and the private sector and there is the culture of short-termism linked to electoral cycles. The topic of social justice is also not high on political agenda because it is considered left wing. One of the ways that this challenge of it being a low priority politically can be overcome, is the increasing frequency/magnitude of disasters may bring climate risks to the fore, potentially within political timescales (e.g. after Hurricane Sandy there was more urgency and less resistance to implement measures to reduce climate risks and communities were more engaged than before the hurricane). The current EU political climate (including Brexit) is diverting attention away from climate change and there is also a decrease of international commitment, e.g. USA withdrawal from Paris agreement, which creates the impression that there is no perceived need for urgent responses. The priorities of organisations addressing poverty and 'social justice' are also focussing on immediate issues (such as the economic downturn) rather than long-term planning.

Knowledge – A challenge in terms of access to knowledge is the lack of established, shared practice within this field such as, lack of knowledge on the effect of responses, consistency in terminology and different interpretations of 'fairness'. There is uncertainty with regard to future socio-economic trends and limited resources, knowledge and assessment methods to assess these trends.

A significant enabling factor is the presence of research institutes nationally that focus on social issues along with portals (Climate Just) that provide 'how to' information. The availability of national and international data to supplement local-scale data supports decision-making. These factors, combined with city networks that facilitate knowledge and practice exchange among cities, peer-to-peer learning and reporting requirements enables cities to access and use all the relevant knowledge that is available.

6 Conclusions

6.1 Why is assessment of social vulnerability and design of just adaptation policies important?

In recent years, European cities have seen increasing rates of poverty and exclusion among the urban population and have had to face the consequences of demographic change and migration. In the context of climate change, these trends pose specific challenges to urban adaptation policies, as they create groups with high susceptibility to climate change impacts, which in many cases live in specific parts of the city that are often characterized by low environmental qualities. Climate change can worsen poverty and disadvantage, and conversely poverty increases vulnerability to climate impacts. Awareness has grown in recent years about the fact that increasing inequalities in urban areas will lead to unequal distributions of damage and harm from climate impacts among different social groups. This increasing awareness ideally needs to expand beyond just the small group of cities that are more advanced so that all cities have the capacity to identify the vulnerable groups, locate them to address their needs, and know how to involve them in the planning process. Finally cities need to plan to monitor the socially just adaptation actions that they implement to ensure that the actions and policies do not worsen or create new inequalities or unintended effects.

Thus, planning of urban adaptation policies and interventions needs to integrate the points of view of vulnerable groups by allowing them to influence decision making and take part in adaptation planning. This would ensure procedural justice, and will highlight who will gain or lose as a result of these decisions and plans (distributional justice).

6.2 What knowledge is available?

Knowledge and practice for developing socially just adaptation in response to climate-related impacts is still in its infancy. While research and insight of biophysical factors from climate hazards (high temperatures and flooding) on people and assets is quite well developed, there is less experience and knowledge about the social factors (network, age, and resources) that drive individual or communities' vulnerability to climate change. There has been a gradual integration between disaster risk expertise and climate change impacts expertise that has brought greater awareness and knowledge of social drivers into the assessment process and the need for participation of vulnerable groups in choosing the adaptation option. This is because social drivers are a crucial element in the humanitarian component of disaster risk management activities. Knowledge has also increased due to the growing awareness and experience of some local authorities and parts of the research community dealing with local policy making.

There are different framings of vulnerability and its social aspects and this can create confusion when concepts are being translated into assessments. Different understandings of vulnerability lead to different frameworks for assessment and identification of vulnerable people and communities. A variety of different approaches such as top-down, e.g. data driven analysis, or bottom-up, e.g. participative investigations of local specific contexts, can be used for assessment.

There are also different understandings of how the concept of social justice should be translated into criteria for the selection of adaptation options. Different understandings of the term may lead to different policies and outcomes that still can be considered 'just' but from different perspectives.

To date, top-down approaches creating socio-spatial maps have been used to prioritise areas of cities for further detailed assessment , while bottom-up assessments based on the participation of vulnerable groups are critical to building community resilience to the impacts of climate change, e.g. creating self-help flood groups. The relationship between top-down analysis and bottom-up assessments can be seen as complimentary, where large scale (national, regional, or city-wide) spatial mapping of vulnerability indices can lead to the identification of potentially vulnerable areas and where participation of vulnerable groups can lead to the prioritizing and selection of adaptation interventions.

A range of urban adaptation guidance documents are available to support cities in taking them through the key steps for addressing social vulnerability (*identifying* vulnerable groups, *locating* them within the urban area in order to be able to plan for their needs, and *involving* them in the adaptation planning process). However, these documents only cover some of these aspects and are in most cases lacking specific methods for the identification of vulnerable groups and for their involvement in adaptation decision-making. They also do not provide suggestions for indicators for monitoring the social outcomes of adaptation actions over time.

Detailed support for policy makers and local authorities in the development of assessments of local vulnerability and the design of socially just adaptation policies should be integrated into existing guidance tools for urban climate change adaptation. In addition, sharing knowledge and experiences between cities that wish to address social vulnerability in the future should be facilitated through knowledge exchange platforms like those represented by the Covenant of Mayors.

6.3 How are cities addressing social vulnerability and just adaptation?

The report has presented some experiences from local authorities that have identified groups that are socially vulnerable to climate change and are beginning to plan and implement socially just adaptation actions. These cases cover various climate impacts such as heat waves, river flooding and coastal flooding. The assessment strategies observed in these examples include both data driven top-down approaches used for the identification of vulnerable groups, and bottom-up participatory approaches which aim at identifying specific needs and enhancing community resilience. Community resilience has been increased through involvement in the selection of adaptation options, e.g. cooling and shading of buildings and green space, behaviour of residents during heatwaves, and sections of glass sea walls to ensure a view.

Top down assessments were based on predefined sets of indicators and have been used for prioritization of interventions. They furthermore depend on the availability of detailed socio-economic data, and access to datasets owned by different authorities can be difficult to gather and may require integration. Cities require staff with technical capacities for translating the results from these analyses into policy interventions. As these analyses are based on quantitative data, it is also possible to use them for projections for socio-economic scenarios for assessing future vulnerabilities under changing climate conditions.

However, they cannot detect “unmappable” groups such as the homeless, that are not recorded in administrative systems and this is where local knowledge from bottom-up assessment is needed to supplement top-down socio-spatial mapping approaches. Local knowledge is also needed as vulnerabilities change over time, e.g. pregnancy. Bottom-up assessments also offered opportunities for involving local communities in the selection and design of adaptation options.

Housing markets and housing policies are important drivers of spatial clustering of social vulnerabilities urban areas, with low cost housing areas being often concentrated in those parts of the cities that are most exposed to climate impacts. Therefore careful design of adaptation policies in order to avoid gentrification and appropriate management of the public housing stock can be an important process for addressing social vulnerability in urban areas.

6.4 Recommendations from the Expert Workshop

During the Expert Workshop a number of experts shared their experiences and the approaches that they have used to date in Europe. The challenges and enabling factors were discussed and recommendations for action were identified by the participants:

City level

– Local government

- There is a need to build the capacity of staff in municipalities to understand these issues and take forward (champion) initiatives.
- Social vulnerability is a multi-dimensional issue that needs quantitative data and qualitative information from many different departments within local governments to come together and local municipalities need to facilitate this sharing.
- Local governments should aim to involve citizens, including vulnerable groups (which should be seen as a source of local knowledge and part of the solution rather than a problem), more extensively into the strategies and vision-making of the city. This would enable the identification of strong/weak points within strategies, provide ideas about how best to communicate with citizens, and to potentially address both environmental and social issues. Local municipalities should aim to have two-way integration - integrating adaptation into public health and social care provision and neighbourhood development AND integrating social justice into existing legislative processes and climate change, environment, and development activities.
- Local governments could consider innovative funding mechanisms for socially just adaptation actions such as through local taxes and crowd funding.

Communities

- Aim to galvanise third sector and community organisations to mobilise the communities to take ownership of the problem and lobby the city municipality for socially just adaptation. Using the social networks of community groups is also a way to get access to vulnerable people.

National and EU

- There is a need for funding mechanisms at the national and/or EU level (e.g. Life, ESIF, and Interreg) with specifications that include assessment, planning, and implementation of socially just adaptation in cities.
- National and local governments need help to write bids that can access the funds available.
- National adaptation strategies need to include social justice issues.

International

- There is a need for international and national policy frameworks to support city level development of socially just adaptation responses by including socially just adaptation principles within strategies and standards, e.g. ISO 14080, EU Adaptation Strategy, EU Urban Agenda, and

the Sustainable Development Goals. This would allow cities to link their vision and plans to a wider agenda.

- To facilitate the sharing of best practice and peer to peer learning, within and between countries and cities, existing networks (e.g. Covenant of Mayors/UCCRN) need to raise awareness of socially just adaptation and encourage interaction. This would allow cities the best chance of developing climate adaptation strategies and plans that support vulnerable groups.

Research

- Research is needed on future socio-economic scenarios and projections that go beyond population demographics.

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Annex 1: The expert workshop

Expert workshop on assessing social vulnerability to climate change and socially just adaptation actions in European cities. Copenhagen, 12 September 2017

The workshop was organized as part of the joint EEA and ETC CCA (European Topic Centre for Climate Change Impacts, Vulnerability and Adaptation) activities on climate vulnerability, impacts and adaptation in urban areas. The aim was to gather experts' input on experiences and approaches to assessment of social vulnerability to climate change in European cities to date; to explore the barriers and opportunities for planning and implementing socially just urban adaptation actions; and to highlight the gaps and needs in knowledge, policy and practice related to assessing social vulnerability to climate change and realising socially just adaptation actions.

Participants

Aleksandra Kazmierczak	EEA
Andre Jol	EEA
Andrej Steiner	Carpathian Development Institute
Cassie Sutherland	Greater London Authority
Catherine Ganzleben	EEA
Clare Downing	ETC/CCA (UKCIP)
Diana Reckien	University of Twente
Ib Jespersgaard	City of Vejle (VIFIN)
Jo Barnes	University of the West of England
Katharine Knox	Independent consultant, formerly JRF
Kirsi Mäkinen	ETC/CCA (SYKE)
Linda Romanovska	ETC/CCA (Fresh Thoughts)
Margaretha Breil	ETC/CCA (CMCC)
Martin Adams	EEA
Richard German	Aether
Ruth Wolstenholme	Sniffer
Sandro Nieto-Silleras	DG Climate Action
Susanna Kankaanpää	Helsinki Region Environmental Services Authority HSY

Agenda

09.00	Welcome and opening (Andre Jol, EEA)
	Introduction to the workshop (Aleksandra Kazmierczak, EEA)
09.15	Round of introductions
09:30	Climate Change, Social Justice & Community resilience: a stocktake of the Joseph Rowntree Foundation programmes 2009-17 (Katharine Knox, independent consultant)
	Presentation and discussion
10.00	Workshop session 1: Setting the scene
	Plenary discussion
11.00	Coffee
11.15	Social factors as the organic component of the local climate vulnerability assessment – practical examples from the Slovak Republic (Andrej Steiner, Carpathian Development Institute)
	Presentation and discussion
11.40	Workshop session 2: Assessment of social vulnerability to climate change
	Breakout groups discussion

13:00 Lunch

14:00 Workshop session 3: Planning and implementing socially just adaptation actions Breakout groups discussion

15.15 Coffee

15.30 Summary

16.00 Close

Annex 2: List of urban adaptation guidance documents reviewed

Key:

(A) Advised; (R) Required (mandatory)
(++) specific groups listed/comprehensive (+) generic recommendation (-) no indication
(0) none, (Sp) Spatial analysis (St) statistical analysis (QTD) Qualitative Top-down (QBU) Qualitative Bottom-up (CTD) Quantitative (census) top-down (CBU) Quantitative (Census) bottom-up

			Social vulnerability analysis				Socially-just adaptation				
Name	Year	Geographical scope	SVA required /advised	Specific groups to cover in SVA	Methods suggested for identification of vulnerable groups	Vulnerability /impact Indi	Inclusion of social aspects in selection of adaptation options?	Involvement of vulnerable groups in adaptation planning?	Methods suggested for involvement of vulnerable groups	Actions addressing social issues	Indicators for monitoring social outcomes of adaptation actions
Urban Adaptation Support Tool	2016	Europe	A	++	SP	-	++	+	0	0	0
Climate Just	2014	National UK	A	++	SP / CTD	++	++	+	++	++	0
Sustainable Energy and Climate Action Plan Template AND The Covenant of Mayors for Climate and Energy Reporting Guidelines	2016	Global	R	-	-	++	0	+	0	0	
Planning for Adaptation to Climate Change - Guidelines for Municipalities	NA	Europe	A	++	QBU	++	+	+	+	0	++

			Social vulnerability analysis				Socially-just adaptation				
Name	Year	Geographical scope	SVA required /advised	Specific groups to cover in SVA	Methods suggested for identification of vulnerable groups	Vulnerability /impact Indi	Inclusion of social aspects in selection of adaptation options?	Involvement of vulnerable groups in adaptation planning?	Methods suggested for involvement of vulnerable groups	Actions addressing social issues	Indicators for monitoring social outcomes of adaptation actions
Five steps to managing your climate risks: A Guide for Public Bodies in Scotland	2013	National Scotland	A	++	QBU	+	+	0	0	0	++
Disaster Resilience Scorecard for Cities	2017	Global	A	-	CBU / QBU	++	+	++	++	++	0
Changing Climate, Changing Communities: Guide and Workbook for Municipal Climate-ADAPTation	NA	Global	A	-	-	-	+		++	0	0
Climate Change Emergencies and European Municipalities: Guidelines for Adaptation and Response	NA	Europe	R	-	-	-	0	0	+	0	0
The Integrated Management for Local Climate Change Response: Capacity Development Package	2012	Global	R	++	-	+	+	++	0	0	0
Climate change adaptation by design - a guide for sustainable communities	2007	National UK	A	++	-	-	+	0	0	0	0
LCLIP: Local Climate Impacts Profile (For assessing current climate vulnerability)	2015	National UK	A	++	-	-	0	0	0	0	0

			Social vulnerability analysis				Socially-just adaptation				
Name	Year	Geographical scope	SVA required /advised	Specific groups to cover in SVA	Methods suggested for identification of vulnerable groups	Vulnerability /impact Indi	Inclusion of social aspects in selection of adaptation options?	Involvement of vulnerable groups in adaptation planning?	Methods suggested for involvement of vulnerable groups	Actions addressing social issues	Indicators for monitoring social outcomes of adaptation actions
Guidebook urban climate / Handbuch Stadtklima Maßnahmen und Handlungskonzepte für Städte und Ballungsräume zur Anpassung an den Klimawandel (in German)	2010	Regional NRW (D)	R	-	SP	+	0	0	0	0	0
Climate-Friendly Cities: A Handbook on the Tracks and Possibilities of European Cities in Relation to Climate Change	2011	Europe	R	++	SP / QBU	++	++	0	++	++	++
Guide to Climate Change Adaptation in Cities	2011	Global	R	++	SP / CTD / CBU	++	+	+	++	++	0
How To Make Cities More Resilient: A Handbook For Local Government Leaders	2012	Global		++	SP QBU	+	++	++	++	++	++
IEA Training Manual Volume Climate Change Vulnerability and Impacts in Cities	2011	Global	R	++	-	++	+	+	0	0	++
Adapting to Urban Heat: A Tool Kit for Local Governments	2012	National USA	R	++	SP / QBU	-	++	0	0	++	0

			Social vulnerability analysis				Socially-just adaptation				
Name	Year	Geographical scope	SVA required /advised	Specific groups to cover in SVA	Methods suggested for identification of vulnerable groups	Vulnerability /impact Indi	Inclusion of social aspects in selection of adaptation options?	Involvement of vulnerable groups in adaptation planning?	Methods suggested for involvement of vulnerable groups	Actions addressing social issues	Indicators for monitoring social outcomes of adaptation actions
Participatory Climate Change Vulnerability and Adaptation Assessment – A toolkit based on the Sorsogon City experience	2010	Global	R	-	-	-	0	0	0	0	0
Climate change planning for regional and local authorities	2012	Europe	R	-	-	+					
NG GAIN Index Urban Adaptation Assessment	2017	Global	R	-	-	++	0	0	0	0	0
Guideline for Stress Testing the Climate Resilience of Urban Areas	2014	National NL	A	-	SP	-	+	++	++	0	0
Adaptation Compass tool and guidance	2014	Europe		++	-	-	+	0	0	0	0
Methods and Tools for Adaptation to Climate Change - A Handbook for Provinces, Regions and Cities	2014	National Austria	R	++	-	-	++	0	0	++	0
Guidelines for Resilience Systems Analysis - How to analyse risk and build a roadmap to resilience	2014	Global	A	0	-	++	++	++	+	++	0
Building Resilient Cities: FROM RISK ASSESSMENT TO REDEVELOPMENT	2013	Global	R	-	-	-	+	0	0	++	0

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