



**European Committee  
of the Regions**

**Commission for  
the Environment,  
Climate Change and Energy**

**ENVE**

# **Adapting to climate change: Challenges and opportunities for the EU local and regional authorities**



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# List of abbreviations

<b>CF</b>	Cohesion Fund
<b>CCIV</b>	Climate change impact and vulnerability
<b>CoR</b>	European Committee of the Regions
<b>EAFRD</b>	European Agricultural Fund for Rural Development
<b>EEA</b>	European Environmental Agency
<b>EIB</b>	European Investment Bank
<b>EMFF</b>	European Maritime and Fisheries Fund
<b>ERDF</b>	European Regional Development Fund
<b>ESF</b>	European Social Fund
<b>ESIF</b>	European Structural and Investment Funds
<b>GHG</b>	Greenhouse gas
<b>ICZM</b>	Integrated Coastal Zone Management
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IWRM</b>	Integrated water resources management
<b>JRC</b>	Joint Research Centre
<b>LRAs</b>	Local and regional authorities
<b>MF</b>	Multiannual Financial Framework
<b>NAS</b>	National adaptation strategy
<b>NCFF</b>	Natural Capital Financing Facility
<b>NECP</b>	National Energy and Climate Plan
<b>SECAP</b>	Sustainable Energy and Climate Action Plan
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change

# Glossary

*Concepts related to climate change<sup>1</sup>:*

## **Adaptation**

The process of adjustment to actual or expected climate and its effects. In human systems, this is important for minimising harm or exploiting beneficial opportunities. In natural systems, the process of adjustment can be facilitated by human intervention. There are two main types of adaptation:

- *Incremental adaptation* - Adaptation that maintains the essence and integrity of a system or process at a given scale.
- *Transformational adaptation* - Adaptation that changes the fundamental attributes of a socioecological system in anticipation of climate change and its impacts.

## **Climate extreme** (extreme weather or climate event)

The occurrence of a value of a weather or climate variable above/below a threshold value near the upper/lower ends of the range of observed values of the variable. Although the definition of ‘extreme’ could vary in different places, it is understood that extreme events are rare at a particular place and time of year. Examples include floods, droughts, storm events or heat waves.

## **Disaster**

Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response.

## **Hazard**

The potential occurrence of a natural or human-induced physical event 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.

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<sup>1</sup> Based on IPCC, 2018, Annex I: Glossary. *In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty;* and IPCC, 2014, Annex II: Glossary. *In: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.*



## **Impacts**

The effects of climate change on natural and human systems as a result of extreme weather and climate events (i.e. climate-related hazards) and of climate change.

## **Mitigation**

Human interventions aimed to reduce emissions or enhance the sinks of greenhouse gases and consequently reduce the severity of climate change impacts. Mitigation measures can include technologies, processes or practices that contribute to, for example, renewable energy, energy efficiency, sustainable transport and waste minimisation.

## **Resilience**

The capacity of social, economic and environmental systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation.

## **Risk**

In the context of the assessment of climate impacts, the term risk is often used to refer to the potential for adverse consequences of a climate-related hazard on lives, livelihoods, health and well-being, ecosystems and species, economic, social and cultural assets, services and infrastructure. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence.

## **Vulnerability**

The propensity or predisposition to be adversely affected by climate change impacts. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

*Concepts related to measures and responses<sup>2</sup>:*

### **Early warning systems**

The set of technical, financial and institutional capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organisations threatened by a hazard to prepare and reduce the possibility of harm or loss.

### **Ecosystem based approach**

The combination of strategies and measures for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. This approach considers the *ecosystem services*, i.e. the benefits that people obtain from ecosystems or their direct and indirect contributions to human well-being.

### **Green Infrastructure**

A strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. In urban areas, many different features may be part of green infrastructure (for example, parks, gardens, grassy verges, green walls or green roofs) as far as they are part of an interconnected network and are delivering multiple ecosystem services. These green urban elements (or '*blue infrastructure*' if aquatic ecosystems are concerned) may be found within the city and in its peri-urban area.

### **Integrated Coastal Zone Management (ICZM)**

A dynamic, multidisciplinary and iterative process to promote sustainable management of coastal zones and ultimately to balance environmental, economic, social, cultural and recreational objectives, all within the limits set by natural dynamics. It covers the full cycle of information collection, planning (in its broadest sense), decision making, management and monitoring of implementation based on informed participation and cooperation of all stakeholders.

### **Integrated Water Resources Management (IWRM)**

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<sup>2</sup> Based on IPCC, 2018; [European Environment Agency, Glossary for urban green infrastructure](#); [European Environment Agency, Water glossary](#); and [Global Water Partnership, What is IWRM?](#)

A process which promotes the coordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment.

**Nature-based solutions**

Actions that are inspired or supported by natural processes, which simultaneously provide environmental, social and economic benefits. Such solutions are designed to bring natural features and processes to cities, landscapes and seascapes and are often cost-effective approaches.



# Summary

Despite commitments by most countries under the Paris Agreement to strengthen climate action and limit global temperature rise to ‘well below 2°C’, the impacts of climate change are already being felt throughout the globe. The frequency and intensity of these impacts will only increase, and thus a sound approach to climate risk means that adapting to these impacts is as necessary as limiting emissions of greenhouse gases (GHG). The impacts of climate change are diverse, varying according to local geographical conditions, socio-economic characteristics and adaptive capacity. Local and regional authorities (LRAs) are critical to successfully responding to these impacts.

This report presents a review of key issues and challenges in adapting to the impacts of climate change for local and regional authorities in the EU. It first provides a summary, based on recent literature, of the likely physical impacts of climate change and the effects they can have on socio-economic systems within EU Member States, based on a review of recent literature. Then a review of adaptation measures available to LRAs is provided, noting the potential opportunities for synergies and risks of trade-offs between adaptation and other policy areas. The report notes here the growing recognition of the impacts of climate change on health and social systems, and particularly existing socio-economic disparities. The challenges LRAs face in addressing these multi-layered issues are today compounded by the COVID-19 pandemic; but there may also be opportunities to mitigate the social impacts of the current crisis and build our preparedness for future pandemics through measures that also support adaptation goals.

A mapping of sources of financing for adaptation action at the local and regional levels is provided, followed by an assessment of the key challenges faced by LRAs in climate change adaptation is provided, based on a review of literature and a survey of stakeholders within regional and municipal authorities. The key challenges identified can be categorised into the following four groups: Lack of political leadership and commitment to adaptation; Insufficient administrative capacity; Insufficient financial resources; and Knowledge gaps. A lack of commitment to adapting to climate change as a political priority across all levels of government was identified as the key challenge by LRAs responding to the survey.

Finally, the report concludes by providing a set of recommendations that can be pursued at the EU-level to overcome these challenges.



# Introduction

The historic Paris Agreement requires its Parties, including the EU, to strengthen the global response to climate change and keep global temperature rise ‘well below 2°C’ while pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels. Nevertheless, regardless of the ambition and commitment to mitigation efforts, the impacts of climate change are already being felt throughout the globe and adaptation to these impacts is as necessary as limiting the emissions of greenhouse gases (GHG). In the EU, the impacts of climate change are, and will continue to be, very diverse, based on local geographical conditions, socio-economic characteristics and adaptive capacity. The current experience of the COVID-19 pandemic highlights the urgent need to improve the resilience of social and economic systems to face large scale disruptions. The pandemic also illustrates the way that global crises can have vastly different impacts at the local level and the critical role of local and regional governments in responding to them<sup>3</sup>. These considerations underscore the need for strong climate adaptation policies and responses for local and regional authorities (LRAs). This study aims to shed light on the specific needs and issues EU LRAs face when adapting to climate change.

## EU Adaptation Strategy

Climate change impacts affect both natural and socio-economic systems. These impacts entail considerable economic losses and adaptation is likely to be costly, especially if postponed. For instance, 2012 estimates suggested that the economic, environmental and social costs of inaction for the EU would be around EUR 100 billion in 2020 and EUR 250 billion in 2050<sup>4</sup>. Therefore, the EU Adaptation Strategy<sup>5</sup> was adopted in 2013 to ensure the Union is well prepared and equipped to address the impacts of climate change. Its main purpose is to contribute to the climate resilience of Europe by ‘*enhancing the preparedness and capacity to respond to the impacts of climate change at local, regional, national and EU levels, developing a coherent approach and improving coordination*’. To deliver on this the Strategy defines three specific objectives aimed at promoting action by the Member States, filling knowledge gaps and improving decision-making and promoting action in vulnerable sectors. It elaborates eight concrete actions for delivering these objectives (summarised in Table 1).

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<sup>3</sup> OECD, 2020, The territorial impact of COVID-19: Managing the crisis across levels of government, OECD Policy Responses to Coronavirus (COVID-19), <http://www.oecd.org/coronavirus/policy-responses/the-territorial-impact-of-covid-19-managing-the-crisis-across-levels-of-government-d3e314e1/>

<sup>4</sup> European Commission, 2018a, Report on the implementation of the EU Strategy on adaptation to climate change, COM(2018) 738 final.

<sup>5</sup> European Commission, 2013, An EU Strategy on adaptation to climate change, COM(2013) 216 final.

In 2018, the Commission published an evaluation of the EU Adaptation Strategy<sup>6</sup>, which took stock of the progress to date (summarised for each action in Table 1) and assessed the relevance, effectiveness, efficiency, coherence and EU added value of the Strategy.

**Table 1 Actions of the EU Adaptation Strategy**

<b>Promoting action by Member States</b>
Action 1: Encourage all Member States to adopt comprehensive adaptation strategies
Action 2: Provide LIFE funding to support capacity building and step up adaptation action in Europe
Action 3: Introduce adaptation in the Covenant of Mayors framework
<b>Better informed decision-making</b>
Action 4: Bridge the knowledge gap
Action 5: Further develop Climate-ADAPT as the ‘one-stop shop’ for adaptation information in Europe
<b>Climate-proofing EU action: promoting adaptation in key vulnerable sectors</b>
Action 6: Facilitate the climate-proofing of the Common Agricultural Policy, the Cohesion Policy and the Common Fisheries Policy
Action 7: Ensuring more resilient infrastructure
Action 8: Promote insurance and other financial products for resilient investment and business decisions

Source: EU Adaptation Strategy.

Overall, the evaluation found that the EU Adaptation Strategy is delivering on its objectives and is fit-for-purpose. Nevertheless, it also identified different areas for improvement. The following findings and areas for improvement, identified during the evaluation<sup>7</sup>, are particularly relevant for LRAs:

- Member States vary in the extent to which development of regional, sub-regional and local adaptation strategies has been encouraged, and adaptation action at the local level varies substantially as it is voluntary. Moreover, national adaptation strategies were generally not effective in identifying and addressing regional and cross-border issues while regional cooperation initiatives through European Territorial Cooperation (i.e. Interreg) helped address this.
- There is potential for greater coherence between action at city level, encouraged through the Covenant of Mayors, and action to improve national-level adaptation activity. The adoption of local adaptation strategies and the integration of adaptation into national/regional and local legal frameworks (for example, urban, spatial and coastal planning, public

<sup>6</sup> European Commission, 2018b, Evaluation of the EU Strategy on adaptation to climate change, SWD(2018) 461 final.

<sup>7</sup> COM(2018) 738 final; SWD(2018) 461 final; and Smithers, R. et al. 2018, Study to support the evaluation of the EU Adaptation Strategy, Ricardo Energy & Environment et al. report for the European Commission, Directorate-General for Climate Action.



health policies) should be promoted and facilitated.

- There is still a need to consider adaptation at all levels and across policies as there is strong evidence inaction would be costly. There is a need for more consistent and comprehensive climate-proofing of EU policies, infrastructure investments, insurance and other financial products. Further progress in identifying and exploiting synergies between adaptation and other policies such as climate mitigation policies is also necessary.
- There are still knowledge gaps to complete and emerging ones to address, including on topics such as ecosystem-based adaptation, transboundary effects of climate change impacts, adapting infrastructure in different geographical areas and long-term lack of water resources.
- There is a need to share existing knowledge (for example, results from research projects), assist the uptake of available information across governance levels and sectors and start applying it in decision-making.
- There is a need for more investments in adaptation and public resources might not be sufficient, increasing the importance of leveraging private funds for adaptation.
- Adaptation policies at all levels should better reflect social vulnerability to climate change and vulnerable groups should be involved in the design of fair adaptation policies and socially just adaptation in cities.

## Way forward and the role of this study

The European Green Deal (in short ‘Green Deal’)<sup>8</sup>, introduced in December 2019 by the Commission, sets out an ambitious policy framework for sustainable development and climate action. Among the priority objectives for climate action, it announced the adoption of ‘*a new, more ambitious EU strategy on adaptation to climate change*’ to strengthen ‘*the efforts on climate-proofing, resilience building, prevention and preparedness*’, ‘*influence public and private investments*’ and ‘*ensure that across the EU, investors, insurers, businesses, cities and citizens are able to access data and to develop instruments to integrate climate change into their risk management practices*’. In addition, the Commission is expected to launch a European Climate Pact for engaging with the public on climate action and building upon existing initiatives such as the Covenant of Mayors and the European Urban Initiative. This might create new opportunities for engaging LRAs in the EU climate policy-making process.

Since the publication of the evaluation, the Commission has taken action to address some of the areas identified for improvement. For instance, the Regulation on the Governance of the Energy Union (in short ‘Governance Regulation’)<sup>9</sup> was

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<sup>8</sup> European Commission, 2019, The European Green Deal, COM(2019) 640 final.

<sup>9</sup> Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action.

adopted and it includes the requirement for Member States to report on their adaptation strategies and actions as part of their National Energy and Climate Plans (NECPs). This is expected to improve the monitoring of adaptation policy implementation and stimulate the adoption of more actions at the national and sub-national levels. In addition, the same Regulation requires Member States to hold ‘multi-level climate and energy dialogues’ with LRAs and other stakeholders. These dialogues can facilitate the exchange of information and ensure climate policies work at all levels of governance taking into account the concerns of different stakeholders. The Commission also put forward proposals for a 2021-2027 Multiannual Financial Framework (MFF)<sup>10</sup>, which sets a climate finance target of 25% for the EU budget, and a Regulation on the establishment of a framework to facilitate sustainable investment<sup>11</sup>, which provides guidelines or a ‘taxonomy’ for sustainable investment projects. Together with the Sustainable Europe Investment Plan<sup>12</sup> these proposals are expected to ensure climate is mainstreamed across EU spending as understanding of what investments support mitigation and adaptation is improved and financing from additional sources is stimulated.

These developments highlight the importance that climate action is likely to have in the future policies and spending of the EU, which in turn may create new possibilities for LRAs to address adaptation at the regional and local level. In addition, the findings of the EU Adaptation Strategy’s evaluation suggest that the potential new Strategy might have increased focus on the needs for local and regional adaptation. Therefore, the main objective of this study is to provide EU policy makers with information about the specific adaptation challenges and needs of LRAs and thus support their efforts to fine tune the EU Adaptation Strategy towards local and regional needs, making it a more effective policy instrument at the sub-national level. More specifically, the study aims to provide information about relevant adaptation measures, financing, information sources and specific challenges faced by LRAs before outlining a set of recommendations.

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<sup>10</sup> European Commission, 2018c, A Modern Budget for a Union that Protects, Empowers and Defends, The Multiannual Financial Framework for 2021-2027, COM(2018) 321 final.

<sup>11</sup> European Commission, 2018d, Proposal for a Regulation on the establishment of a framework to facilitate sustainable investment, COM(2018) 353 final.

<sup>12</sup> European Commission, 2020a, Sustainable Europe Investment Plan, European Green Deal Investment Plan, COM(2020) 21 final.

## Approach

This study is based on a literature review of various publications and existing information sources, including academic and grey literature (a complete list is available at the end of the report) and a survey of stakeholders in local and regional authorities.

The main purpose of the survey was to gather LRAs' and other relevant stakeholders' opinions on the adaptation needs and challenges they face. The questionnaire (available in Annex 3) was drafted with a view to gather specific examples of issues or challenges experienced by different LRAs depending on the conditions in their territories as well as broader opinions on the adaptation needs at the local or regional level. The main participant target group was local and regional authorities and their networks or representatives. The questionnaire, translated in all EU languages and shared via EU Survey, was disseminated by the CoR ENVE Secretariat and through Milieu's social media networks and was open for completion in April-May 2020.

The survey was completed by 49 respondents from 14 countries. Overview statistics from the questionnaire are available in Annex 4 while results and findings can be found in relevant sections of the report.

The report is structured as follows:

- Section 1 provides an overview of impacts, adaptation needs and measures at the local and regional level;
- Section 2 provides information about financing sources available for adaptation;
- Section 3 summarises the main challenges LRAs experience in implementing adaptation measures;
- Section 4 provides conclusions and recommendations.



# 1. Adaptation at a regional and local level

Even if global efforts to mitigate climate change prove effective, climate impacts on the Earth's natural and human systems are unavoidable, due to the temperature impacts from emissions already in the atmosphere. The physical impacts of climate change and the associated socio-economic effects differ significantly not only from country to country but also from region to region within countries themselves. This means that adaptation responses are complex and context-dependent and there are no 'one-size-fits-all' solutions. LRAs will therefore be on the front line of climate change adaptation. To implement successful adaptation responses, LRAs will need to understand the likely risks, opportunities, vulnerabilities, and potential economic losses of climate change in their areas in order to undertake appropriate adaptation measures and improve the preparedness of local communities.

Although, it is difficult to provide an exact mapping of all possible physical and socio-economic impacts of climate change, this section provides a short summary of likely impacts for different types of European regions and key economic sectors. It then outlines types of adaptation responses that could be pursued at the local or regional level without aiming to be exhaustive or prescriptive, as the 'best' measures will be highly-context specific and tailored to local needs.

## 1.1 Climate change impacts and the need for adaptation

### *1.1.1 Climate hazards and physical impacts*

As increased greenhouse gas concentrations drive temperature increases, and subsequent sea level rise, the frequency and intensity of extreme weather events is projected to increase – from heatwaves, droughts and forest fires to floods, storms and heavy precipitation. These changes will in turn impact wildlife and flora, with natural habitats changing faster than species can adapt, leading to the extinction of certain species and/or the spread of invasive alien species<sup>13</sup>.

The physical impacts of climate change will greatly vary from one region to another, depending on the existing local geographical conditions such as coasts, forests, mountains or urban areas. Some regions of Europe will experience more rapid changes than others and each region will be faced with different types of

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<sup>13</sup> Kurni, B. et al. 2017, Climate change adaptation and disaster risk reduction in Europe: Enhancing coherence of the knowledge base, policies and practices, EEA report No 15/2017.

extreme weather events<sup>14</sup>. Figure 1 provides an overview of the different impacts of climate change by type of region in Europe. Broadly speaking, the main climate hazards and physical impacts associated with climate change are:

## Temperature increases

Average global temperatures have increased since the 19<sup>th</sup> century around the globe, raising the number of warm days and nights per year<sup>15</sup>. This in turn brings more extreme weather events such as *heatwaves*, *extreme heat* and even more frequent *wild and forest fires* (see Table 2 in section 1.1.3 for definitions, examples and a summary of the impacts). The survey conducted among the LRAs for this study highlighted temperature increases as the most frequently physical impact of climate change already being experienced at local level (43 out of 49). In Europe, higher temperatures will have negative impacts on Southern/Mediterranean regions due to increasingly severe heatwaves but potentially positive impacts on Northern regions thanks to longer periods of warmer weather<sup>16</sup>. Even though the absolute risk of forest fires is higher in Southern Europe, managing the relative increase in fire danger might be harder in Northern and Western Europe, where these events have been rare in the past and preparedness is lower<sup>17</sup>.

## Changes in precipitation

One of the consequences from higher temperatures is that patterns in precipitation are changing. This translates in more frequent occurrence of extreme events such as *droughts*, *floods*, *storms and heavy rainfall/ extreme precipitation or even landslides*<sup>18</sup> (see Table 2). LRAs responding to the survey indicated that changes in precipitation, extreme rainfalls, coastal storms and flooding are the second most frequently experienced phenomena (39 out of 49). North-Western and Central European regions are expected to experience more frequent heavy precipitations and floods, as Southern regions will face more droughts<sup>19</sup>. However, these impacts may also vary within the regions or over time, with periods of heavy precipitation followed by periods of water scarcity within the same region.

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<sup>14</sup> Füssel, H.M. et al. 2017, Climate change, impacts and vulnerability in Europe 2016: An indicator-based report, EEA report No 1/2017.

<sup>15</sup> IPCC, 2013, Summary for Policymakers in *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.

<sup>16</sup> Füssel, H.M. et al. 2017.

<sup>17</sup> [European Environment Agency, Climate change impacts in Europe](#)

<sup>18</sup> IPCC, 2013.

<sup>19</sup> Füssel, H.M. et al. 2017.

## Melting ice cover

As a result of higher average temperatures, *ice sheets, glaciers and permafrost are losing mass* globally<sup>20</sup> (see Table 2). In Europe, this translates in negative impacts primarily for the Arctic and mountainous regions. The latter will be hit particularly hard by climate change, as they are expected to experience a much higher increase in temperatures than the global average<sup>21</sup>. This is projected to lead to very specific issues linked to decreasing snow levels and mountain permafrost areas along with the extinction of local species (especially in the Alpine regions)<sup>22</sup>.

## Rising sea levels

As a result of thermal expansion and glacier loss, *sea level has risen* since the beginning of the 20<sup>th</sup> century, with higher average levels observed since the 1990s<sup>23</sup>. This increases the risks of *coastal erosion and flooding* putting in danger coastal regions in particular. Most Coastal European regions are expected to experience more frequent coastal flooding and coastal erosion, linked to the rise in sea level and storm surges<sup>24</sup> (see Table 2).

## Indirect impacts

The above-mentioned climate change impacts could be heightened in urban areas as the built environment and high soil sealing create unique microclimates. This can affect air temperatures, wind direction and precipitation worsening the risks of, for example, heatwaves and urban floods<sup>25</sup>.

In addition, the combination of changes, especially to temperature and precipitation, could alter the life cycles of different species and facilitate the spread of invasive alien species, pests, vector-borne diseases (i.e. those spread by insects, ticks, parasites etc.) or disease pathogens to new geographical areas<sup>26</sup>. This in turn poses significant risks to plant, animal and human health (for further details see section 1.1.2).

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<sup>20</sup> IPCC, 2013.

<sup>21</sup> Füssel, H.M. et al. 2017.

<sup>22</sup> Euromontana, 2018, Evaluation of the EU's Strategy on Adaptation to Climate Change: What future for Europe's mountains?

<sup>23</sup> IPCC, 2013.

<sup>24</sup> [European Environment Agency, Climate change impacts in Europe](#)

<sup>25</sup> Georgi, B. et al. 2016, Urban adaptation to climate change in Europe 2016, Transforming cities in a changing climate, EEA Report No 12/2016; and

Vandecasteele I. et al. 2019, The Future of Cities – Opportunities, challenges and the way forward, Joint Research Centre.

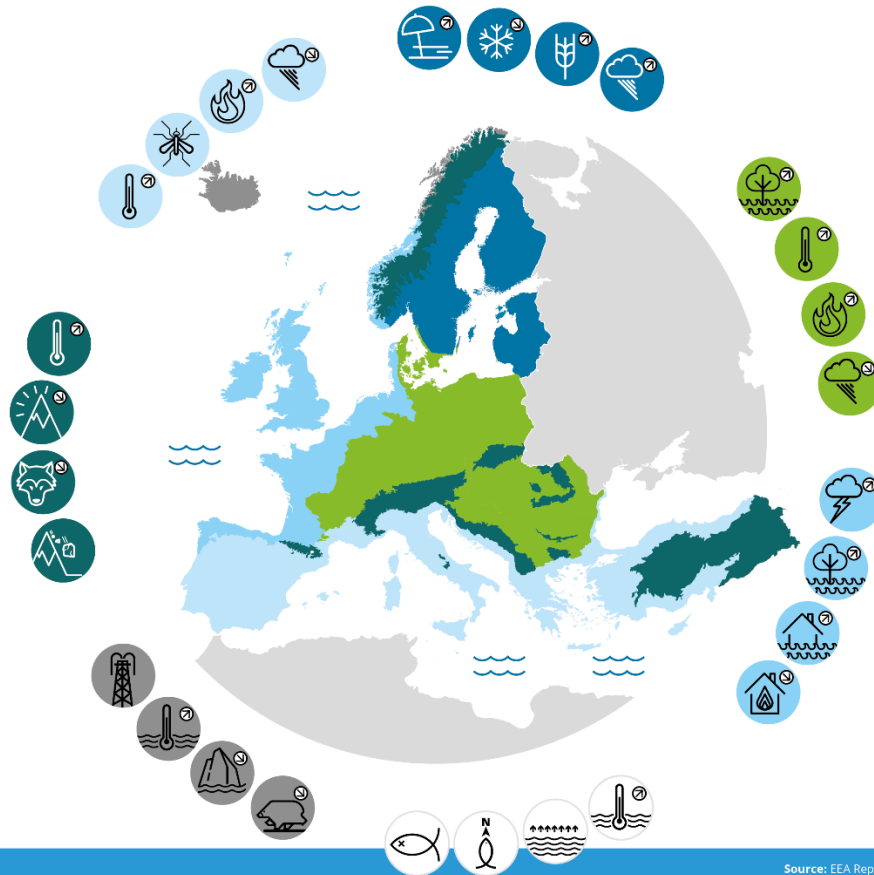
<sup>26</sup> Jacobs, C. et al. 2019, Climate change adaptation in the agriculture sector in Europe, EEA Report No 04/2019; and

Kendrovski, V. et al. 2018, Public Health and Climate Change Adaptation Policies in the European Union, Final Report, World Health Organisation.

**Figure 1 Overview of the main climate change impacts in Europe's regions**

**Climate change impacts in Europe's regions**

Climate change is projected to impact the availability of water in Europe, putting additional pressure on southern regions already facing water stress. Other parts of Europe are expected to face more frequent flooding events, while low-lying regions are at risk from storm surges and sea level rise.



**Mediterranean region**

- Large increase in heat extremes
- Decrease in precipitation and river flow
- Increasing risk of droughts
- Increasing risk of biodiversity loss
- Increasing risk of forest fires
- Increased competition between different water users
- Increasing water demand for agriculture
- Decrease in crop yields
- Increasing risks for livestock production
- Increase in mortality from heat waves
- Expansion of habitats for southern disease vectors
- Decreasing potential for energy production
- Increase in energy demand for cooling
- Decrease in summer tourism and potential increase in other seasons
- Increase in multiple climatic hazards
- Most economic sectors negatively affected
- High vulnerability to spillover effects of climate change from outside Europe

**Boreal region**

- Increase in heavy precipitation events
- Decrease in snow, lake and river ice cover
- Increase in precipitation and river flows
- Increasing potential for forest growth and increasing risk of forest pests
- Increasing damage risk from winter storms
- Increase in crop yields
- Decrease in energy demand for heating
- Increase in hydropower potential
- Increase in summer tourism

**Continental region**

- Increase in heat extremes
- Decrease in summer precipitation
- Increasing risk of river floods
- Increasing risk of forest fires
- Decrease in economic value of forests
- Increase in energy demand for cooling

**Atlantic region**

- Increase in heavy precipitation events
- Increase in river flow
- Increasing risk of river and coastal flooding
- Increasing damage risk from winter storms
- Decrease in energy demand for heating
- Increase in multiple climatic hazards

**Coastal zones and regional seas**

- Sea level rise
- Increase in sea surface temperatures
- Increase in ocean acidity
- Northward migration of marine species
- Risks and some opportunities for fisheries
- Changes in phytoplankton communities
- Increasing number of marine dead zones
- Increasing risk of water-borne diseases

**Arctic region**

- Temperature rise much larger than global average
- Decrease in Arctic sea ice coverage
- Decrease in Greenland ice sheet
- Decrease in permafrost areas
- Increasing risk of biodiversity loss
- Some new opportunities for the exploitation of natural resources and for sea transportation
- Risks to the livelihoods of indigenous peoples

**Mountain regions**

- Temperature rise larger than European average
- Decrease in glacier extent and volume
- Upward shift of plant and animal species
- High risk of species extinctions
- Increasing risk of forest pests
- Increasing risk from rock falls and landslides
- Changes in hydropower potential
- Decrease in ski tourism

Source: EEA Report No 01/2017 — Climate change, impacts and vulnerability in Europe 2016.

Source: [European Environment Agency, Climate change impacts in Europe's regions](#)



### ***1.1.2 Socio-economic impacts***

The physical impacts of climate change have very diverse socio-economic consequences that differ by sector and region (for an overview of links and examples see Table 2 in section 1.1.3). Even within the same local area or region the same climate change impacts can be experienced very differently across sectors and social groups. Although, it is difficult to provide an exact mapping of all possible socio-economic impacts of climate change, examples of impacts in key sectors relevant for European LRAs include:

#### **Health and social vulnerability**

One of the main pathways through which climate change is going to affect economic systems is through impacts on human health and social vulnerability. In particular, climate change is likely to cause various health and safety risks such as: illnesses and mortality due to heatwaves or cold spells; mortality, chemical hazards and poisoning due to extreme weather events, floods or wild fires; new illnesses and spread of communicable diseases due to changing patterns in the activity of pathogens, viruses and parasites<sup>27</sup>.

For example, heatwaves can cause heat stress, dehydration and heat strokes while cold spells can cause hypothermia and trauma. Both extremes can worsen pre-existing conditions and cardiovascular and respiratory diseases. Higher temperatures are also expected to alter the duration, start and intensity of the pollen season, which is linked to a growth in the cases of asthma and allergies<sup>28</sup>.

A warming climate, as well as changing land-use patterns, may lead to an increased risk of outbreaks of infectious diseases. Although not the sole determinant for the spread of infectious diseases (for example, international travel and trade as well as human behaviour are often more important determinants), climate change can contribute to or alter the distribution and transmission of such diseases. This impact could be direct through effects on the behaviour of pathogens and vectors, or indirect by influencing people's behaviour and exposure to infectious diseases (for example, higher temperatures may prompt people to spend more time outdoors in areas with ticks)<sup>29</sup>. Pathways through which climate change can contribute to the spread of diseases include:

- Air-borne diseases: Increased humidity could increase the risks of lower respiratory tract infections;
- Food-borne diseases: Higher ambient temperatures increase the replication

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<sup>27</sup> Kurni, B. et al. 2017; and Kendrovski, V. et al. 2018.

<sup>28</sup> Kendrovski, V. et al. 2018.

<sup>29</sup> [European Centre for Disease Prevention and Control. Climate change in Europe](#)

cycles of pathogens for food-poisoning (such as campylobacteriosis and salmonellosis);

- Water-borne diseases: Extreme precipitation can increase the risk and the amount of pollutants entering recreational coastal waters as well as overwhelm urban water treatment plants and raise the risk of disease outbreaks in the drinking water distribution systems;
- Vector-borne diseases and pathogens: Climate change can alter the life cycles of vectors and the reproduction rate of parasites and viruses, reducing incubation periods and increasing transmission risks. Long-term seasonal changes can influence vector, animal and human activity and further affect the spatial-temporal distribution of diseases<sup>30</sup>.

Finally, there is a growing body of evidence to suggest that climate change, combined with other human activities impacting biodiversity, will increase the risk of future pandemics. Spatial patterns of some animal species are likely to change in response to increased temperatures and other climate impacts, increasing the likelihood of human-animal contact. This creates a risk of transmission of new viruses from animal to human populations. Recent research suggests significant increased animal-human viral transmission risk even under relatively optimistic climate change scenarios, highlighting the importance of adaptation responses such as emergency preparedness<sup>31</sup>.

Poor health resulting from these risks can in turn reduce the productivity of the workforce and negatively impact businesses and industry in all economic sectors. For instance, as temperatures and humidity rise the human body reacts by increasing blood flow and sweating, which can make it harder to perform physical and cognitive tasks, in turn reducing the overall labour productivity. Some studies have found that labour productivity starts to decline at around 25°C as heat stress starts to grow<sup>32</sup>.

Furthermore, the various economic and health impacts would likely affect vulnerable groups of society more gravely. Personal characteristics (for example, age, health) and socio-economic status (for example, income, race or ethnicity, employment or education) determine how vulnerable people are and how they can cope, if exposed to these impacts. Consequently, children, the elderly or persons experiencing material disadvantage are much more vulnerable to climate change.

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<sup>30</sup> Semenza, J. C. and Suk, J. E. 2017, Vector-borne diseases and climate change: a European perspective, *FEMS Microbiology Letters*, 365, 2017; and

[European Centre for Disease Prevention and Control, Climate change in Europe](https://www.euro.who.int/en/about-us/partners/european-centre-for-disease-prevention-and-control)

<sup>31</sup> Carlson, C. J. et al. 2020, 'Climate change will drive novel cross-species viral transmission', unpublished preprint, available online at: <https://www.biorxiv.org/content/10.1101/2020.01.24.918755v2>

<sup>32</sup> Ciscar, J. C. et al. 2018 Climate impacts in Europe: Final report of the JRC PESETA III project, JRC Science for Policy Report, Joint Research Centre.

At the same time, climate change impacts can exacerbate existing vulnerabilities by increasing poverty or inequalities or worsening existing health conditions<sup>33</sup>.

All these factors will increase the demand for health and social services putting additional pressures on these systems and their infrastructure. In countries where the provision of such services is decentralised, this might result in additional pressure on local and regional budgets and resources.

LRAs responding to the survey mentioned higher health costs and costs for social services as a very important impact already experienced at local level. When combined, these two responses are the most frequently mentioned impact among all others (46 out of 49).

## **Agriculture, forestry and aquaculture**

In the agriculture, forestry and aquaculture sectors, climate change is likely to affect crop yields, species reproduction and growth, water availability and the pathways for invasive alien species, diseases and pathogens. While these changes could bring about positive outcomes in some regions by allowing the growth of new species or extending crop periods, they could reduce productivity in other areas. The economic consequences of these changes include fluctuations in food prices, farm incomes and overall food security at regional, national or even global level<sup>34</sup>. In line with this, the survey found that losses stemming from impacts on agriculture is the second most frequently mentioned socio-economic impact of climate change (38 out of 49).

## **Energy**

In the energy sector, a changing demand for energy is likely to be one of the main impacts of climate change. Temperature extremes can affect both the amount and periods for heating and cooling energy demand. Reduced water availability could affect the amount of power produced by thermal power generation (for example, fossil fuel, biomass or nuclear power plants rely on large quantities of water for cooling and their production could be interrupted due to water shortages). Combined, these shifting patterns for energy demand and supply can create risks for the overall stability of electricity networks during peak demand periods.

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<sup>33</sup> Kaźmierczak, A. 2018, Unequal exposure and unequal impacts: social vulnerability to air pollution, noise and extreme temperatures in Europe, EEA Report No 22/2018; and Breil, M. et al. 2018, Social vulnerability to climate change in European cities – state of play in policy and practice, ETC/CCA Technical Paper - ETC/CCA 2018/1.

<sup>34</sup> Jacobs, C. et al. 2019; and COACCH, 2018, The Economic Cost of Climate Change in Europe: Synthesis Report on State of Knowledge and Key Research Gaps. Policy brief by the COACCH project.

Moreover, extreme weather events could cause physical damage to energy infrastructure resulting in power cuts or safety hazards that can in turn jeopardise operations in other sectors of the economy<sup>35</sup>.

## **Transport**

Physical damages to infrastructure following extreme events is also a likely impact in the transport sector. Other impacts stemming from rising temperatures and heatwaves would be problems of rail buckling and pavement deterioration. Such damage to the road, rail, water and air transport infrastructure could in turn disrupt the flow of goods and passengers with corresponding economic consequences across sectors and regions, especially if international transport networks are affected<sup>36</sup>.

## **Tourism**

Tourism is highly likely to be impacted by climate change. Rising temperatures, heatwaves, sea level rise and coastal erosion could reduce the size of beach tourism in traditional European destinations (for example, Mediterranean). Similarly, changes in snow availability and higher temperatures could cause shrinkages in the size of ski tourism in traditional destinations (for example, the Alps). These impacts could result in the shift of these types of tourism to new locations or different periods of the years or give way to new types of tourism<sup>37</sup>. For instance, mountainous areas at lower altitudes that experience shorter ski seasons are expanding the opportunities available for other touristic activities such as camping, mountain climbing or hiking.

## **Construction, housing and infrastructure**

Some of the main competences of LRAs relate to the development of local infrastructure and land use. As a result of climate change construction is likely to see delays and increased costs following fluctuating weather conditions and extreme events such as floods or landslides. Furthermore, building material requirements and construction codes are likely to evolve to address the changing weather conditions as rebuilding and repair demand might grow following new patterns of natural disasters and damages<sup>38</sup>. At the same time, the occurrence of

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<sup>35</sup> Füssel, H.M et al. 2019, Adaptation challenges and opportunities for the European energy system: Building a climate-resilient low-carbon energy system, EEA Report No 01/2019.

<sup>36</sup> Georgi, B. et al. 2014, Adaptation of transport to climate change in Europe, Challenges and options across transport modes and stakeholders, EEA Report No 8/2014.

<sup>37</sup> COACCH, 2018.

<sup>38</sup> Arent, D. J. et al. 2014, Key economic sectors and services. *In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.*

extreme events can cause physical damages to critical infrastructure, including health, energy, transport and education infrastructure. The survey with LRAs also indicated that damage to infrastructure and buildings is already happening on the ground (39 out of 49).

## **Water management and services**

Climate change creates risk for the smooth provision of water services to different sectors and the broader management of water resources. There are direct impacts resulting from precipitation changes such as floods or droughts but also risks of damages to the water infrastructure. The latter could disrupt the provision of local water and sanitation services or water for irrigation<sup>39</sup>. Interruption or decrease in the quality of these services as a consequence of climate change could facilitate the spread of diseases and put the public health at risk. In addition, climate change could also increase competition among sectors for critical resources such as water. For instance, a strain on water resources either as a direct result of climate change (for example, droughts) or indirectly (for example, damages to critical infrastructure following floods, wild fires or storms) could exacerbate the competition between agriculture and aquaculture, energy, tourism and water supply<sup>40</sup>. Prolonged periods of water scarcity may thus require a prioritisation of needs and consumption across sectors at the local or regional level.

## **Manufacturing and services**

Although the impacts of climate change on sectors such as manufacturing or services (particularly those other than tourism or health services) are less studied, they are likely to be the consequences of changes in primary economic activities such as labour productivity and energy demand or disruptions to transport networks. These changes could result in fluctuations of prices and qualities for manufacturing inputs, higher production costs as well as disrupted supply chains or interruption of services. Expected losses in labour productivity as a result of higher temperatures, increased humidity or the spread of infectious and vector-borne diseases could potentially be offset by technological progress in the manufacturing sector<sup>41</sup>. However, this might not be possible for the services industry.

### ***1.1.3 Vulnerability and the need for adaptation***

As evidenced by existing research, climate change will have very diverse physical and socio-economic impacts in Europe (for a summary see Table 2). These

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<sup>39</sup> Arent, D. J. et al. 2014; and COACCH, 2018.

<sup>40</sup> Bretagne Region, 2018, Letter of Opinion on Adaptation.

<sup>41</sup> Arent, D. J. et al. 2014.

impacts are likely to vary according to European geographical macro-regions but also to specific physical characteristics such as coasts, altitude, vegetation or micro-climate. Even within the same countries or regions, these impacts could differ posing diverse pressures on local communities and socio-economic systems. Furthermore, the costs of damages and economic losses associated with disrupted economic activities across sectors could pose additional challenges on local communities.

The socio-economic impacts of climate change can result in significant economic losses and costs. In the period 1980-2016, the costs associated with weather and other climate extremes in Europe amounted to more than EUR 436 billion<sup>42</sup>. Even though the exact projections vary according to the sector assessed and the models used, existing estimates conclude that the costs of inaction are likely to exponentially grow in the future<sup>43</sup> (a compilation of some existing estimates is provided in Annex 1). Last but not least, climate impacts could have cumulative effects and affect the economic prosperity and well-being of local communities, especially their most vulnerable members. Regions and countries in Europe are also vulnerable to climate change impacts beyond their borders through trade, international financial flows and migration<sup>44</sup>, which could in turn exacerbate the impacts they already experience.

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<sup>42</sup> COM(2018) 738 final.

<sup>43</sup> COACCH, 2018.

<sup>44</sup> COM(2018) 738 final.

**Table 2 Examples of the main climate hazards and climate change impacts in Europe**

Climate Hazard	Description	Example	Examples of socio-economic impacts
<p><b>Increased temperature and heatwaves</b></p>	<p>Temperatures higher than the average for the period and location. Heatwaves represent a period of abnormally hot and usually humid weather that is atypical for the specific location and season.</p>	<p>Heatwaves are projected to increase throughout Europe, especially in Southern and Central Europe. In the Slovakian cities of Trnava and Košice, for example, the number of tropical days (mean temperature above 30 °C) has increased from 12 to 20 days in the last 20 years, with the maximum temperature frequently exceeding 34°C. The annual number of summer days (mean temperature above 25 °C) is projected to rise from 58 (1961–1990) to 100 (2051–2100). Trnava is extremely vulnerable to the urban heat island effect, notably due to a high proportion of paved surfaces, which exacerbate heat stress during periods of high temperature<sup>45</sup>.</p>	<ul style="list-style-type: none"> <li>• Poor health, mortality and reduced labour productivity, spread of diseases pathogens</li> <li>• Reduced crop yields (Southern Europe), potentially higher yields (Northern Europe), spread of pests or diseases, higher food prices</li> <li>• Increased energy demand for cooling and risks to the balance of the electricity system during peak demand</li> <li>• Rail buckling and pavement deterioration, passenger discomfort and higher demand for cooling in the vehicles</li> <li>• Decline in beach tourism and increase in mountain/ rural tourism in the summer, decline of ski tourism in winter</li> <li>• Higher manufacturing and transport costs and thus increasing prices for commodities and products</li> <li>• Demand for new construction materials and/or practices that can ensure adequate cooling in the buildings</li> </ul>

<sup>45</sup> [Climate-ADAPT, Social vulnerability to heatwaves – from assessment to implementation of adaptation measures in Košice and Trnava, Slovakia \(2018\)](#)

Climate Hazard	Description	Example	Examples of socio-economic impacts
<b>Forest and wildfires</b>	Fires burning in areas of land with many trees or grass/bushes in the countryside, which spread quickly and out of control.	According to the European Commission Annual Report on Forest Fires of 2018, wildfires destroyed nearly 178,000 hectares of forests and land in the EU over the course of the year. Sweden, for example, experienced the highest and most devastating number of forest fires in its history. The total burnt area of over 21,605 ha mapped in Sweden was registered as the second highest in the EU, an unusual position in the ranking for a northern country <sup>46</sup> .	<ul style="list-style-type: none"> <li>• Poor health, mortality</li> <li>• Damages to housing, property and (critical) infrastructure, higher construction costs and delays</li> <li>• Lost or reduced agriculture and forest yields, higher food and wood prices</li> </ul>
<b>Droughts</b>	A period of abnormally dry weather sufficiently prolonged so that the lack of water causes serious supply shortages.	Droughts are projected to increase severely especially in the Iberian Peninsula (which includes Portugal and Spain). In 2008, for example, Barcelona ran out of water due to a severe drought, forcing it to import drinking water from France. The frequency of droughts in Spain has continued to increase ever since - the latest being in 2017 <sup>47</sup> .	<ul style="list-style-type: none"> <li>• Increased competition for water resources between sectors</li> <li>• Reduced crop yields, higher food prices</li> <li>• Risks to the stability of electricity system and lack of water for cooling</li> <li>• Risks to the provision of water and sanitation services</li> </ul>
<b>Extreme precipitation and floods</b>	Periods of abnormal precipitation that is higher than average for the location and season and which can in turn result in floods	Extreme precipitations are expected to increase by 35% in Central and Eastern Europe and by 25% in Southern Europe <sup>48</sup> . Heavy precipitation in the winter of 2018 led to a number of flash floods in France, Italy, Portugal and Spain. In Italy, the government declared a state of emergency in 11 regions affected by extreme meteorological events, with over 30 casualties recorded <sup>49</sup> .	<ul style="list-style-type: none"> <li>• Injuries, mortality and spread of water-borne diseases</li> <li>• Damages to housing, property and (critical) infrastructure, higher construction costs and delays</li> <li>• Risks to the provision of water and sanitation services</li> <li>• Lost or reduced agriculture and forest yields, higher food and wood prices</li> <li>• Demand for repair and rebuilding</li> </ul>

<sup>46</sup> San-Miguel-Ayaz, J. et al. 2019, Forest Fires in Europe, Middle East and North Africa 2018, JRC Technical Report, Joint Research Centre.

<sup>47</sup> Ritter, K., 2019, 'A Decade after Barcelona's water emergency, drought still stalks Spain', Circle of Blue

<sup>48</sup> European Environment Agency, Climate change impacts in Europe

<sup>49</sup> Euronews, 2018, Italy to declare state of emergency following devastating floods



Climate Hazard	Description	Example	Examples of socio-economic impacts
<b>Landslides</b>	The unexpected collapse of a mass of earth or rock from a mountain or cliff.	Landslides occur in many different geological and environmental conditions across Europe. A large landslide occurred in Maierato (Southern Italy), for example, in February 2010, causing nearly 2,300 inhabitants to be evacuated and high economic losses. The probable trigger of the landslide was a long period of abnormally high precipitations (about 150 % of the average rainfall of that period) <sup>50</sup> .	<ul style="list-style-type: none"> <li>• Injuries, mortality</li> <li>• Damages to housing, property and (critical) infrastructure, higher construction costs and delays</li> <li>• Lost or reduced agriculture and forest yields, higher food and wood prices</li> <li>• Demand for repair and rebuilding</li> </ul>
<b>Permafrost and ice melting</b>	Permafrost is frozen soil, silt and rock. It is found in perpetually cold areas (mainly at high altitude in mountain regions) and remains frozen year-round. Due to climate change, however, permafrost has started to progressively thaw, which increases the risk of ice and rock fall.	The Alps are already experiencing decreasing ice cover and the thaw of permafrost. The Pasterze Glacier, for example, which is 9 km-long and located in the North-Eastern slope of the Austrian Alps, is currently losing 5m in height and 20m in length every year <sup>51</sup> . This can lead to loss of habitats and species.	<ul style="list-style-type: none"> <li>• Shorter snow season and decline in ski tourism in winter</li> </ul>
<b>Coastal erosion</b>	The gradual wearing off of land from a coast by the action of sea water.	The White Cliffs of Haute Normandy (France), are projected to be particularly impacted by coastal erosion. It could affect about 180 km <sup>2</sup> of areas of high ecological value in Haute Normandy. Coastal erosion in this region is expected not only to impact the local biodiversity but also directly affect houses located on the cliff top, most notably in the municipalities of Criel, Quiberville and Saint-Pierre en Port <sup>52</sup> .	<ul style="list-style-type: none"> <li>• Damages to housing, property and (critical) infrastructure, higher construction costs and delays</li> <li>• Demand for repair and rebuilding</li> <li>• Decline in beach tourism</li> </ul>
<b>Sea level rise and coastal flooding</b>	An increase in the mean level of the ocean. It can be due to an alteration to the volume of the world ocean or relative to local land movements.	Venice (Italy), for example, will be particularly impacted by rising sea levels, as shown in November 2019, where the co-occurrence of the highest sea tide in 50 years and heavy	

<sup>50</sup> Kurni, B. et al. 2017.

<sup>51</sup> [WWF, Climate change in the Alps](#)

<sup>52</sup> EUROSION, 2004, 'Living with coastal erosion in Europe: Sediment and space for sustainability', Results from the EUROSION study, European Commission

Climate Hazard	Description	Example	Examples of socio-economic impacts
		precipitation led to severe flooding, killing two people and leading to mass infrastructure destruction <sup>53</sup> .	
<b>Invasive alien species</b>	The spread of non-native species, which threaten ecosystems, habitats or other species, can be facilitated by other climate change impacts such as higher temperatures or extreme precipitation.	An example of an invasive alien species in Europe is the killer algae, which has rapidly and uncontrollably spread in the Mediterranean, altering native ecosystems, by destroying and replacing the native algae, displacing native vegetation and drastically reducing the marine biodiversity <sup>54</sup> . The Asian yellow-legged hornet, a highly effective predator for honeybees and other beneficial insects linked to pollination, is another example of an invasive alien species, which has rapidly spread in Europe <sup>55</sup> .	<ul style="list-style-type: none"> <li>• Reduced crop, forest and fisheries yields, spread of pests or diseases, higher food and wood prices</li> </ul>
<b>Diseases and pathogens</b>	The spread of infectious or vector-borne diseases can be facilitated by other climate change impacts such as higher temperatures, extreme precipitation or damages to critical infrastructure.	Climate change has contributed to a shift of the tick species vector for Lyme borreliosis and tick-borne encephalitis to elevated altitudes and latitudes in Europe. Furthermore, there has been an expansion of the Asian tiger mosquito in Europe, which is a vector for diseases such as Zika, dengue and chikungunya. During past heatwaves Southern Europe has also seen epidemics of diseases such as West Nile Fever <sup>56</sup> .	<ul style="list-style-type: none"> <li>• Poor health, mortality and reduced labour productivity</li> <li>• Reduced crop, forest and fisheries yields, higher food and wood prices</li> </ul>

Source: Own compilation based on the cited sources and sections 1.1.1 and 1.1.2.

<sup>53</sup> [European Environment Agency, Climate change impacts in Europe](#)

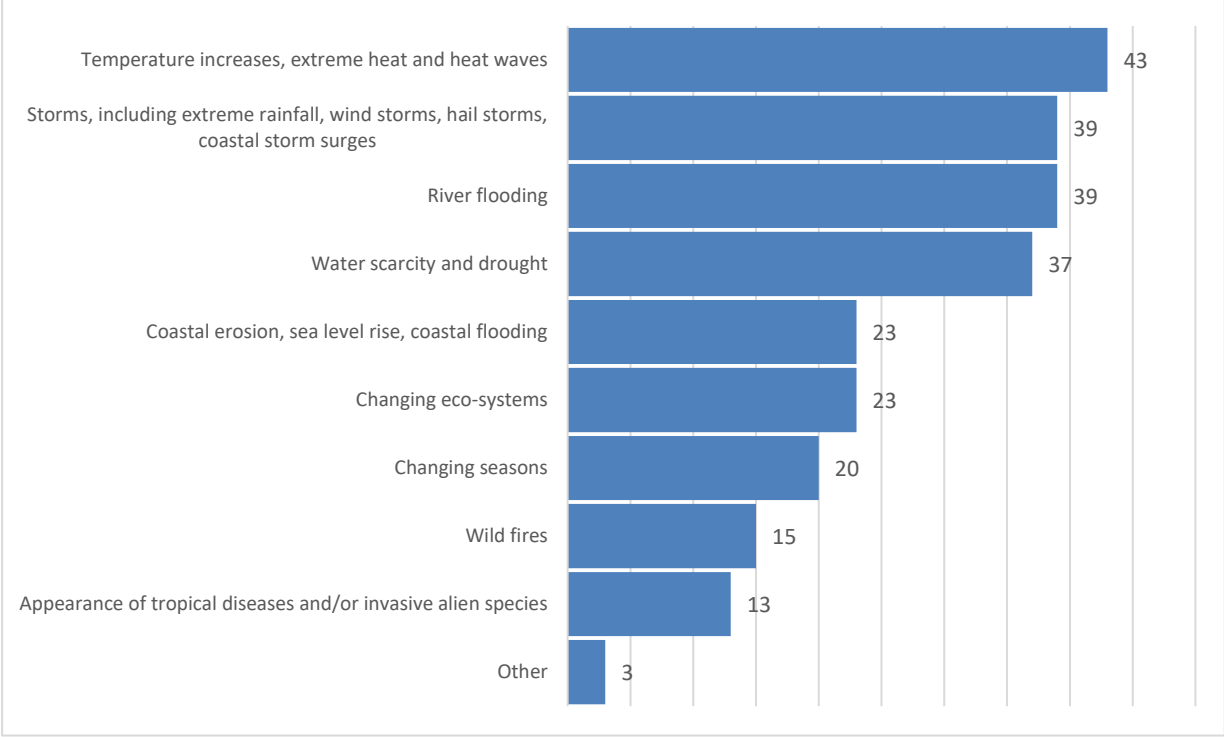
<sup>54</sup> Scalera, R. et al. 2012, The impacts of invasive alien species in Europe, EEA report No 16/12.

<sup>55</sup> Scalera, R. et al. 2012.

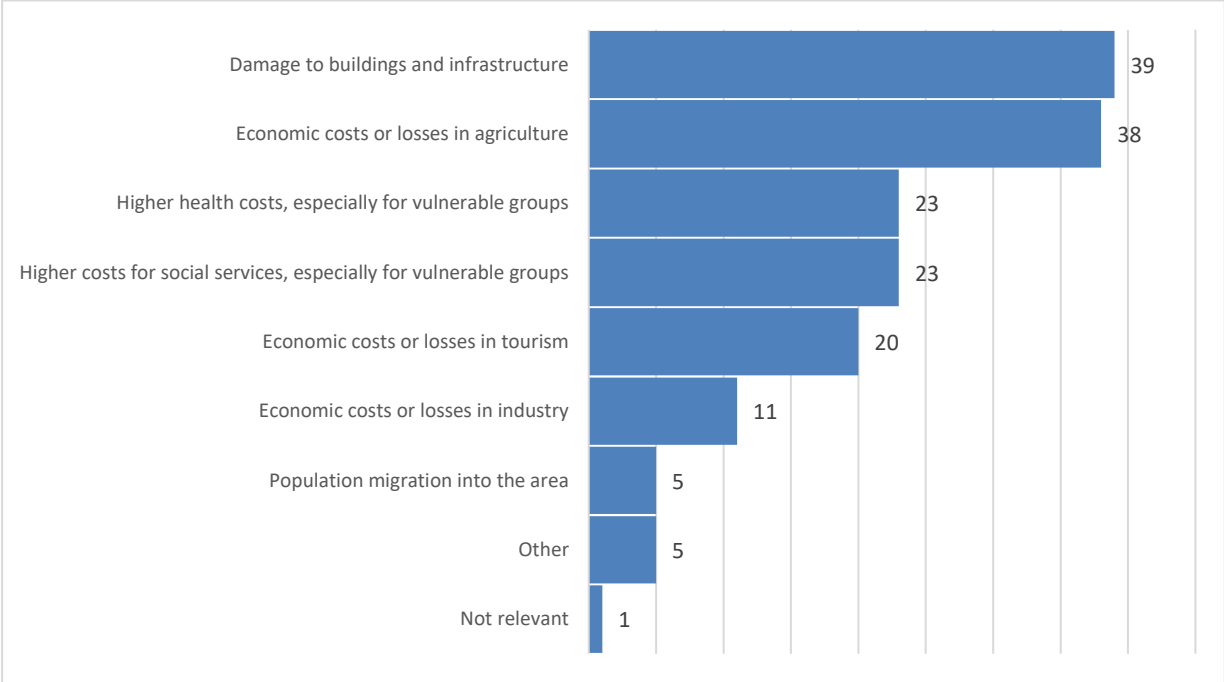
<sup>56</sup> Semenza, J. C. and Suk, J. E. 2017.

The LRAs responding to the survey indicated that their regions are already experiencing the physical impacts of climate change and the socio-economic impacts resulting from them.

**Figure 2 The most significant physical impacts of climate change experienced in the area, N=49 (multiple responses possible)**



**Figure 3 The most significant social/economic impacts of climate change experienced in the area, N=49 (multiple responses possible)**



Therefore, an important first step to ensure that the negative climate change impacts are minimised and adaptation is successful is to identify, understand and, to the extent possible, quantify the likely climate hazards and impacts that might occur. Climate Change Impacts and Vulnerability (CCIV) assessments or CCIV and risk assessments could be used to carry out such analyses. Integrated assessments of vulnerability and risk for multiple climate hazards can provide comprehensive understanding of interdependencies, potential synergies and trade-offs between sectors<sup>57</sup>. These assessments can help identify and compare the best response strategies and adaptation options given the anticipated impacts<sup>58</sup>.

#### **Box 1: Vulnerability to climate change**

There are different frameworks for conceptualising ‘vulnerability’, which sometimes can create confusion among stakeholders. In its 5<sup>th</sup> Assessment Report, the IPCC described vulnerability as a depiction of a system’s sensitivity to a particular climate hazard (i.e. specific climate extreme event) given its exposure to the hazard and considering the hazard’s magnitude/ intensity and probability of occurrence<sup>59</sup>. The Joint Research Centre explains that climate hazards can be considered as risks only if they pose a threat to something of value such as demographic, financial, infrastructure or cultural assets. The gravity of the risks depends on the vulnerability of the system and its capacity to adapt (for example, vulnerable social groups might have lower adaptive capacity to the same hazard as other parts of society resulting in different vulnerability)<sup>60</sup>.

There are different approaches and methodologies for carrying out CCIV assessments. For LRAs the Joint Research Centre (JRC) recommends the use of spatially explicit approaches or indicator-based assessments. The former rely on climate models and could be more costly to produce making them more suitable for large LRAs that have the necessary resources. The latter are based on simpler qualitative approaches for identifying factors that influence a locality’s vulnerability to climate change. These assessments use comparable composite indicators to analyse the vulnerability and risks<sup>61</sup>.

Taking adaptation measures could help reduce vulnerabilities to the expected climate change impacts, improve the preparedness and capacity of communities and systems to deal with these impacts and potentially reduce the associated economic costs. Given the highly diverse distribution of impacts, national-level adaptation actions might not be sufficient or appropriate for all possible regional

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<sup>57</sup> Füssel, H.M. et al. 2017.

<sup>58</sup> Füssel, H.M. et al. 2018, National climate change vulnerability and risk assessments in Europe, 2018, EEA report No 1/2018.

<sup>59</sup> Füssel, H.M. et al. 2018.

<sup>60</sup> Bertoldi P. 2018b, Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP) – PART 3 – Policies, key actions, good practices for mitigation and adaptation to climate change and Financing SECAP(s), JRC Science for Policy Report, Joint Research Centre.

<sup>61</sup> Bertoldi P. 2018a, Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP) – Part 2 - Baseline Emission Inventory (BEI) and Risk and Vulnerability Assessment (RVA), JRC Science for Policy Report, Joint Research Centre.

or local contexts. Therefore, it is up to regional and local policymakers to take adaptation measures that are suited to the particular vulnerabilities, risks and needs of their communities.

## **1.2 Adaptation measures at the local and regional level**

In principle, there is a multitude of measures that LRAs can undertake but in practice this will depend on a number of factors. As these measures follow from the impacts of climate change, the choices that the local authorities and regions will make to face these impacts is inevitably context dependent. Such tailor-made approaches to climate adaptation are necessary to ensure that unique circumstances of the places, from physical to social, are taken into account. As such, adaptive responses will also be able create synergies, bringing additional benefits that would be more difficult to obtain otherwise.

Considering the diverse picture provided in the previous section, trying to provide an exhaustive list of adaptation measures would not be realistic. However, a general overview of different strategies and types of measures is useful and provided in the following sub-sections. It would be up to the local and regional policymakers to select the most suitable adaptation approaches or combinations thereof that best address the risks and anticipated impacts on their communities.

### ***1.2.1 Adaptation measures***

The literature distinguishes between two main types of adaptation approaches. Apart from the ‘coping approach’ of reacting to damages as they occur, adaptation could be:

- Incremental – this approach builds on existing measures and known solutions, increasing their capacity to avoid damage with the purpose to maintain or regain existing services.
- Transformational/ transformative – this approach is based on a broader and systemic perspective, seeking to integrate adaptation with other aspects of urban development or decision-making and go beyond state-of-the-art approaches with the goal of turning climate change challenges into opportunities<sup>62</sup>.

Within these broad approaches, there are different types of adaptation measures. The EEA uses an approach based on the nature of intervention to distinguish

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<sup>62</sup> Georgi, B. et al. 2016; and IPCC, 2018.

between grey, green and soft measures<sup>63</sup>, which is outlined below. These types of measures are often used in combination to build resilience to climate impacts.

**Grey measures** target the physical infrastructure and rely on technological solutions to better equip people and places to the consequences of a changing climate. These include a wide range of interventions to transform the built environment. Some examples are interventions to vital infrastructure such as water, waste or transport<sup>64</sup>, irrigation structures for agriculture<sup>65</sup>, building dykes, beach restoration<sup>66</sup>, designing public spaces to better accommodate storms or designing buildings that will better cope with heatwaves<sup>67</sup>. Making improvements to the infrastructure of critical buildings, which host the most vulnerable populations (such as hospitals, retirement homes or schools)<sup>68</sup>, as well as developing urban planning projects in a way to reduce the threats from climate events<sup>69</sup> are other examples of grey adaptation measures.

**Green measures** also make changes to the built environment, but they use nature-based solutions instead. These measures can be less costly to implement<sup>70</sup> and can deliver other benefits, such as improved amenity or benefits for nature and biodiversity. These measures often represent ‘no or low-regret’<sup>71</sup> solutions for improving the resilience of the human systems, because will they continue to deliver benefits even if climate impacts do not occur or are less serious than anticipated. Such measures are often referred to as green infrastructure (or ‘blue infrastructure’ if aquatic ecosystems are concerned) or ecosystem-based adaptation measures.

Specific examples of using green infrastructure in urban areas is developing landscaped areas on sidewalks to reduce water run-off, or creating green areas between roads or on rooftops to reduce the urban heat island effect<sup>72</sup>. In an agricultural setting, green measures can include increasing crop diversity to build resilience to changing climate conditions, or maintaining forests to provide livestock with shelter against extreme weather. These measures offer multiple benefits, for instance, green roofs can help to reduce water run-off, decrease the urban heat island effect and provide areas for enhanced biodiversity<sup>73</sup>.

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<sup>63</sup> [Climate-ADAPT, Adaptation options](#)

<sup>64</sup> Kendrovski, V. et al. 2018.

<sup>65</sup> Jacobs, C. et al. 2019.

<sup>66</sup> Isoard, S. et al. 2013, Adaptation in Europe - Addressing risks and opportunities from climate change in the context of socio-economic developments, EEA Report No 3/2013.

<sup>67</sup> Füssel, H.M. et al. 2017.

<sup>68</sup> Kendrovski, V. et al. 2018.

<sup>69</sup> Füssel, H.M et al. 2019.

<sup>70</sup> Georgi, B. et al. 2016.

<sup>71</sup> Committee of the Regions, 2013, EU Strategy for Adaptation to Climate Change, Opinion ENVE-V-037.

<sup>72</sup> CoR Opinion ENVE-V-037.

<sup>73</sup> Isoard, S. et al 2013.

**Soft measures** include policy, legal or administrative initiatives that aim to change behaviours, increase the adaptive capacity of people, businesses and public authorities, or build knowledge and know-how<sup>74</sup>. These measures could include awareness raising campaigns for more vulnerable groups regarding how to protect themselves from heatwaves<sup>75</sup>, early warning systems or providing relevant stakeholders with information tools such as CCIV or risk assessments<sup>76</sup> to build their capacity to prepare for climate change impacts. Another type of soft measure could be taking insurance, for example, against damages from extreme weather events. The use of insurance can improve resilience and reduce the risks of climate change impacts. For instance, insurance mechanisms can offer financial compensation to foster recovery or provide information about existing risks<sup>77</sup>.

As certain knowledge gaps about adaptation persist (for details see section 3.4) information platforms such as Climate-ADAPT, other EU databases or national platforms are important types of soft measures that can aid the development and implementation of other adaptation measures. There are many sources available for LRAs and other decision-makers to learn about climate change risks, vulnerabilities and adaptation responses but navigating through the pool of information and data available can be challenging. Annex 2 provides a short library of useful sources and tools to boost LRAs’ capacities in the field of adaptation.

To successfully address the expected climate change impacts a combination of all three types of measures is often needed. The following table provides some examples for the main climate hazards identified in Europe.

**Table 3 Examples of the main climate hazards in Europe and potential adaptation measures**

Climate Hazard	Potential adaptation measures
Increased temperatures and heatwaves	<ul style="list-style-type: none"> <li>• <b>Grey measures:</b> <ul style="list-style-type: none"> <li>- Cooling of indoor public spaces: improving thermal insulation, vertical greenery, shading of transparent openings, windows and displays, green/reflecting roofs.</li> </ul> </li> <li>• <b>Green measures:</b> <ul style="list-style-type: none"> <li>- Increase and revitalization of green areas, parks and fountains in cities, notably to increase shade</li> </ul> </li> <li>• <b>Soft measures:</b> <ul style="list-style-type: none"> <li>- Assessments of vulnerability to high temperatures</li> <li>- Heat-wave action plans (such as toll-free information and assistance numbers, meal delivery and home care)</li> </ul> </li> </ul>

<sup>74</sup> Kurni, B. et al. 2017.

<sup>75</sup> Kendrovski, V. et al. 2018.

<sup>76</sup> Füssel, H.M et al. 2019.

<sup>77</sup> European Commission, 2018f, Using insurance in adaptation to climate change.

Climate Hazard	Potential adaptation measures
<b>Forest and wildfires</b>	<ul style="list-style-type: none"> <li>• <b>Green measures:</b> <ul style="list-style-type: none"> <li>- Agroforestry (a combination of trees and crop cultivation) can help reduce forest fires as it removes the dry vegetation most prone to fire at ground level.</li> </ul> </li> <li>• <b>Soft measures:</b> <ul style="list-style-type: none"> <li>- Vulnerability assessments</li> <li>- Early warning systems</li> </ul> </li> </ul>
<b>Droughts</b>	<ul style="list-style-type: none"> <li>• <b>Grey measures:</b> <ul style="list-style-type: none"> <li>- Improve irrigation systems in agriculture</li> </ul> </li> <li>• <b>Green measures:</b> <ul style="list-style-type: none"> <li>- Water retention spaces in the form of decentralized lakes and ponds</li> <li>- Increase green areas in cities, which absorb and retain water</li> </ul> </li> <li>• <b>Soft measures:</b> <ul style="list-style-type: none"> <li>- Early warning systems</li> <li>- Awareness raising on water consumption</li> </ul> </li> </ul>
<b>Extreme precipitation and floods</b>	<ul style="list-style-type: none"> <li>• <b>Grey measures:</b> <ul style="list-style-type: none"> <li>- Sustainable drainage systems</li> <li>- Dikes and dams</li> <li>- Widen roadside ditches</li> <li>- Reduce and open sealed surfaces (i.e. artificial, impenetrable surfaces like tar)</li> </ul> </li> <li>• <b>Green measures:</b> <ul style="list-style-type: none"> <li>- Green areas, green roofs, to help absorb excess water</li> <li>- Floodplain and wetland restoration</li> </ul> </li> <li>• <b>Soft measures:</b> <ul style="list-style-type: none"> <li>- Early warning systems (assessing vulnerability and predicting floods)</li> </ul> </li> </ul>
<b>Landslides</b>	<ul style="list-style-type: none"> <li>• <b>Soft measures:</b> <ul style="list-style-type: none"> <li>- Vulnerability assessments</li> <li>- Early warning systems</li> </ul> </li> </ul>
<b>Permafrost and ice melting</b>	<ul style="list-style-type: none"> <li>• <b>Grey measures:</b> <ul style="list-style-type: none"> <li>- Maintenance and restoration of mountain cliffs</li> </ul> </li> <li>• <b>Green measures:</b> <ul style="list-style-type: none"> <li>- Increase pastures and green spaces, which help regulate temperatures</li> </ul> </li> <li>• <b>Soft measures:</b> <ul style="list-style-type: none"> <li>- Permafrost and glacier monitoring</li> <li>- Vulnerability assessments</li> <li>- Early warning systems</li> <li>- Promotion of insurance for inhabitants of risk-prone areas</li> <li>- Car free tourism / sustainable tourism</li> </ul> </li> </ul>
<b>Coastal erosion</b>	<ul style="list-style-type: none"> <li>• <b>Grey measures:</b> <ul style="list-style-type: none"> <li>- Artificial dunes &amp; dune rehabilitation</li> <li>- Seawalls</li> <li>- Sea dikes</li> <li>- Beach nourishment</li> </ul> </li> <li>• <b>Green measures:</b> <ul style="list-style-type: none"> <li>- Wetland restoration</li> </ul> </li> <li>• <b>Soft measures:</b> <ul style="list-style-type: none"> <li>- Assessment/mapping of future erosion</li> </ul> </li> </ul>
<b>Sea level rise and coastal flooding</b>	<ul style="list-style-type: none"> <li>• <b>Grey measures:</b> <ul style="list-style-type: none"> <li>- Flood barriers</li> <li>- Relocation of infrastructure to higher altitudes</li> </ul> </li> <li>• <b>Green measures:</b> <ul style="list-style-type: none"> <li>- Restore and maintain wetlands, which can act as buffers</li> </ul> </li> <li>• <b>Soft measures:</b> <ul style="list-style-type: none"> <li>- Vulnerability assessments</li> <li>- Include rising sea levels in future urban planning</li> </ul> </li> </ul>
<b>Invasive alien species</b>	<ul style="list-style-type: none"> <li>• <b>Grey measures:</b> <ul style="list-style-type: none"> <li>- Underwater suction devices (to absorb invasive algae)</li> </ul> </li> </ul>

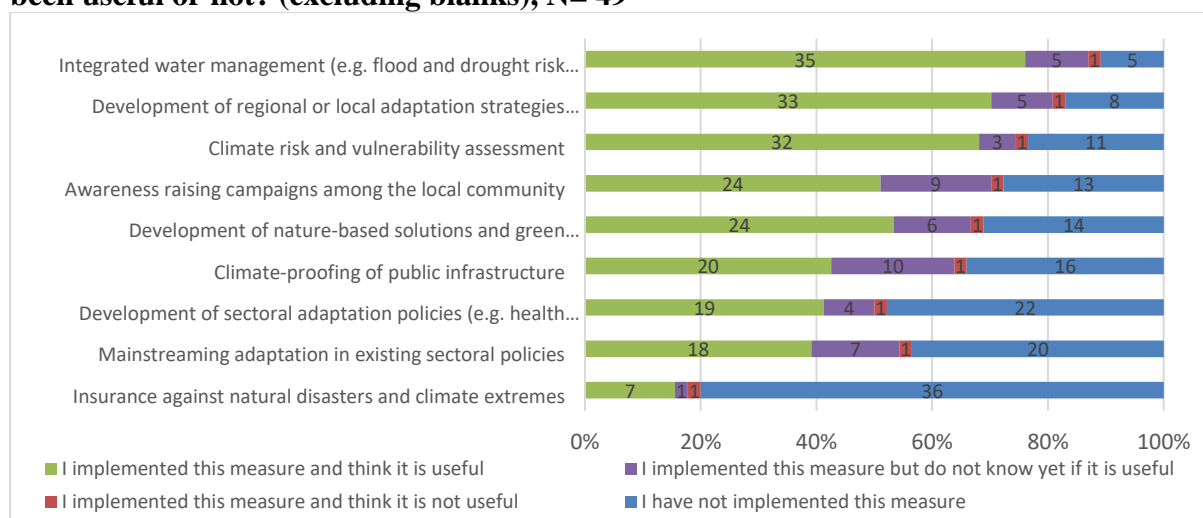


Climate Hazard	Potential adaptation measures
	<ul style="list-style-type: none"> <li>• <b>Green measures:</b> <ul style="list-style-type: none"> <li>- Crop rotations to revitalise soils and prevent pest infection</li> <li>- Introduction of natural predators (like mollusks for algae), with caution on potential unwanted negative consequences</li> </ul> </li> <li>• <b>Soft measures:</b> <ul style="list-style-type: none"> <li>- Identify the most problematic species</li> <li>- Track movements of species and put in place early warning systems (for example for beekeepers in the case of hornets)</li> </ul> </li> </ul>
Diseases and pathogens	<ul style="list-style-type: none"> <li>• <b>Soft measures:</b> <ul style="list-style-type: none"> <li>- Identify the most problematic vectors and pathogens</li> <li>- Track movement of vectors and pathogens and put in place early warning systems</li> <li>- Raise awareness and provide information on prevention measures</li> </ul> </li> </ul>

Source: Own analysis.

The survey among the LRAs indicate that there is a wide range of adaptation measures deployed at local level, almost always as a combination of grey, green and soft measures. Still, when taken together, soft measures such as risk assessments, awareness raising campaigns and development of local adaptation strategies, are the most frequently deployed category of measures. The most commonly used adaptation measure is integrated water management which can be considered a combination of grey and green measures (41 out of 49). Green measures such as nature-based solutions and green infrastructure is also used (31 out of 49), along with climate proofing of public infrastructure (31 out of 49) although to a lesser extent. In line with the findings of other studies and consultations, insurance seem to be less developed, only mentioned by a small number of respondents (9 out of 49). The figure below provides the detailed overview of their replies.

**Figure 4 Which adaptation measures have you implemented in your area? Have they been useful or not? (excluding blanks), N= 49**



### ***1.2.2 Synergies and trade-offs with other policy objectives***

Due to the interaction between adaptation and other policy areas, adaptation measures can have positive or negative impacts on other policy goals; similarly other policy measures can positively or negatively impact the ability of communities to adapt to climate impacts. Careful policy design and implementation is key to the maximisation of positive co-benefits, or synergies, and the minimisation of negative unintended consequences and trade-offs. These interactions are particularly clear in certain policy areas, including spatial planning, environment, climate change mitigation, energy, and health and social policy.

Many adaptation measures can be implemented together with other environmental measures to achieve co-benefits in both areas. For example, the development of green infrastructure can bring about not only climate adaptation but also various environmental benefits such as preserved biodiversity or enhanced ecosystem services. Integrating climate change adaptation into key environmental policy instruments, such as environmental impact assessment, environmental permitting, nature protection and water management, can help to maximise these synergies. Successful integration requires alignment of environmental and adaptation policies in spatial planning, a key area of local authority competence.

There are strong interactions between climate adaptation, mitigation and energy policy measures. Certain mitigation and energy efficiency measures, such as improved insulation for residential and commercial buildings helps households and businesses adapt to extreme temperatures, reduce energy consumption from heating and cooling, and more broadly, reduces GHG emissions and social vulnerability. However, other adaptation measures, such as water desalination, can increase energy demand and GHG emissions<sup>78</sup>. Most importantly, the successful implementation of mitigation measures (for example, deployment of renewable energy, energy efficiency or sustainable transport) that reduce the emissions of GHG in the atmosphere could halt the impacts of climate change or reduce their severity. This in turn could decrease the need for adaptation or make the implementation of adaptation measures easier.

In the area of social policy, reducing social vulnerability generally, through measures such as poverty reduction, improved access to health and social services, better service provision to vulnerable groups (for example, elderly, immigrants) is beneficial in its own right but also reduces the vulnerability of these groups to climate impacts. LRAs are central to efforts maximising such benefits. LRAs

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<sup>78</sup> Kovats, R. S. et al. 2014, Europe. *In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.*

participating in the survey stressed the need to integrate the social dimension in the adaptation responses, to be able to go beyond technical responses.

Achieving synergies between adapting to climate change and ensuring adequate provision of health and social services is even more critical in light of the current crisis. The COVID-19 pandemic coincides with increased frequency and intensity of climate impacts, creating both a risk of trade-offs between pandemic responses and adaptation measures as well as the opportunity to maximise synergies in the two policy areas. Together these challenges create ‘compound risks’ that potentially exacerbate existing racial and other socioeconomic disparities<sup>79</sup>. Responding to these risks also puts a significantly increased strain on the resources and personnel of public authorities, particularly at the local and regional levels of government where LRAs are often responsible for delivering health, social and emergency services. Policy measures that build the overall resilience of communities to global shocks and reinforce emergency preparedness can contribute to climate change adaptation goals as well as potential future infectious disease outbreaks. Where these efforts also seek to reduce the vulnerabilities of groups at risk of social exclusion, they will also reduce the risk of disproportionate social impacts of climate change.

These synergies and trade-offs highlight the importance of well-designed adaptation strategies and Involvement authorities, and communities, at the local and regional levels of policymaking can help to maximise synergies, minimise trade-offs and avoid unintended consequences.

### **1.3 The role of LRAs**

The adaptation measures described above are not in competition with each other, and the best results are achieved through a combination of different measures<sup>80</sup>. Given the potential for synergies between climate adaptation measures and other policy goals, and the risk of trade-offs, it is crucially important that adaptation measures are deployed in a strategic way so that synergies are maximised and trade-offs are minimised. The importance of holistic approaches was also mentioned by the survey respondents. From the viewpoint of LRAs, coherent policies across a wide range of fields will not only deliver more efficient results, but also prevent inaction in the field of adaptation because of competing political agendas.

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<sup>79</sup> Phillips, C. A., et al. 2020, ‘Compound climate risks in the COVID-19 pandemic’, *Nature Climate Change*, Vol. 10, July 2020, pp586-598

<sup>80</sup> Isoard, S. et al. 2013.

The participation of regional and local authorities is therefore essential in the design and implementation of adaptation efforts. With few exceptions such as large inter-regional infrastructure projects or legislation that is designed at national level, most of the adaptation measures will need to be designed and implemented at local level. This is particularly true for interventions in the areas where local and regional authorities play a key role, including urban planning, environmental management, water management, provision of health and social services, public housing, disaster risk reduction and response, transport and citizens awareness raising. In the same vein, LRAs are the most familiar with their own specific circumstances, which is a crucial point in the vulnerability assessments. Therefore, to design and implement successful adaptation strategies LRAs need to start by identifying and assessing the climate risks relevant for their territories, the likely impacts they would have on local socio-economic systems and develop adaptation responses that can address these impacts.

In the EU, cross-border cooperation between LRAs is also important as local areas mountainous or coastal regions will face similar challenges. A relatively small number of LRAs state that they already engaged in transboundary aspects of climate adaptation (15 out of 49) particularly in related to water management such as floods, droughts and water storage. EU networks and initiatives such as the Covenant of Mayors for Climate and Energy and the Interreg Programme are considered important tools for transboundary cooperation.

In order to design and implement climate adaptation measures, LRAs require a wide range of resources from technical expertise to financial instruments. As a result, climate adaptation is often challenging for many regions and municipalities and the approaches, level of awareness, and resources available to implement action can vary significantly<sup>81</sup>.

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<sup>81</sup> Georgi, B. et al. 2016.

## 2. Financing for climate adaptation

While the scale of investment needs associated with adaptation is uncertain, it is clear that dedicated resources will need to be mobilised to prepare for the impacts of climate change. Financing sources for climate action can generally be grouped as public and private sources. Public climate finance comprises funding from public budgets and public development or promotional banks at the EU, national or local level. Private climate finance includes finance from commercial banks, institutional investors (for example, pension funds and insurance companies), other financial market investors (for example, high net worth individuals, venture capital and equity providers), private companies and individuals<sup>82</sup>. While some mitigation actions, such as development of renewable energy and sustainable mobility, may generate returns for investors, adaptation actions might not always involve a profit or high rate of return. This can make adaptation investments less attractive, particularly, to private investors, which typically seek to maximise the return on their funds. Therefore, often public funding is needed for adaptation actions at the regional and local level.

### Box 2: Adaptation finance: What did the survey find?

The debates about adaptation funding mostly focus on costs associated with interventions to the built environment. However, LRAs stress that other costs associated with training of the staff, capacity building, providing support innovative projects, research and engaging with the public and other stakeholders can generate significant burden as well, and they should be taken into account as indispensable components of climate adaptation budgets.

The following sections provide an overview of the main sources for financing local adaptation available to LRAs in the EU, with a focus on public sources. In addition, some examples of strategies undertaken by LRAs are presented together with an outlook of how recent EU policy developments might affect the landscape of adaptation finance.

### 2.1 EU financing sources for adaptation

The main EU sources of financing for adaptation are funds within the EU budget and the European Investment Bank (EIB). To ensure its climate action commitments can be supported, the EU has set a target of spending at least 20% of its 2014-2020 budget on climate-related actions (including both mitigation and adaptation). This mainstreaming target will be increased to 25% in the 2021-2027

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<sup>82</sup> Rademaekers, K. et al. 2017, Assessing the European clean energy finance landscape, with implications for improved macro-energy modelling, Trinomics et al. report for the European Commission, Directorate-General for Energy.

financial period<sup>83</sup>. Together with specific fund objectives this target has managed to ensure climate is integrated across different EU spending programmes. Nevertheless, the lack of differentiation between mitigation and adaptation in the target means that both objectives are not necessarily attracting equal amounts of expenditure<sup>84</sup>. In practice the spending on mitigation and adaptation is not tracked or reported separately<sup>85</sup> and the exact share of expenditures available or dedicated specifically to adaptation is not known for most EU funds. Therefore, this section looks at EU sources for climate finance in general as the programmes available can usually invest in both mitigation and adaptation actions. The key funds for supporting climate action will remain largely similar in the next EU financing period<sup>86</sup>.

One of the largest sources for climate investments are the European Structural and Investment Funds (ESIF). They comprise five different funds – the European Regional Development Fund (ERDF), the Cohesion Fund (CF), the European Social Fund (ESF), the European Agricultural Fund for Rural Development (EAFRD) and the European Maritime and Fisheries Fund (EMFF). The ERDF, CF and ESF are largely focused on ensuring territorial cohesion in the Union by investing in objectives related to economic and social development. Even though they mostly focus on mitigation actions (for example, renewable energy, energy efficiency, sustainable transport), they can also invest in measures that ultimately contribute to adaptation objectives. For instance, the ERDF and CF can support environmental protection and implementation of the EU environmental acquis through measures for biodiversity conservation, waste management, water management and flood risk protection. The ESF can invest in life-long learning and re-skilling programmes, which can support the adaptation of the labour force to climate change impacts and the low-carbon transition<sup>87</sup>. The scope of support available under the EMFF and the EAFRD is focused on climate action in the aquaculture and agriculture sectors. Both funds can invest in measures that reduce GHG emissions in those sectors and can contribute to the development of sustainable fisheries and agriculture and climate-resilient coastal and rural areas<sup>88</sup>.

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<sup>83</sup> COM(2018) 321 final.

<sup>84</sup> Forster, D. et al. 2017, Climate mainstreaming in the EU Budget: preparing for the next MFF, Ricardo Energy & Environment et al. report for the European Commission, Directorate-General for Climate Action.

<sup>85</sup> European Court of Auditors, 2016, Spending at least one euro in every five from the EU budget on climate action: ambitious work underway, but at serious risk of falling short, Special Report 31.

<sup>86</sup> According to the European Commission's 2018 proposals for the next MFF the main sources for climate finance from the period 2014-2020 remain largely the same. However, in May 2020 the Commission updated its MFF proposal and published a proposal for its pandemic recovery plan (COM(2020) 442 final). This proposal included the Next Generation EU instrument, which included new instruments that could finance climate action, notably the proposed EUR 560 billion Recovery and Resilience Facility.

<sup>87</sup> Rossi, L. Gancheva, M. and O'Brien, S. 2017, Financing climate action: opportunities and challenges for local and regional authorities, Milieu study for the European Committee of the Regions.

<sup>88</sup> [Covenant of Mayors. Financing opportunities for Sustainable Energy & Climate Action Plans](#)

The ESIF programmes also include territorial integrated systems that allow the combination of different objectives and spending programmes to invest in integrated urban and territorial strategies. The Community-led Local Development and the Integrated Territorial Investments are territorial integrated systems that may be used by LRAs to support adaptation actions in combination with other local objectives<sup>89</sup>. In addition, the ESIF can support initiatives which specifically target LRAs and can support them in the testing of new policies (see the next box).

### **Box 3: Urban Innovation Actions (UIA)**

Funded through the ERDF and specifically aimed at urban authorities, UIA provides urban areas with resources to test new and unproven solutions for urban challenges. This will allow urban authorities to take risks, experiment and put innovative research outcomes into practice. UIA can fund up to 80% of a project and can help capture and share the knowledge generated through the innovative project. UIA covers a variety of topics, including climate adaptation.

Website: <https://www.uia-initiative.eu/en>

The ERDF also invests in European Territorial Cooperation (or Interreg), which supports common challenges across regions and represents the main EU source of financing for transboundary investments. There are three strands of Interreg programmes, including:

- Cross-border cooperation (Interreg A) covering border regions from neighbouring countries;
- Transnational cooperation (Interreg B) covering the 15 European macro regions (for example, Baltic Sea, Danube, Alpes);
- Interregional cooperation (Interreg C) covers all Member States through four pan-European programmes for experience and knowledge sharing<sup>90</sup>.

Depending on the specific priorities of each spending programme, Interreg could be a suitable source for addressing transboundary adaptation challenges and exchanging practices across LRAs (see the next box).

### **Box 4: URBACT**

URBACT III is one of the Interreg C pan-European programmes in the period 2014-2020. Its objective is to help cities work together to develop integrated solutions for common urban challenges. By facilitating networking, capacity building and dissemination it aims to improve the cities' capacity to manage sustainable urban policies, improve the design and implementation of urban policies and share knowledge and know-how. Environment is one of the five major urban topics covered by the programme. It includes different themes such as carbon neutrality, circular economy and climate adaptation.

Website: <https://urbact.eu/>

<sup>89</sup> Rossi, L. Gancheva, M. and O'Brien, S. 2017.

<sup>90</sup> [European Commission, Interreg: European Territorial Cooperation](#)

Investments in mitigation and adaptation can also be supported under the EU research and innovation programme – Horizon 2020, and the EU environment action programme – LIFE. LRAs can partner with researchers and other stakeholders to access funding for adaptation-related research under Horizon 2020 (see the next box). Pilot testing, demonstration, capacity building and awareness raising projects on adaptation can be funded under LIFE. A number of financial instruments are also available under the EU budget, for example the European Fund for Strategic Investments and financial instruments under ESIF and LIFE. However, they are primarily targeting mitigation measures such as energy efficiency rather than adaptation<sup>91</sup>.

#### **Box 5: JPI Urban Europe**

Co-funded by Horizon 2020, JPI Urban Europe aims to provide relevant solutions and improvements for cities by facilitating transboundary research and cooperation between different stakeholders. Its purpose is to connect public authorities, civil society, scientists, innovators, business and industry to provide a new environment for research and innovation. Its calls cover several thematic priorities, including ‘environmental sustainability and resilience’.

Website: <https://jpi-urbaneurope.eu/>

The survey results paint a similar picture. EU funds are used to varying degrees by the LRAs. The most important EU funds mentioned by the respondents were Cohesion Policy, the European Agricultural Fund for Rural Development and the Life programme.

In addition to the EU budget, the other main source of public financing for climate action in the EU is the EIB. The Bank has a target of spending at least 25% of its resources, across all operations, on climate, which it has exceeded in recent years and plans to raise to 50% by 2025<sup>92</sup>. This suggests the EIB would be an important public source of financing that LRAs can tap into for adaptation investments. In addition to ‘traditional’ products such as loans, equity and guarantees, the EIB offers a number of blending instruments (i.e. financial products that combine EIB lending with grants from partner institutions). One of its blending products is the Natural Capital Financing Facility (NCFE). The NCFE combines EIB resources with LIFE funding to support projects that promote the conservation, restoration and management of natural capital for biodiversity and adaptation benefits. It can be particularly targeted to urban adaptation by supporting cities invest in green infrastructure (for example, creation of green corridors, planting of trees, green roofs, greening of grey surfaces, permeable parking, rain gardens, rehabilitation of industrial sites or abandoned land) and blue infrastructure (for example, nature-based flood protection, sustainable urban drainage systems, retention basins,

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<sup>91</sup> Rossi, L. Gancheva, M. and O’Brien, S. 2017.

<sup>92</sup> [EIB. Climate Action](#)



lakes, ponds or watershed management). Such projects can be stand-alone or integrated in broader urban or social housing investment schemes<sup>93</sup>. The survey findings suggest that LRAs are aware of the EIB financing instruments (22 out of 49) but the level of uptake remains low (6 out of 49).

Nevertheless, navigating the array of EU resources available for climate action and particularly adaptation can be challenging. The replies to the survey suggest that navigating the complex landscape of EU funding and complex application procedures can be barrier to access these tools. As a response, the European Commission has put in place guidance mechanisms. The following box provides some examples of available guidance documents and support services that LRAs can benefit from.

#### **Box 6: Examples of guidance documents and support services for EU funds**

The European Commission's 'A Guide to EU Funding' provides basic information about how the EU budget works and introduces stakeholders to key terminology: <https://op.europa.eu/en/publication-detail/-/publication/7d72330a-7020-11e7-b2f2-01aa75ed71a1>

The European Parliament's 'Guide to EU Funding 2014-2020' outlines the different EU funding available per policy theme and is available in several languages: [https://www.europarl.europa.eu/EPRS/Funding\\_Guide.pdf](https://www.europarl.europa.eu/EPRS/Funding_Guide.pdf)

The Covenant of Mayors provides an 'Interactive Funding Guide' where its signatories or other interested stakeholders can find out about different EU funds and the types of investments they can support: <https://www.covenantofmayors.eu/support/funding.html>

The European Investment Advisory Hub provides various services to potential beneficiaries of EU financing, including project development support, financial advice, guidance and training: <https://eiah.eib.org/about/index>

In addition to managing the Hub, the EIB offers a number of advisory services (for example, JASPERS, ELENA, JESSICA) that can help beneficiaries prepare successful projects for different funds: <https://www.eib.org/en/products/advisory-services/index.htm>

## **2.2 Other financing sources for adaptation**

Local and regional adaptation can also be financed from the public budgets of national, regional or local administrations. The survey findings clearly demonstrate that main funding resource for adaptation remains the public budgets (38 out of 49 mentioned 'own resources'). Furthermore, in some Member States financing is also available from national promotional banks, environmental agencies or other public authorities. Green bonds are commitments that the bond

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<sup>93</sup> [EIB, Natural Capital Financing Facility](#)

issuer will use the proceeds to finance exclusively environmentally sustainable activities. These could be another instrument available to LRAs to diversify their funding sources and raise funds for investing in adaptation projects<sup>94</sup>. Crowdfunding could be an alternative option for LRAs to raise adaptation funds, however this is a fairly new and untested approach that, for now at least, is typically used for small projects<sup>95</sup>. Additional financing might also come from international institutions such as the European Bank for Reconstruction and Development or the European Economic Area grants, which are available to LRAs in certain Member States<sup>96</sup>. The former can provide loans for large-scale projects, while the latter targets primarily information exchange and strategy development<sup>97</sup>.

Among the private sources of financing, LRAs might be eligible for obtaining resources from commercial banks or institutional investors. However, the survey revealed that private financing remains considerably underexploited with only a small number of respondents having already use such tools (2 out of 49). Several reasons can explain the situation. For instance, adaptation projects might not be the most obvious investment choices for such investors. For instance, commercial banks tend to prefer projects with well-established technologies and often prefer projects with mature renewable energies as their main climate investments. Institutional investors manage and invest pooled resources on behalf of beneficiaries or clients. Bound by this accountability, they tend to choose conservative and prudent investments, often in large projects, with guaranteed returns. However, a growing number of institutional investors are committing to stop financing carbon-intensive investments<sup>98</sup>. Even though this may open up additional funds for climate projects, it is not yet clear to what extent institutional investors will direct their resources to such projects and if adaptation measures will be attractive for their portfolios.

Although LRAs might face some challenges is obtaining adaptation financing from certain sources (for details see Section 2), they could foster direct investments by local stakeholders such as foundations, real estate developers, companies, house owners or individuals. Facilitating local stakeholders' own investments in adaptation measures could be promoted through integration of adaptation needs in urban planning and design regulations, building standards, local policy regulations on water management, health or nature protection<sup>99</sup>.

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<sup>94</sup> Rossi, L. Gancheva, M. and O'Brien, S. 2017.

<sup>95</sup> Rademaekers, R. et al. 2017.

<sup>96</sup> Support from both institutions is available for Bulgaria, Croatia, Cyprus, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. European Economic Area grants are also available for Malta and Portugal.

<sup>97</sup> Georgi, B. et al. 2017, Financing urban adaptation to climate change, EEA Report No 2/2017.

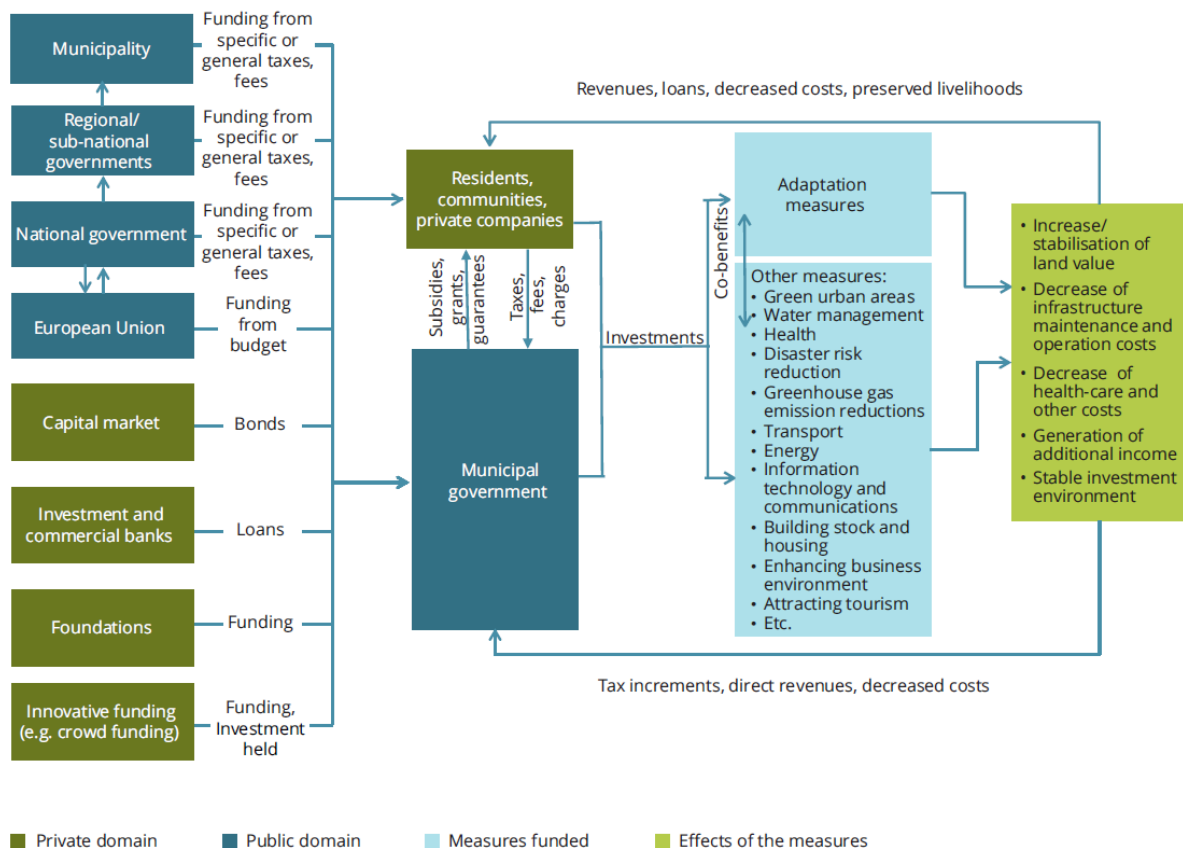
<sup>98</sup> Rademaekers, K. et al. 2017.

<sup>99</sup> Georgi, B. et al. 2017.

## 2.3 Examples of financing strategies for adaptation

As evidenced by the previous sections there is a wide variety of sources available at the EU, national and sub-national levels that can fund adaptation (see the following figure for an overview of the main types of financing sources and the adaptation measures they can support). There is no ‘right’ choice or specific solution LRAs should follow when investing in adaptation. Many adaptation measures are linked to investments in other sectors, such as water management, transport, nature conservation or health. Therefore, different sources of financing (including those geared towards specific sectors) can be complementary and can provide adaptation benefits while costs are reduced<sup>100</sup>.

**Figure 5 Main types of adaptation financing sources, stakeholders and measures**



Source: Georgi, B. et al. 2017, p.8

The experiences of real-life case studies sheds light on lessons for adaptation financing studies. A 2017 EEA analysis of 11 case studies of urban adaptation projects confirms that different financing strategies can be successful<sup>101</sup>. Combining funds from different types of sources, government levels and sectors (for example, water management, urban revitalisation) can open up resources for

<sup>100</sup> Georgi, B. et al. 2017.

<sup>101</sup> Georgi, B. et al. 2017.

adaptation even when those were not originally aimed for it. Furthermore, some ‘seed money’ from municipal governments or other public sources can be a catalyst for attracting financing from other investors. Bundling multiple smaller projects together (even across municipalities or local authorities) could be another strategy for attracting financing, especially from investors interested in large projects. In addition, awareness raising and stakeholder engagement campaigns can facilitate local support for projects and offer additional opportunities for raising funds from individuals and private stakeholders. Last but not least, considering climate resilience in infrastructure investments can provide benefits at little extra costs.

Therefore, it is critical that LRAs are aware of the different financing possibilities for adaptation and are ready to use creative ways for combining different resources, objectives and projects in their territories. This can be facilitated by integrating adaptation consideration in different sectoral policies and local development investment plans early on in the planning process.

**Box 7: Financing strategies: What did the survey find?**

To counter the impacts of limited local budgets dealing with urgent, day to day priorities; the participants propose long-term funding resources made available to the LRAs, tailored to their specific needs. Consistent, sustainable investment and other financial instruments, both from national and EU budget should be easily accessible to LRAs. New, innovative ways of accessing funding should encouraged. Examples include, integrating climate adaptation into infrastructure maintenance budgets, creating PPPs, tax measures, loans and subsidies.

## **3. Main challenges for LRAs implementing adaptation policies**

As highlighted in the previous sections, the impacts of climate change will be highly diverse and context-specific making the implementation of tailor-made solutions critical. At the same time a variety of adaptation measures and financing source can be deployed to improve the preparedness of local communities. Nevertheless, LRAs face different challenges when planning or implementing adaptation policies and measures and this can put in jeopardy their capacity to undertake climate strategies that take advantage of opportunities while successfully managing risks. The different types of challenges, presented in more detail in the rest of this section, work as interrelated factors that reinforce each other and should not be seen in silos. This suggest that addressing one challenge would very likely lead to improvement in others, and barriers left unaddressed will likely to continue to undermine efforts in other areas.

### **3.1 Lack of political leadership and commitment**

The overarching strategic visions regarding climate change adaptation are shaped at higher levels of policy making, but their implementation is almost inevitably linked to all levels of government from national to regional to local. Invariably the success of all policies will be determined by political action. In fact, lack of political commitment at different levels is frequently mentioned by various sources as an important challenge, hindering adaptation efforts at all levels. For instance, the absence of a strong political will at national level is likely to result in less ambitious National Adaptation Strategies (NAS) or other policy frameworks, which will in turn limit the action at local level<sup>102</sup>. In other cases, even with an ambitious national adaptation agenda, political will might be lacking at lower levels of governance, undermining the effect pushing for action from higher to lower levels. The survey underlined the lack of political will at local, regional and national level as the key challenge (40 out of 49). Furthermore, conflicts between the policies is also an important barrier (31 out of 49), which is potentially related to lack of political will to take action in the area of adaptation.

The lack of political ambition can be related to various factors. Sometimes it is a structural issue: the inherent characteristics of adaptation necessitate long-term planning spanning several decades. In sharp contrast, political decisions respond

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<sup>102</sup> Breil, M. et al. 2018.

to much shorter feedback cycles (for example, municipal or national elections)<sup>103</sup>. This structural shortcoming is only exacerbated by the existence of competing political agendas with sometimes conflicting priorities, as also identified by the survey. For instance, there might be contradictory elements between nature protection measures, farming activities and flood defence measures<sup>104</sup>. As a result, it can be difficult for the policy makers to create a coherent framework for planning interventions<sup>105</sup>. Another related factor is budgetary limitations: with the ever-growing constraints on public budgets, policy makers might be less willing to give priority to climate adaptation compared to more pressing issues with readily visible impacts. Furthermore, when the adaptation measures are costly without producing immediate results, this is considered a less desirable path of action in a system that relies on short-term cost-benefit considerations<sup>106</sup>.

Lack of certainty and lack of knowledge are other factors that contribute to the lack of political commitment on adaptation. This is related to lack of knowledge and awareness by administrations as well as gaps in the current scientific knowledge, particularly on projections of climate impacts at the local level (see section 3.4). Making political decisions based on uncertainty in an ever-changing dynamic system is a challenge that political leaders are not always willing or able to face<sup>107</sup>.

Another factor is related to institutional setting and legislation: sometimes the responsibilities of different government levels are not clearly defined and coordination between them is not ensured. For instance, this can be the case for NAS<sup>108</sup>. This results in a general lack of action as different government levels might fear duplication (for example, doing the work that somebody has already done or will do, or doing the work which might be carried out by somebody else)<sup>109</sup>. This point was also mentioned by the survey participants who stressed the importance of EU and national level policy frameworks providing clear directions and roles for actors at different levels.

#### **Box 8: Multi-level governance for climate adaptation: What did the survey find?**

LRA who participated to the survey point out to the complementarities between different levels of governance. The EU institutions provide strategic direction and impetus for climate action. The role they play is considered very important for supporting scientific research, providing support for implementation and better governance, target setting and monitoring as well as building bridges between the diverse landscape of LRAs in sharing experience and

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<sup>103</sup> McGuinn, J. et al. 2013, Study of Adaptation Activities at Regional Level in the EU, Milieu Study for the European Commission, Directorate-General for Climate Action.

<sup>104</sup> Conference of Peripheral Maritime Regions, 2017, Review of EU Strategy on Adaptation to Climate Change.

<sup>105</sup> Jacobs, C. et al. 2019.

<sup>106</sup> Breil, M. et al. 2018.

<sup>107</sup> Füssel, H.M et al. 2019.

<sup>108</sup> McGuinn, J. et al. 2013.

<sup>109</sup> McGuinn, J. et al. 2013.

knowledge. National governments are seen by respondents as enablers for action by setting the general legislative framework and removing existing barriers, ensuring better governance, defining clear roles for different levels of government, providing resources and support for implementation (financial, technical and others) and supporting exchange between different LRAs in their territory. In return, empowered by the support from both EU and national levels, the local authorities hold the key to the identification of the best approaches to adaptation that suit their specific needs.

## 3.2 Insufficient administrative capacity

Another frequent challenge is the insufficient administrative capacity of regional or local actors. Often, adaptation strategies and action plans rely considerably on the implementation at local level, without providing additional support that corresponds to these ambitions<sup>110</sup>. Without question, a very important challenge here is limited financial resources (see section 3.3); however, there are other dimensions to insufficient capacity that go beyond financial constraints. Key among these is the lack of human resources, particularly the lack of personnel with necessary skills and expertise on adaptation issues<sup>111</sup>. The replies to the survey provide a similar picture: lack of awareness and technical expertise among the staff is the third most frequently mentioned challenge by the LRAs (28 out of 49). An important remark is that there is often not a dedicated unit or staff working on adaptation at local administrations and the work is usually carried out by employees who do not have expertise on the issue. Furthermore, participants also mentioned there is a need for coordination staff to provide liaison between different regions and across departments so that efforts can be mainstreamed, and knowledge shared. Several root causes can be identified: climate adaptation is a new field of expertise and it can be hard for the public actors at different levels of government to find relevant professionals to hire. In the same vein, it can be hard to cultivate relevant expertise among existing staff due to lack of training. Another factor is the difficulty in building expertise in professional structures with high staff turnover<sup>112</sup> and the difficulty for the non-expert administrators to identify the necessary skills.

Shortcomings in incorporating expertise and knowledge generated by own or other projects and collaborations is another important aspect. It has been reported that local authorities might experience difficulties in fully exploiting the experience gained through adaptation projects they carried out or might not be fully able to use the knowledge created by others to implement projects

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<sup>110</sup> Breil, M. et al. 2018; and Füssel, H.M et al. 2019.

<sup>111</sup> Georgi, B. et al. 2016; and Smithers, R. et al. 2018.

<sup>112</sup> McGuinn, J. et al. 2013.

themselves<sup>113</sup>. This points out to an issue of knowledge transfer both within and across different LRAs which is essential to accumulate know-how and expertise.

Insufficient administrative capacity has multiple implications: without specific and adequate knowledge and understanding of the issue, LRAs find it difficult to take necessary actions; they find it hard to operationalise policy needs into real action<sup>114</sup>. Local projects might experience delays or even be abandoned due to lack of staff<sup>115</sup>.

Another direct result of the lack of capacity to navigate the landscape of climate adaptation is the difficulty local actors face in accessing available funds. For instance, handling complicated application formalities and negotiation procedures for funding and often requires human resources that are simply not available to smaller municipalities<sup>116</sup>. In the same vein, lack of administrative capacity hinders the access to the necessary knowledge. In a limited timeframe, an abundance of information on climate adaptation has been made generated; however, the mere presence of information does not automatically lead to efficient use by the target audience. In the lack of adequate capacity, such abundance can even be counter-productive, creating confusion<sup>117</sup>. These observations regarding access to funding and knowledge point to a vicious circle: the local and regional authorities who need the most support are also the ones who have the greatest difficulties in accessing it.

Other consequences of limited administrative capacity include difficulties in designing policies at local level tailored to vulnerable groups<sup>118</sup> and difficulties in creating and sustaining climate change adaptation platforms<sup>119</sup>.

### 3.3 Insufficient financial resources

The lack of sufficient financial resources to fund adaptation measures remains a challenge for LRAs and is often cited as a barrier to implementing adaptation policies and measures at the regional and local level<sup>120</sup>. Unsurprisingly, the survey

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<sup>113</sup> European Environment Agency, 2018, Addressing climate change adaptation in transnational regions in Europe, Briefing no. 17/2018.

<sup>114</sup> Bretagne Region, 2018.

<sup>115</sup> McGuinn, J. et al. 2013.

<sup>116</sup> Georgi, B. et al. 2017.

<sup>117</sup> Committee of the Regions, 2017, Towards a new EU climate change adaptation strategy: taking an integrated approach, Opinion ENVE-VI/015.

<sup>118</sup> Breil, M. et al. 2018.

<sup>119</sup> Street, R. et al. 2015, Overview of climate change adaptation platforms in Europe, EEA Technical report No 5/2015.

<sup>120</sup> McGuinn, J. et al. 2013; Smithers, R. et al. 2018; and

Lucat, E. et al. 2016, Regional and Local Adaptation in the EU since the Adoption of the EU Adaptation Strategy in 2013, Ecologic Institute, ICLEI and UCL study for the European Committee of the Regions.



identified insufficient financial resources as the second-most significant challenge that LRAs have to face (36 out of 49). The underlying reasons for this lack of resources include limited public funding, conflicting objectives for funding, lack of awareness about available funding, unsuccessful funding applications, and the cost of the adaptation measures.

The first two factors are often linked as public budgets at all levels of governance need to balance expenditures on different priorities and policies. As suggested by the survey participants, this can be more limiting for local administrations with smaller budgets who have to deal with more pressing issues in their day to day operations. Nevertheless, the shortage of public financing is exacerbated in cases where budgets are determined at the national level in a top-down manner limiting the flexibility for regions and municipalities to decide how to spend their resources. Budgets are also often based on macro-economic considerations that prioritise cost reduction and can result in cuts to spending on policies such as climate change, sustainability or social services, if those are not viewed as a priority<sup>121</sup>. Therefore, a lack of integration of adaptation or climate objectives in general, into sectoral policies and funding programmes can further limit the resources available as adaptation is seen as an additional or non-priority policy. In addition, combining mitigation and adaptation financing under a common policy and category of climate expenditures often results in mitigation measures overcrowding adaptation ones as the former are better understood<sup>122</sup>. Hence, mainstreaming adaptation objectives across policies and spending programmes across all governance levels, especially for measures that offer synergies across sectors (for example, water management, public health), can ensure that adaptation is prioritised and some resources for investments are available.

The insufficient amount of national, regional or local public financing for adaptation makes the use of complementary EU and other sources critical to investing in adaptation. However, LRAs often lack awareness of the available opportunities for funding adaptation<sup>123</sup>. Application processes for funding can be burdensome and challenging for LRAs with limited technical capacity, and when they are unsuccessful, they can further dissuade LRAs from exploring different opportunities or attempting to access additional climate financing. The use of non-grant sources such as loans, guarantees and other financial instruments can be more complex due to requirements on the minimum size of projects, their ‘bankability’, or returns on investment, which might not be realistic for all adaptation measures<sup>124</sup>. This makes the availability of support services and guidance for LRAs critical. On the one hand, as also demonstrated by the survey

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<sup>121</sup> Breil, M. et al. 2018.

<sup>122</sup> McGuinn, J. et al. 2013.

<sup>123</sup> Georgi, B. et al. 2016.

<sup>124</sup> Rossi, L. Gancheva, M. and O’Brien, S. 2017; and Georgi, B. et al. 2017.

findings, guidance is needed on raising awareness and accessing EU funds<sup>125</sup>. On the other hand, further support is needed to help LRAs prepare successful fund applications for adaptation projects (for example, through available EIB programmes for technical assistance)<sup>126</sup> and attract additional private investors (for example, by designing specific incentives)<sup>127</sup>.

Another factor underpinning the shortage of financial resources for adaptation is the costs of the measures. Some adaptation measures require substantial investments that are prohibitive for some LRAs<sup>128</sup>. For instance, the survey respondents indicated that interventions to the built environment such as water infrastructure and coastal management are important adaptation measures that necessitate considerable investment. Nevertheless, there are adaptation measures that can be linked to investments in other sectors while improving the resilience of infrastructure can provide savings in future costs<sup>129</sup>. Therefore, a better understanding of climate-related risks and risk management strategies, including insurance, is required to help make public budgets more resilient<sup>130</sup>. A better understanding of local climate risks and vulnerabilities can help LRAs anticipate the associated costs and benefits of different adaptation measures better and thus plan their spending accordingly. In addition, an understanding of the full range of adaptation measures available can help avoid an over-reliance on grey adaptation measures, such as engineering responses, which are often more costly.

#### **Box 9: Insurance and climate adaptation: What did the survey find?**

Insurance is one of the least developed financial tools to tackle the costs of climate adaptation. Some barriers identified include lack of knowledge among the local authorities as to how insurance can be used for climate adaptation, legislative barriers which prevent them using private insurance, the perceived role of insurance as a remedy tool where as adaptation focuses on prevention and lack of appropriate products from the insurance sector.

### **3.4 Knowledge gaps about climate change and adaptation**

Apart from the political, human and financial resources constraints, LRAs are also faced with more general knowledge gaps surrounding both climate change and climate change adaptation. Several main knowledge gaps can be identified.

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<sup>125</sup> Climate Alliance, 2017, Implementing adaptation to climate change at the local level, Resolution; and Conference of Peripheral Maritime Regions, 2017.

<sup>126</sup> Georgi, B. et al. 2017.

<sup>127</sup> Convention of Scottish Local Authorities, EU Climate Adaptation Strategy Evaluation, Response for Public Consultation.

<sup>128</sup> Conference of Peripheral Maritime Regions, 2017.

<sup>129</sup> Georgi, B. et al. 2017.

<sup>130</sup> FERMA, 2018, FERMA contribution to the European Commission evaluation of the EU's Strategy on Adaptation to Climate Change.

The first gap is a lack of localised data on future climate trends and extreme weather events. The implementation of effective climate change adaptation measures greatly depends on the ability to predict, detect and understand long-term local climate behaviours, which in turn enables the identification of specific local vulnerabilities and adaptation needs. Downscaling climate change research to the local level, however, remains challenging due to the lack of reliable meteorological data and difficulties in selecting appropriate statistical models<sup>131</sup>. Most weather and climate related datasets are fragmented and incomplete, with great disparities in the amount of information available between regions<sup>132</sup>. In addition, when data and research are available, they are generally not easily accessible or freely shared with public authorities. This was also observed based on the survey replies, with a relatively significant number of respondents citing the lack of scientific data and information as a main challenge (21 out of 49). Specifically, they have stressed the need for data specific to local context, scenario modelling, decision making tools (for instance evaluating which option is the best approach) and robust datasets spanning longer time periods. The importance of local data for local authorities is a key theme with many noting that data is often not specific to the region and downscaling national data is not easy or even possible.

The second gap is a lack of knowledge on the socio-economic impacts of climate change — particularly at local level. Knowledge in this area has improved over recent years, with many EU Member States having conducted CCIV and risk assessments. However, there is still insufficient understanding of the impacts of climate change in specific sectors (especially in the transport, agriculture, energy and human health sectors) and, crucially, also insufficient understanding of the indirect and spill-over effects of climate change across different sectors. In addition, more CCIV assessments, which consider regional specificities, such as mountain, coastal, fluvial or urban challenges, are crucial to help develop regional/local adaptation measures<sup>133</sup>. A key challenge in this regard is the limited information available concerning the impacts of past climate-related events (economic, human and ecological), which can support better assess future impacts<sup>134</sup>. This was another point emphasised by the LRAs participating in the survey: beyond climate data, information on the socio-economic dimension of climate adaptation is also needed to support decision-making.

The third gap is a lack of knowledge on concrete adaptation measures and solutions available. There is insufficient research focusing specifically on climate

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<sup>131</sup> Kurni, B. et al. 2017.

<sup>132</sup> Kurni, B. et al. 2017; and Conference of Peripheral Maritime Regions, 2017.

<sup>133</sup> Füssel, H.M. et al. 2017.

<sup>134</sup> Kurni, B. et al. 2017.

change adaptation measures, as it is still often seen as being part of the same policy field as climate change mitigation<sup>135</sup>. While both have synergies, climate adaptation nonetheless requires specific measures which focus on the long-term. Climate change adaptation measures must be tailor-made to local circumstances, which reduces the pool of relevant research and information available to individual LRAs. Increased micro-level case studies and exchange of best practice can, therefore, help transfer knowledge between LRAs facing similar challenges. The participants in the survey also emphasised the importance of knowledge and experience sharing as well as identification and dissemination of good practices between the LRAs. This is already supported to an extent through the Covenant of Mayors programme; however, some LRAs noted that often the work under this initiative is more focused on mitigation. This will help better understand selection criteria for measures, challenges in implementation and how to integrate climate adaptation within routine decision-making and planning<sup>136</sup>.

Lastly, there is a lack of knowledge on the relative costs and benefits of climate adaptation. The inherent uncertainty linked to climate change coupled with the knowledge gaps mentioned above, make it extremely difficult to assess the extent to which possible measures will be effective and proportional to the costs invested. It is also difficult to base calculations on existing climate adaptation measures, as the environmental, economic and social costs/benefits of an action may only be visible in the future or never fully understood<sup>137</sup>. All these factors impede the estimation of the investment needs associated with adaptation and thus undermine the capacity of public authorities to adequately plan resources for these needs. Combined, the different knowledge gaps on climate change and adaptation hinder also the estimation of risks, which is crucial for the development of insurance policies that can help different actors cope and respond to climate change. Ultimately, this uncertainty feeds into political inertia and undermines the efforts of policy efforts who want to take bold action. The need for a better understanding of costs and benefits was mentioned by the survey respondents as well. They stressed that a better understanding is needed of how to estimate and demonstrate the benefits of action, compared to the costs of non-action, to be able to better make the case for climate adaptation.

All these knowledge gaps point to the need for exchange platforms and increased cooperation between scientists, weather stations, researchers, businesses and public authorities<sup>138</sup>. These exchange platforms should help:

(1) identify local climate changes; (2) evaluate the impacts of these changes; (3)

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<sup>135</sup> McGuinn, J. et al. 2013.

<sup>136</sup> Füssel, H.M. et al. 2017.

<sup>137</sup> Füssel, H.M et al. 2019.

<sup>138</sup> Climate Alliance, 2017; and Conference of Peripheral Maritime Regions, 2017.

elaborate tailored-made adaptation measures; and (4) assess the relative costs/benefits of these solutions. As mentioned above, the EU can play an important role in this regard. A key consideration in this regard, however, is to ensure that the information, data and research gathered is intelligible for non-experts and easy to translate into policymaking<sup>139</sup>. Recent years have seen the multiplication of different resources and indicators using different methodologies and scenarios, which could lead to confusion, inconsistencies and conflicting information for LRAs<sup>140</sup>.

**Box 10: Knowledge gaps: What did the survey find?**

Scientific publications are an important source of information for the LRAs to learn about climate adaptation (35 out of 49). Equally important are Covenant of Mayors (32 mentions), national adaptation platforms (31 mentions) and reports from the IPCC and other international organizations (30 mentions). Taking part in international efforts, such as under UN Habitat and Urban Agenda is considered another way of learning about climate adaptation.

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<sup>139</sup> McGuinn, J. et al. 2013.

<sup>140</sup> Street, R. et al. 2015.



## 4. Conclusions and recommendations

### 4.1 Mainstreaming adaptation in EU policies

#### *4.1.1 Adaptation and EU climate and energy policy*

The non-binding nature of the EU Adaptation Strategy has been reported to be a barrier to undertake decisive action in the area of adaptation at local and regional level<sup>141</sup>. If the Adaptation Strategy remains as such, one way of addressing this may be to create links between the latter and other initiatives, especially binding legislation. These synergies can boost the efforts in the area of adaptation. The recently published Green Deal<sup>142</sup> has the potential to support all aspects of climate adaptation from two powerful leverage points. First, it explicitly recognises the need to push forward more ambitious policies in the area of adaptation to climate change leading to ‘large-scale changes’, emphasising the importance of ‘climate proofing, resilience building, prevention and preparedness’. It recognises the crucial importance of cities having access to data in order to better integrate the dimension of climate adaptation into their risk management and vulnerabilities assessments. Furthermore, the Green Deal explicitly underlines the importance of cities in the transformation of society and stresses the importance of considering the specific needs and vulnerabilities to climate risks of outermost regions and rural areas. These theme-based areas of focus can create important opportunities for boosting efforts of LRAs in the area of adaptation.

The second leverage point of the Green Deal is the ambition to create a dialogue with all segments of society and all levels of government, via its primary tool, the Climate Pact<sup>143</sup>. As a strategic step, the Climate Pact has considerable potential to support all efforts in the area of climate adaptation, building much needed multi-level dialogue in this area. Efforts in the area of adaptation are context dependent but can also benefit enormously from peer learning, exchange of practices and sharing of knowledge. If successful in its ambitious, the Climate Pact can create momentum and facilitate these efforts. Furthermore, the Pact supports the concept of ‘pledges’ by public institutions to carry out concrete action in the area of climate adaptation. As part of the Climate Pact the European Commission can also support action in specific targeted areas, all of which are closely related to LRAs. One of these areas, namely ‘tree planting, nature regeneration and greening of urban areas’ is a powerful tool of adaptation to climate change as they are part of the green infrastructure measures LRAs can employ. These are important entry points where synergies can be created if the Green Deal and the Climate Pact can

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<sup>141</sup> CoR Opinion ENVE-VI/015.

<sup>142</sup> COM(2019) 640 final.

<sup>143</sup> [European Commission, European Climate Pact](#)

successfully incorporate different levels of government and ensure the participation of local actors, including citizens to the design and implementation of policies.

Regarding the legislative instruments, an important potential source of synergy and providing decisive stimulus is the Governance Regulation<sup>144</sup>. It covers both mitigation and adaptation and requires the Member States to prepare NECPs as well as Long Term Strategies (LTS). These are the main tools for the Member States to design, monitor and report on the implementation of measures contributing to overarching objectives. Thus, in theory, both LTS and NECPs should provoke concrete action in the field of adaptation at different levels of government. However, in practice, this will depend on two factors: the degree to which the local and regional perspective is incorporated into the instruments of the Governance Regulation and whether the proposed content of NECPs and LTS pay enough attention to the field of adaptation.

A general observation is that the Governance Regulation and its main instruments only partially incorporate the local and regional level into their design and implementation rationale. The Regulation itself requires the Member States to create a multi-level dialogue with different stakeholders and the proposed structure of the NECPs requires the Member States to provide information on how governance at different levels is organised and ensured. However, the dominant perspective remains largely national and it fails to capture the local and regional levels in a specific manner. This has been also demonstrated by the shortcomings of the NECPs regarding the consultation processes they underwent and a general lack of awareness among the public<sup>145</sup>. This was also one of the drivers behind the suggestion by the Committee of the Regions to propose integration of locally determined contributions into the national plans and creation of Multilevel and Climate and Energy Dialogues<sup>146</sup> to consolidate the indispensable role that LRAs play in the climate governance process<sup>147</sup>.

The second factor which directly concerns the adaptation efforts also remains challenging. Although the Governance Regulation mentions the adaptation as an integral part of the LTS and asks Member States' to provide information about 'adaptation policies and measures', the proposed structure of its main instrument, NECPs, is largely dominated by a mitigation perspective. There is only one mention of adaptation in the proposed NECPs structure, and this is to stress that the NECP should provide information on adaptation, 'if available'. Nevertheless,

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<sup>144</sup> Regulation (EU) 2018/1999.

<sup>145</sup> Committee of the Regions, 2019, Implementing the Clean Energy Package: the NECPs as a tool for local and territorial governance approach to climate, active and passive energy, Opinion ENVE-VI/041.

<sup>146</sup> Committee of the Regions, 2019, The Green Deal in partnership with local and regional authorities, Resolution RESOL-VI/038.

<sup>147</sup> CoR Opinion ENVE-VI/041.



important links exist, especially in areas where natural synergies between mitigation and adaptation are particularly strong. For instance, the NECPs include the energy security dimension and Member States are expected to consider the energy mix, dependency on imports and risks relevant to energy supplies. This has direct links to the risks stemming from climate change on energy supplies. In the same vein, the energy efficiency of the buildings in particular and the concept of passive energy in general are important elements of climate mitigation and efforts in this area can be shaped to bring on additional benefits in the field of the adaptation. However, the Governance Regulation does not explicitly require such synergies to be explored and does not promote further action on adaptation in concrete terms. The NECPs remain largely focused on mitigation and provide some ground for adaptation work, as long as this comes as a by-product of natural synergies between the two fields. Based on these observations, it can be said that the main instruments of the Governance Regulation are not fully equipped to promote additional support for adaptation efforts. This can be considered as a missed opportunity, especially since climate change mitigation seems to be overcrowding the political agendas and different projects have to compete with limited financial resources.

The proposal for a Climate Law<sup>148</sup> aims, among others, to amend the Governance Regulation and reiterates the importance of adaptation to climate change. It stresses the crucial importance of national plans in the field of climate adaptation and in assessing the progress made in this area. Furthermore, in alignment with the Climate Pact, the proposal integrates the principle of inclusive governance stating that the European Commission will engage with all levels of public administration and stakeholders from all parts of society. It is therefore promising that the Climate Law emphasises the importance of the multilevel climate and energy dialogues, to be established by the Member States to serve as a platform for all the relevant parties to participate in the climate governance process, including LRAs.

#### ***4.1.2 Adaptation and EU climate finance***

In 2018, the Commission published an Action Plan for financing sustainable growth<sup>149</sup> that sets out priority actions for ensuring financing is available for sustainable investments. Some of the actions concern providing guidelines for the types of actions that can be considered sustainable investments, developing a common green bonds standard and an EU ecolabel for financial products and strengthening the advisory services for investments. The basis for these actions

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<sup>148</sup> European Commission, 2020b, Proposal for a Regulation establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999 (European Climate Law), COM(2020) 80 final.

<sup>149</sup> European Commission, 2018e, Action Plan: Financing Sustainable Growth, COM(2018) 97 final.

would be the establishment of a common EU ‘taxonomy’ of sustainable projects, which the Commission started defining in its proposal for a Framework to Facilitate Sustainable Investment<sup>150</sup>. This framework outlines criteria for determining whether an economic activity is environmentally sustainable and empowers the Commission to adopt delegated acts specifying further technical screening criteria for defining what constitutes an economic activity’s contribution to environmental objectives and what could be considered as significant harm to these objectives.

The framework requires that a sustainable economic activity contributes to and does not significantly harm the following environmental objectives: 1) climate change mitigation; 2) climate change adaptation; 3) sustainable use and protection of water and marine resources; 4) transition to a circular economy, waste prevention and recycling; 5) pollution prevention and control; (6) protection of healthy ecosystems. According to Article 7 of the proposal *‘an economic activity shall be considered to contribute substantially to climate change adaptation where that activity contributes substantially to reducing the negative effects of the current and expected future climate or preventing an increase or shifting of negative effects of climate change’*. Adaptation benefits can also be achieved by investments in different sectors and economic activities that contribute to the other five objectives.

The adoption of this framework for sustainable investments as well as any accompanying acts and guidelines that provide further details for the specific sustainability criteria will be an important step to ensuring climate action and adaptation receive adequate financial support. For LRAs and other stakeholders, a taxonomy of sustainable investments will provide stakeholders and LRAs with guidance on what measures can provide adaptation benefits. This can help regional and local administrations identify and prioritise relevant investments, especially if they lack knowledge or hesitate between different options. For private sector investors, the taxonomy will provide with clarity on the types of adaptation actions they can support. This will be important for tapping into the resources of investors who have pledged to increase their investments in sustainable activities.

The European Commission’s recent Green Deal<sup>151</sup> and Sustainable Europe Investment Plan<sup>152</sup> emphasise the importance of mainstreaming climate action across different EU budget instruments and defining a common EU taxonomy and standards for sustainable investments. The Sustainable Europe Investment Plan specifies the different avenues through which the EU budget can contribute to

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<sup>150</sup> COM(2018) 353 final.

<sup>151</sup> COM(2019) 640 final.

<sup>152</sup> COM(2020) 21 final.

climate and environmental objectives, both directly and by leveraging other public and private funds. It also highlights the EIB's commitment to become the EU 'climate bank' by increasing its climate and environmental sustainability investments to 50% of all its operations. While some of these commitments will be linked to EU budget instruments, the Bank is likely to invest its own resources as well in order to reach the new target. The Plan also introduces a new financing mechanism, complementary to the proposals already tabled under the EU's 2021-2027 financial period. This new Just Transition Mechanism will specifically target the regions most affected by the low-carbon transition offering support for the reskilling of workers or helping them adapt to new working conditions. The support under this new mechanism will be conditional upon the development of regional transition plans and could be a source for LRAs to invest in the social aspects of transition and climate change adaptation.

Although these new policy documents introduce few new sources of financing, they signal the EU's commitment to invest in more climate projects and to provide a framework that enables private sector investment in adaptations. As most funds have focused mainly on mitigation measures so far<sup>153</sup>, this reinforced commitment to climate mainstreaming might trigger more resources for adaptation projects too. These political commitments may also inspire similar actions at the national, regional and local levels, which together with the taxonomy for sustainable investments may stimulate the development of more adaptation projects and attract more public and private resources for adaptation.

## **4.2 Recommendations**

### ***4.2.1 Promote the mainstreaming of adaptation across policies and at all levels of governance***

As highlighted in section 3 political commitment is a critical pre-condition for the success of adaptation. Such commitment and concrete adaptation actions are needed at all levels of governance. Thanks to the EU Adaptation Strategy Member States have developed NAS, however actions are as necessary and sometimes even more crucial at the regional or local level. Therefore, the update of the Strategy offers an opportunity to consider how adaptation action by LRAs can be facilitated and promoted as a way to support the implementation of the NAS. One possibility could be to encourage the development of regional or local adaptation strategies. Another approach could be to strengthen the links with existing policy instruments such as the NECPs or LTS under the Governance Regulation. Even though both instruments are largely focused on mitigation measures, multiple

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<sup>153</sup> Forster, D. et al. 2017.

synergies can be established between mitigation and adaptation measures and these documents can encourage policymakers to consider such synergies more concretely.

The new Strategy could also recognise and strengthen the links to voluntary initiatives such as the Sustainable Energy and Climate Action Plan (SECAPs) under the Covenant of Mayors. Although voluntary, these plans, which in some cases include adaptation commitments, represent the readiness of many European LRAs to take action on climate change regardless of commitments or requirements at the national level.

Committing to the implementation of adaptation actions at the local and regional level can be challenging especially when this requires complex decisions about local budgets. In light of the COVID-19 pandemic and the inevitable negative impacts it will have on the European economy, investing in climate change or sustainability in general might seem as a lesser priority for some administrations, particularly those with already strained budgets. Nevertheless, preparedness for such unforeseen events, extremes or natural disasters requires similar actions and there could be many synergies between investments in risk preparedness and adaptation. Therefore, policymakers should not consider investments in climate change adaptation measures in isolation but rather seek the synergies and possibilities to make investments that can improve the resilience of local economies to shocks and risks while also helping them prepare for the expected impacts of climate change. For instance, investments in the health systems can not only prepare communities for other future pandemics but also ensure that these systems have capacity to meet the future demand for services resulting from climate extremes. Similarly, measures for strengthening the supply chain or the transportation networks to prepare for future shocks can also improve the resilience of local industries and business in case of extreme events that can cause severe disruptions.

#### ***4.2.2 Develop the administrative capacity of LRAs to implement adaptation measures***

The success of adaptation measures depends on authorities' ability to develop and implement the most suitable measures. Therefore, capacity of LRAs to undertake adaptation should be supported. Smaller administrations might particularly need support as they operate with limited resources and in-house expertise. Although some existing platforms such as Climate-ADAPT or Covenant of Mayors can provide capacity building and expertise, LRAs are not necessarily aware of all existing initiatives. Moreover, they may have specific needs for support that are not addressed by existing capacity building platforms. The multilevel climate and energy dialogues encouraged under the Governance Regulation could be suitable

platforms to not only canvass the opinions and policy suggestions of LRAs but also discuss the challenges they face and the specific support needs they have, particularly to the extent that these challenges relate to the energy sector. This could allow national policymakers to develop capacity building strategies for the local and regional authorities as well as permit LRAs to network and learn from their peers.

#### ***4.2.3 Ensure climate finance is available for investing in adaptation***

Adaptation measures require investments and sufficient resources should be provided to realise these investments at any level of governance and particularly at the local level. Although different sources are available both from EU funds and other institutions (see section 2), LRAs might not necessarily be aware of the financing opportunities or have the capacity to successfully access the finance. Therefore, it is critical to ensure LRAs are aware of the available climate finance opportunities and to receive support, whenever needed, to develop successful investment projects. This could be part of capacity building and peer learning initiatives, including discussions within the framework of the multilevel climate and energy dialogues.

In these trying times it will also be important not to reduce the availability of financing resources for climate. The negotiations for the EU's 2021-2027 Multiannual Financial Framework and the COVID-19 pandemic recovery spending package are ongoing. As highlighted previously adaptation, resilience and preparing the economy for future risks and shocks are not mutually exclusive objectives. It is important, perhaps more than ever before, to continue investing in preparedness, resilience and adaptation and public budgets and COVID-19 recovery spending should ensure resources are available at local and regional level.

#### ***4.2.4 Fill in the knowledge gaps related to adaptation***

The lack of data scaling-down climate projections to the local level should be addressed by continued investments in policy-relevant climate adaptation research. As individual LRAs are unlikely to be able to finance and support such research individually, these investments should be funded by the EU and national governments. In addition, efforts are needed to ensure that research is communicated to LRAs through tools and guidance documents that are relevant to the needs of policy makers. In particular, data and tools to support climate change impact risk and vulnerability assessments at the local level would be valuable to LRA policymakers and practitioners.

LRAs also find it challenging to access knowledge on the costs and benefits of adaptation options. Building opportunities to learn from the experiences of other LRAs in designing and implementing adaptation responses would be beneficial. This could become a growing area of focus within the work of the Covenant of Mayors.

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# Annex 1: Economic losses and costs of climate change

**Table 4 Overview of existing estimates of economic losses and costs of climate change in Europe**

<b>Impact/sector</b>	<b>Estimated losses/costs in Europe, if no adaptation</b>
Coastal flooding and erosion	EUR 6-19 billion per year to EUR 15-65 billion per year in the 2060s, depending on the scenario
Flooding	Estimated annual damage of EUR 32 billion per year by 2050
Agriculture	Climate-related costs of EUR 18 billion per year, driven by yield reductions in Southern Europe (opposite effects in Northern Europe)
Forestry	Estimated annual damage from forest fires of EUR 1.5 billion per year
Energy	Costs of additional cooling of EUR 30 billion per year by 2050, rising to EUR 109 billion per year by 2100
Transport	Total costs from extreme weather events in the period 1998-2010 were EUR 2.5 billion per year, these will increase by 20% by 2050; The multi-hazard, multi-sector damage due to climate change will rise from EUR 0.8 billion to EUR 11.9 billion by the 2080s
Tourism	Climate change cost in terms of a fall in revenue would be EUR 15 billion per year by 2100
Health	An additional 23 thousand deaths would be attributable to climate change at 2°C of warming (mid-century), with estimated economic costs of EUR 41 billion per year

Source: COACCH, 2018.

Note: These estimates are compiled from different existing studies using varying scenarios, assumptions and timelines and are thus not directly comparable. They should be understood merely as illustrative examples of the extent of economic costs associated with climate change impacts.





## **Annex 2: Examples of information sources on adaptation**

### **Climate-ADAPT**

The European Climate Adaptation Platform ([Climate-ADAPT](#)) is the key tool available at EU level to bridge the knowledge gap on climate change adaptation. Launched in 2012, it aims to facilitate access and sharing of data and information on climate change adaptation between stakeholders — the information covers different sectors, geographical levels, funding opportunities and networks of key partners for cooperation at all levels of governance. Climate-ADAPT strives to be the ‘one-stop-shop’ for adaptation information in Europe, as it regroups many different external sources of information into a single platform. Users can access statistical databases with information concerning climate trends, reports on the impacts of climate change or an interactive map showcasing local case studies of climate adaptation strategies across Europe. The platform also hosts several adaptation policy-making tools. The [Urban Adaptation Support Tool](#) supports and guides decision-makers through each of the main steps of the climate change adaptation cycle specifically tailored for urban challenges. In addition, users have the possibility of contributing information and data to the platform themselves — with all submissions being subject to rigorous quality controls<sup>154</sup>.

### **Copernicus Climate Change Service**

While Climate-ADAPT covers a broad scope of different types of information, the [Copernicus Climate Change Service](#) focuses on providing past, present and future climate data. Copernicus enables policy makers to access and explore datasets, for example on: seasonal forecasts, heat and cold spells, water quality, pressure levels, sea surfaces, etc., notably via the [ERA5 Explorer](#) tool, which provides visualisations of historical climate statistics at city level.

### **Environmental information systems**

The Biodiversity Information System for Europe ([BISE](#)) provides information and data on biodiversity and ecosystem services, it regroups all related policies, data centres, assessments and research findings from various external sources.

The Water Information System for Europe ([WISE](#)) is another portal created by the European Commission in partnership with the EEA. It provides data (statistics,

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<sup>154</sup> Mattern, K. et al. 2018, Climate-ADAPT profile, EEA and ETC/CCA.

interactive maps, forecasting, etc.) and information (case studies, funding opportunities, etc.) for policymakers involved in the development and implementation of both in land and marine water policies.

## National adaptation platforms

Climate change adaptation platforms are also available at national level in several EU Members States. Similar to the EU level platforms, these platforms facilitate communication, information and knowledge exchange at national level between different levels of government, scientists and other public and private agents<sup>155</sup>. Examples of existing national adaptation platforms is provided in the next box.

### Box 11: Links to National Climate Adaptation Platforms

Austria: <a href="#">Klimawandel-Anpassung</a>	Croatia: <a href="#">Prilagodba-klimi</a>	Denmark: <a href="#">Klimatilpasning</a>
Finland: <a href="#">Climate Guide</a>	France: <a href="#">Wiklimat</a>	Germany: <a href="#">KLiVO</a>
Hungary: <a href="#">NAGiS</a>	Ireland: <a href="#">Climate Ireland</a>	Netherlands: <a href="#">Delta</a>
Poland: <a href="#">KLIMADA</a>	Spain: <a href="#">AdapteCCa</a>	Sweden: <a href="#">Klimatanpassning</a>

## National CCIV assessments

CCIV assessments can also be good sources of information for LRAs on climate adaptation measures, as many assessments also include information on sub-national levels<sup>156</sup>. Most of the national CCIV assessments are available via the [EIONET library](#) on the website of European Environment Agency (EEA).

## Transnational exchange platforms

Climate change adaptation platforms also exist at a transnational level between European regions facing similar challenges. Examples include: [The Climate Adaptation Platform for the Alps](#) (CAPA) and [The Pyrenean Climate Change Observatory](#) (OPCC).

## City networks

Another useful source of information for LRAs are city networks, which organise city twinnings, conferences, exchange of best practice and support in capacity building for climate change adaptation policies<sup>157</sup>. The biggest city networks include:

<sup>155</sup> Street, R. et al. 2015.

<sup>156</sup> Füssel, H.M. et al. 2018, National climate change vulnerability and risk assessments in Europe, 2018, EEA report No 1/2018.

<sup>157</sup> Kurni, B. et al. 2017.

- [The Covenant of Mayors for Climate and Energy](#): this network is a European initiative supported by the European Commission. With 10,016 signatories it is the world's largest movement for local climate and energy actions.
- [C40 Cities](#): a network of megacities, regrouping 94 of the world's largest cities.
- [Making cities resilient](#): an initiative run by the UN Office for Disaster Risk Reduction (UNDRR), this network regroups 4 317 cities across the globe.
- [Resilient Cities annual conference](#): organised by Local Governments for Sustainability (ICLEI) is hosted every year in Bonn and brings together 500 participants from all over the world.



# Annex 3: Questionnaire

## Local and regional authorities adapting to climate change – Questionnaire

### Introduction

In November 2018, the European Commission published an evaluation of the EU Adaptation Strategy (COM(2013) 216). The evaluation found that the Strategy is relevant and delivering on its objectives but it also identified certain areas for improvement, including the need to foster adaptation action at the local level. Furthermore, in the European Green Deal (COM(2019) 640) the Commission signalled its intention to adopt ‘a new, more ambitious EU strategy on adaptation to climate change’. In anticipation of a proposal, **the European Committee of Regions (CoR) has launched a study on the adaptation-related challenges and opportunities for local and regional authorities.** The purpose of this questionnaire is to gather information for this study and support the understanding of local and regional authorities’ experiences and needs in relation to climate change adaptation. The findings of this questionnaire and of the entire study will feed into the new CoR opinion on the subject.

Should you have any question in this regard, do not hesitate to contact the ENVE commission secretariat at [enve@cor.europa.eu](mailto:enve@cor.europa.eu)

Please note that the ENVE secretariat may wish to contact you within the next 2 years after the publication of this survey to invite you to participate to further consultation on the topic. Please indicate if you wish to be contacted or not (YES/NO).

### Privacy policy

Please confirm you read and agree with the data privacy policy in order to start the survey (check box, the click is needed to proceed with the survey).

### Background (*Mandatory questions*)

1. Please indicate your name (*open*)
2. Please indicate the name of your organisation (*open*)
3. Contact email address (this won’t be published) (*open*)
4. Which country are you located in? (*Closed, multiple choice, one response allowed*)
  - a. Austria
  - b. Belgium
  - c. Bulgaria
  - d. Croatia
  - e. Cyprus
  - f. Czech Republic
  - g. Denmark
  - h. Estonia
  - i. Finland
  - j. France

- k. Germany
- l. Greece
- m. Hungary
- n. Ireland
- o. Italy
- p. Latvia
- q. Lithuania
- r. Luxembourg
- s. Malta
- t. Netherlands
- u. Poland
- v. Portugal
- w. Romania
- x. Slovakia
- y. Slovenia
- z. Spain
- aa. Sweden
- bb. United Kingdom
- cc. Other (please specify)

5. In what capacity are you completing this questionnaire? (*Closed, multiple choice, one response allowed*)
- a. Regional government/ administration
  - b. Local government/ administration
  - c. Organisation representing regional authorities
  - d. Organisation representing local authorities
  - e. Other (please specify)

*If local or regional government, ask Q5B-E:*

5B. What type of region do you represent or come from? (*Conditional on Q5, closed, multiple choice, one response allowed*)

- f. Predominantly urban
- g. Predominantly rural
- h. Mixed or intermediate

5C. What are the geographic features of the region you represent or come from? (*Conditional on Q5, closed, multiple choice, multiple answers possible*)

- i. Inland
- j. Coastal
- k. River-/lakeside
- l. Island
- m. Flat plains
- n. Mountainous
- o. Outermost region

5D. What is the size of the local area you represent? (*Conditional on Q5, closed, multiple choice, one response allowed*)

- p. 0 – 50,000 citizens
- q. 50,000 – 100,000 citizens
- r. 100,000 - 500,000 citizens

- s. 500,000 – 1,000,000 citizens
- t. Over 1,000,000 citizens

5E. Has your administration developed a regional or local adaptation strategy? (*Conditional on Q5, closed, multiple choice, one response allowed*)

- u. Yes
- v. No
- w. Not yet but it is under development

**Adaptation experience** (*voluntary questions*)

6. What are the most significant climate change impacts in your area? (*Closed, multiple choice, multiple answers possible*)

- a. Coastal erosion, sea level rise, coastal flooding
- b. River flooding
- c. Storms, including extreme rainfall, wind storms, hail storms, coastal storm surges
- d. Water scarcity and drought
- e. Wild fires
- f. Temperature increases, extreme heat and heat waves
- g. Changing seasons
- h. Changing eco-systems
- i. Appearance of tropical diseases and/or invasive alien species
- j. Other (please specify)
- k. Climate change impacts are not relevant in my region/area

7. What are the most significant socio-economic impacts of climate change experienced in your area? (*Closed, multiple choice, multiple answers possible*)

- a. Higher health costs, especially for vulnerable groups (e.g. elderly, children, low-income citizens, rural communities)
- b. Higher costs for social services, especially for vulnerable groups (e.g. low-income citizens, homeless persons, energy-poor households, rural communities)
- c. Economic costs or losses in agriculture
- d. Economic costs or losses in tourism
- e. Economic costs or losses in industry
- f. Damage to buildings and infrastructure (e.g. roads, hospitals, schools, water supply)
- g. Population migration into the area
- h. Population migration out of the area
- i. Other (please specify)
- j. Climate change impacts are not relevant in my region/area

8. Have you undertaken responses to address cross-border impacts of climate change (i.e. impacts that occur elsewhere but have an impact on your region or area)? (*Closed, multiple choice, one response allowed*)

- a. Yes
- b. No
- c. Do not know

*If yes, ask Q8B:*

8B. How have you addressed the cross-border impacts of climate change? (*Conditional on Q12, open*)

9. Which adaptation measures have you implemented in your area? In your opinion, how useful have they been? (*Closed, multiple choice matrix, one answer possible per measure*)

<b>Measure</b>	<b>I have not implemented this measure</b>	<b>I implemented this measure and think it is useful</b>	<b>I implemented this measure and think it is not useful</b>	<b>I implemented this measure but do not know yet if it is useful</b>
9.1 Climate risk and vulnerability assessment				
9.2 Integrated water management (e.g. flood and drought risk management)				
9.3 Climate-proofing of public infrastructure				
9.4 Development of nature-based solutions and green infrastructure				
9.5 Insurance against natural disasters and climate extremes				
9.6 Development of regional or local adaptation strategies and/or action plans				
9.7 Development of sectoral adaptation policies (e.g. health strategies for heat waves)				
9.8 Mainstreaming adaptation in existing sectoral policies				
9.9 Awareness raising campaigns among the local community				
9.10 Other (please specify)				

10. Have you taken actions to monitor and assess the effectiveness of the adaptation measures adopted in your area? (*Closed, multiple choice, one response allowed*)



- a. Yes
- b. No
- c. Do not know

*If yes, ask Q10B:*

10B. How have you monitored and assessed the adaptation measures in your area?  
(Conditional on Q16, open)

11. Which sources of adaptation financing are you aware of and/or have used? (Closed, multiple choice matrix, one answer possible per source)

Financing source	I am not aware of this source	I am aware of this source but have not used it	I am aware of this source and have used it
11.1 European Cohesion Policy funds (e.g. European Regional Development Fund, Interreg)			
11.2 LIFE programme			
11.3 European Rural Development funds (e.g. European Agricultural Fund for Rural Development)			
11.4 Other EU funds			
11.5 European Investment Bank (EIB) financing			
11.6 National funds			
11.7 Regional funds			
11.8 Own budget			
11.9 Commercial banks financing			
11.10 Other (please specify)			

12. The EU Adaptation Strategy promotes the use of insurance as a way to improve resilience and reduce the risks of climate change impacts. For instance, insurance mechanisms can offer financial compensation to foster recovery or provide information about existing risks. Is insurance part of your climate change adaptation response?  
(Closed, multiple choice, one response allowed)

- a. Yes
- b. No
- c. Do not know

*If yes, ask Q12B-C:*

12B. How do you use insurance to manage climate risks at your government level?  
(Conditional on Q18, open)

12C. How do you promote the use of insurance as a means of managing climate risks amongst local households, farmers or businesses? (Conditional on Q18, open)

*If no, ask Q12D:*

12D. Why is insurance not part of your adaptation measures? (Conditional on Q18, open)

**Adaptation needs** (*voluntary questions*)

13. What are the main challenges with implementing adaptation measures in your area? (*Closed, multiple choice, multiple answers possible*)
- Lack of political leadership at the national level
  - Lack of political leadership at the regional level
  - Lack of political leadership at the local level
  - Lack of support among the local community
  - Lack of awareness and relevant technical expertise among staff
  - Insufficient financial resources
  - Conflicts between different sectoral policies
  - Insufficient scientific data and information
  - Other (please specify)
  - I have not experienced challenges with implementing adaptation measures in my area
14. What are the specific expertise or capacity needs that you have in developing or implementing adaptation measures in your area? (*Open*)
15. What are the specific adaptation financing needs that you have? (*Open*)
16. What are specific knowledge (scientific and/or policy-related) gaps that you have in relation to climate change adaptation? (*Open*)
17. What sources have you used to find out information about climate change impacts and adaptation? (*Closed, multiple choice, multiple answers possible*)
- Climate-ADAPT platform
  - Covenant of Mayors for Climate and Energy
  - Intergovernmental Panel on Climate Change (IPCC) and international organisations
  - National adaptation platform
  - Local adaptation platform
  - Academic and scientific publications
  - Other (please specify)
  - I have not used any information sources about adaptation

**Policy needs** (*voluntary questions*)

18. In your opinion, how important is the existence of a national or regional adaptation strategy for preparing a local or regional strategy in your area? (*Closed, multiple choice matrix, one answer allowed per strategy*)

Strategy	Very important	Somewhat important	Not important	Do not know
18.1 National Adaptation Strategy				
18.2 Regional Adaptation Strategy				

- 18B. Please explain your answer (*open*)

19. How should the national level facilitate the development of local or regional adaptation strategies? (*Open*)
20. How should the EU level facilitate the development of local or regional adaptation strategies? (*Open*)
21. In the 2019 European Green Deal, the European Commission announced it would adopt a new EU strategy on adaptation to climate change. What are the specific local or regional adaptation needs or considerations that a new EU Adaptation Strategy should take into account? (*open*)

**Conclusion** (*voluntary questions*)

If you have experiences of good practices concerning adaptation in your area, please provide details here (*open*)

If you wish to provide additional information or comments, please do so here (*open*)

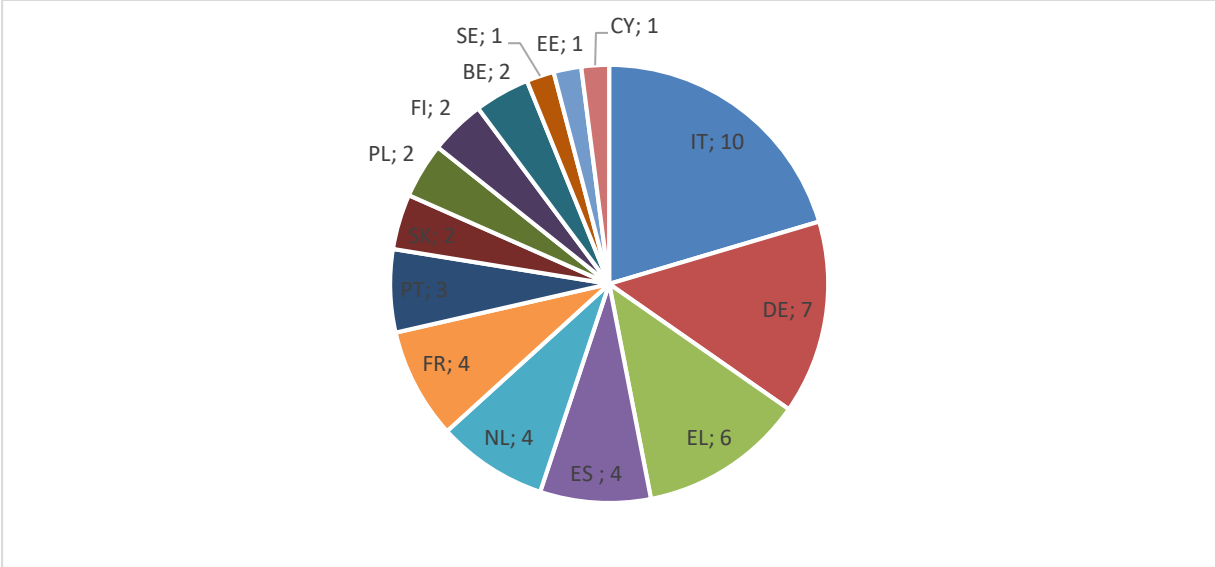


# Annex 4: Detailed report based on survey findings

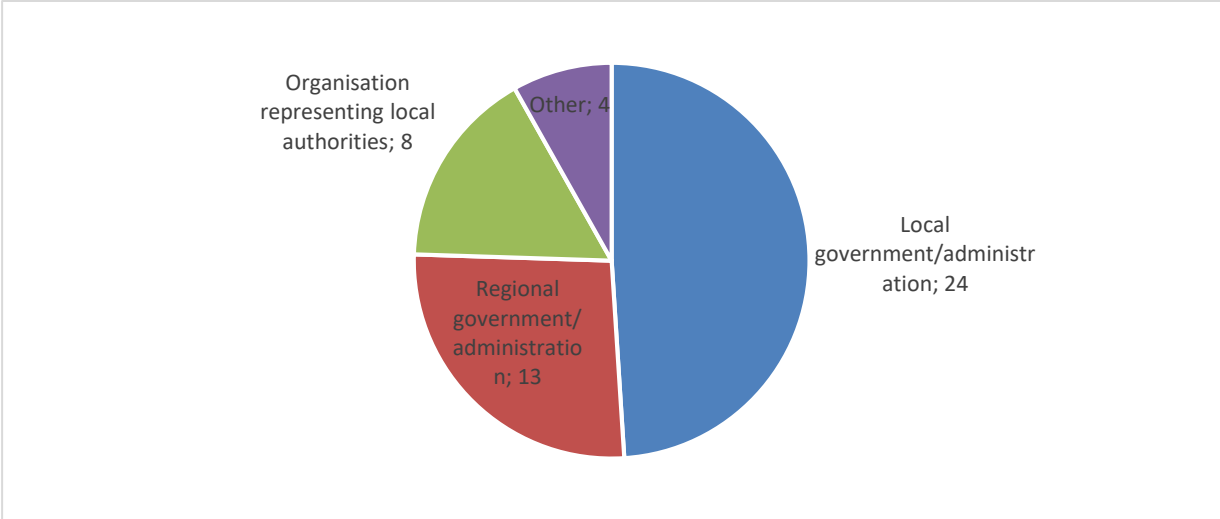
## Profile of respondents

The survey gathered 49 replies from 14 countries. The following figures provide the overview of the replies by country and the type of respondent

**Figure 6: Distribution of countries, N=49**



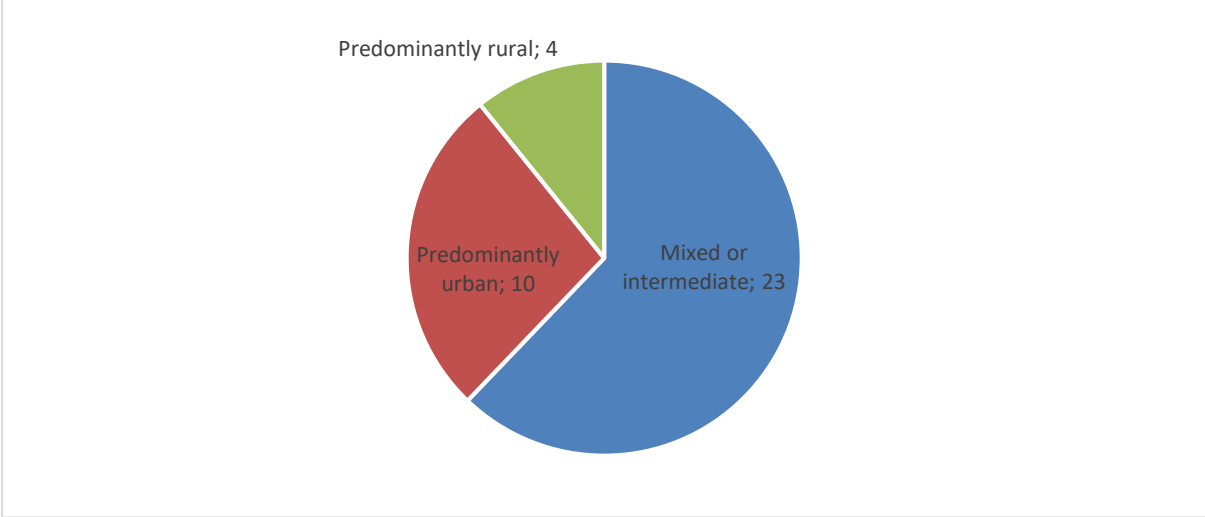
**Figure 7: Q5a: In what capacity are you completing this questionnaire? N= 49**



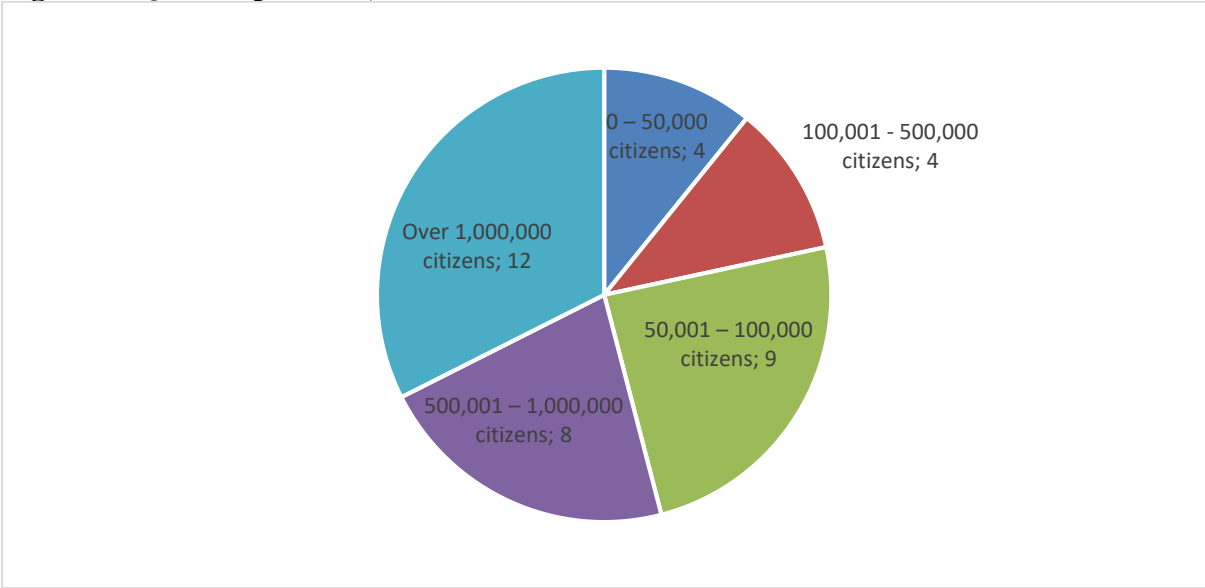
Questions 5B, 5C, 5D and 5E were asked to local and regional governments and administrations to provide an overview of their main characteristics (37 in total). The following charts recapitulate their answers.

The respondents represent a diversity when it comes to the geographical characteristics of their regions. The graph below provides an overview of the replies.

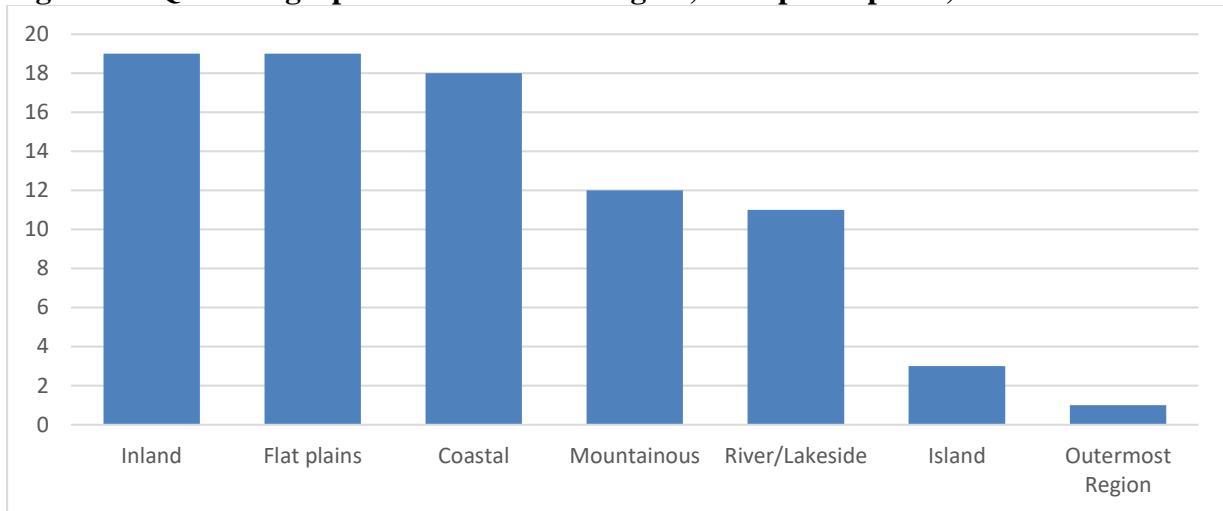
**Figure 8 Q5B: Type of the region, N= 49**



**Figure 9: Q5D: Population; N:49**

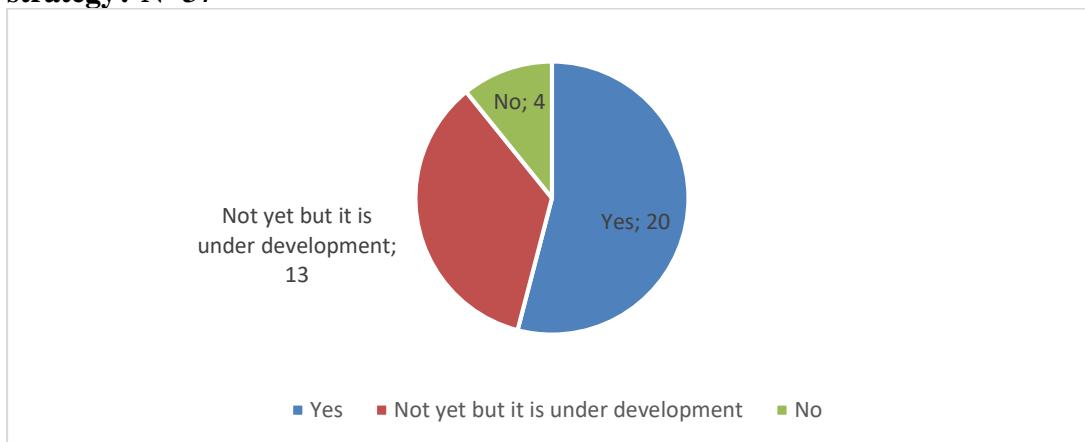


**Figure 10: Q5c: Geographic features of the region, multiple response, N= 37**



Only a small share of respondents stated that they do not have a climate adaptation strategy in place without also indicating that they are in the process of preparing one.

**Figure 11 Q5e: Has your administration developed a regional or local adaptation strategy? N=37**

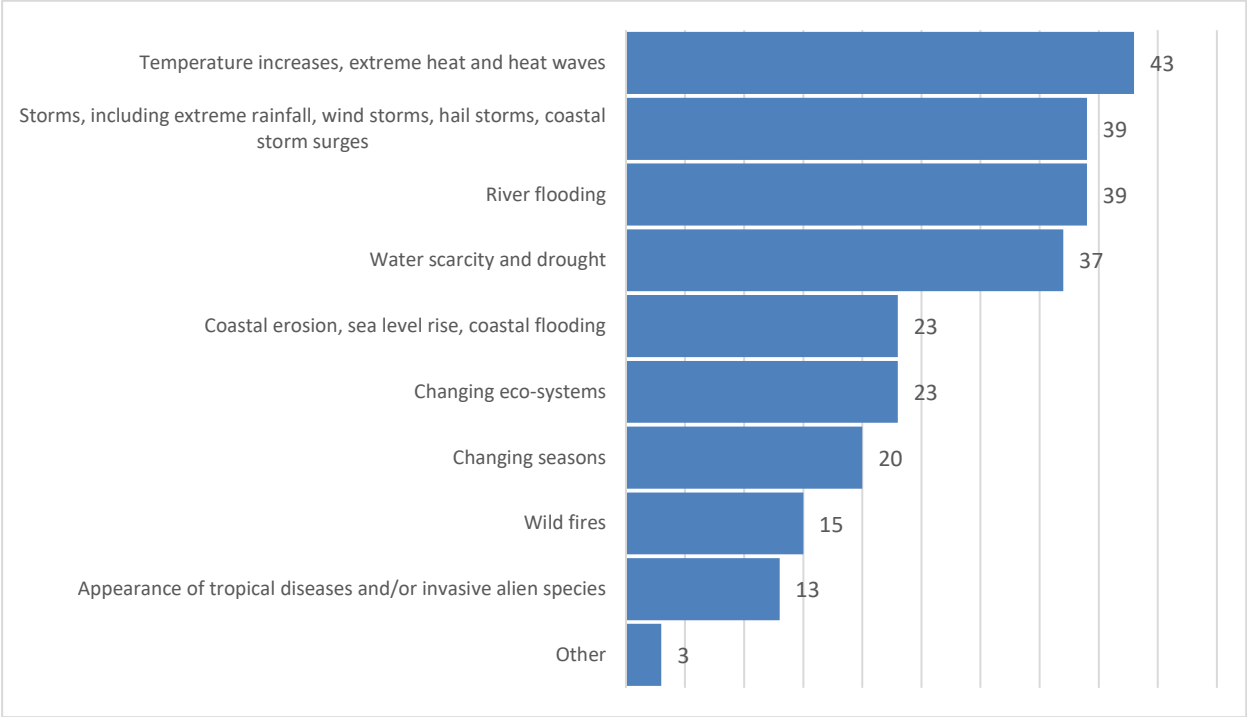


## Experiences of climate change impacts and adaptation

### *Physical and socio-economic Impacts of climate change in the region (Q6)*

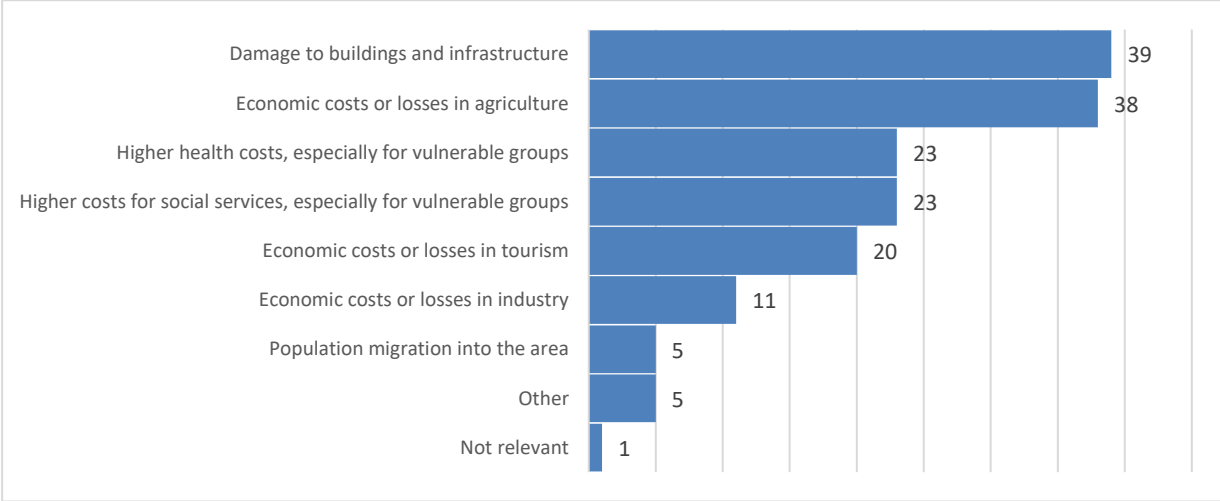
The most significant physical impacts of climate change respondents reported experiencing in their local area were temperature increases, extreme heat and heat waves, followed by storms, extreme rainfalls and hailstorms, and river flooding.

**Figure 12 Q6: Most significant climate change impacts in the area, N=49 (multiple responses possible)**



In turn, these primary physical impacts will lead to disruptions to the built environment as well as social and economic systems. When asked about how climate change will impact these human systems, the responses significantly focus on damage to buildings and infrastructure and impacts on agriculture. Higher social costs such as health spending and social services as well as losses in tourism are also mentioned as impacts already experienced in the area.

**Figure 13 Q7: The most significant socio-economic impacts of climate change experienced in the area, N=49 (multiple responses possible)**





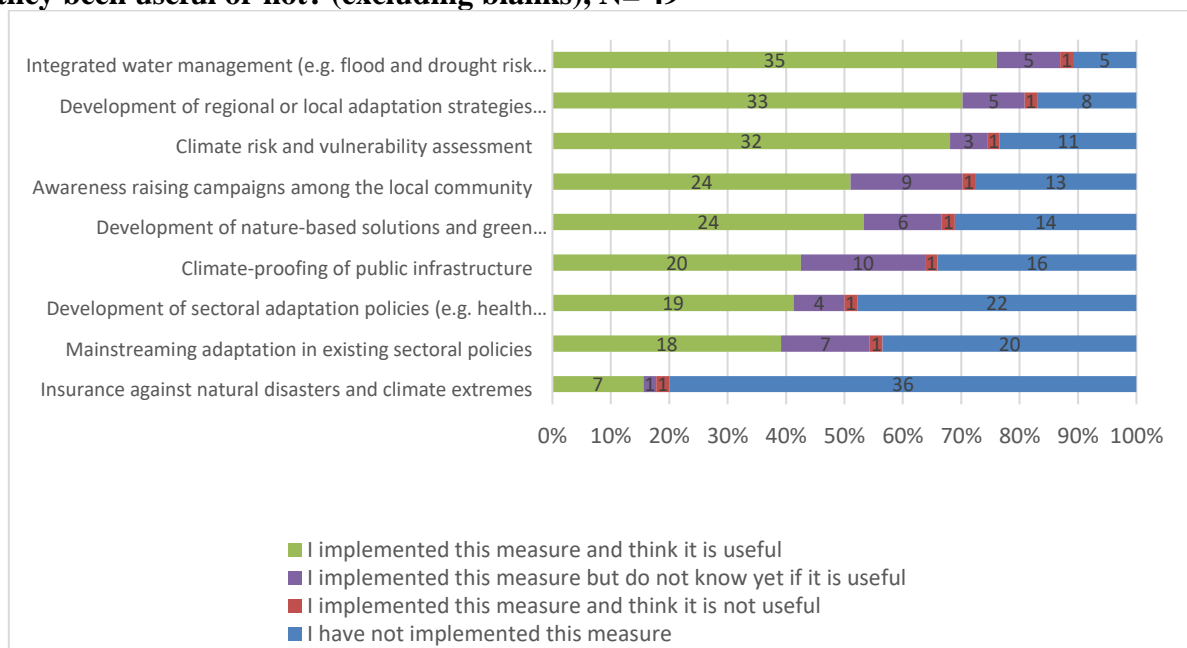
### *Addressing transboundary issues (Q8)*

Almost one-third (15) of respondents indicate they have taken steps to address the transboundary aspects of climate change adaptation (as opposed to 21 reporting they had not taken such action). The transboundary activities involve cooperation between regions within the same country as well as cooperation between different Member States. The importance of EU-funded projects and networks led by the EU institutions is emphasised by some of the respondents. European Territorial Cooperation/Interreg, Climate Alliance and Covenant of Mayors, are mentioned as mechanisms supporting such cooperation. Water related issues such as flooding, droughts and water storage are mentioned by eight of the respondents, confirming the importance of water as a transboundary challenge in climate adaptation.

### *Frequently used adaptation measures (Q9)*

The majority of the respondents find the adaptation measures they have deployed useful, and others are still in the process of discovering the outcomes. Only one respondent states that the measures they have implemented were not useful. Among the measures mentioned in the questionnaire, integrated water management, development of adaptation strategies and climate risk and vulnerability assessments are the most frequently used. In return, most of the respondents have not used insurance schemes as a climate change adaptation tool. In the same vein, development of sectoral adaptation policies and mainstreaming of adaptation into existing sectoral policies is still in development.

**Figure 14 Q9: Which adaptation measures have you implemented in your area? Have they been useful or not? (excluding blanks), N= 49**



When asked to expand on other adaptation measures they have adopted, the respondents mentioned spatial/urban planning and citizen involvement as other important components of climate adaptation in their open text responses.

### ***Monitoring the effectiveness of adaptation measures (Q10)***

Almost half of the respondents (20 out of 49) state that they have a system in place for monitoring the effectiveness of adaptation measures. Developing indicators for monitoring the impact of adaptation measures either within the climate adaptation plans or as a general policy is the most frequent approach (7 out of 20). Some respondents also mention collaborations with research institutes and a more focused monitoring of impacts in relation to specific risks identified (for instance, monitoring of water levels).

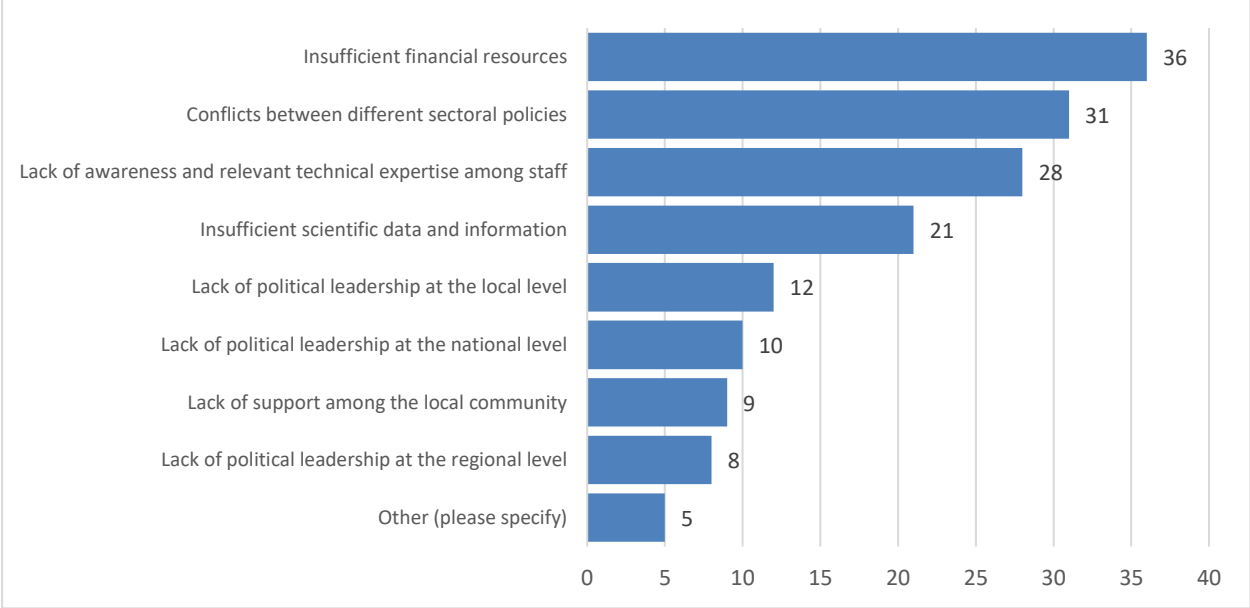
## **Challenges**

### ***Main challenges to implementing adaptation measures (Q13)***

Confirming findings of other studies, financial resources are the biggest challenge to implementation of adaptation measures. However, almost as many respondents report that conflicts between different sectoral policies are a main challenge with implementing adaptation measures. This underlines the importance of holistic and systemic approaches to adaptation, which require integration between policies to create synergies and avoid conflicts.

Lack of awareness and insufficient technical expertise and data are other important challenges reported by LRAs. Apart from the pre-defined responses, the respondents also mention constraints related to gaps in the current legal framework or elaborate on challenges related to the de-prioritisation of adaptation compared to competing issues such as housing or energy transition which might receive more attention in political agenda.

**Figure 15 Q13: What are the main challenges with implementing adaptation measures in your area?, N=49 (multiple responses possible)**



***Needs regarding expertise and capacity for adaptation (Q14)***

Respondents were asked to expand on their specific capacity and/or expertise needs of LRAs to design and implement adaptation measures. Around half of the respondents refer to lack of knowledge and scientific information in their replies. Knowledge gaps include data specific to local context, scenario modelling, decision making tools (for instance evaluating which option is the best approach) and robust datasets spanning longer time periods. The importance of local data for local authorities is a key theme in the responses, with many noted that data is often not specific to the region and downscaling national data is not possible. Beyond the climate data, information on socio-economic dimension of climate adaptation is also needed to support decision-makers. Mechanisms that allow LRAs to share information, experiences and lessons learned were also mentioned.

Institutional capacity is also a key theme in responses: municipalities, especially smaller ones, do not have dedicated staff to design, implement and monitor adaptation measures. Staff without expertise or training on the subject currently fill these roles. Furthermore, some respondents report a need for a dedicated unit (or employee) to coordinate efforts across different policy fields and departments. This links to the need for whole-of-government approaches to climate adaptation noted above.

***Knowledge gaps specific to adaptation (Q16)***

As noted above, LRAs report insufficient scientific data and information as a barrier to adaptation action. Gaps in knowledge range from more specific data on

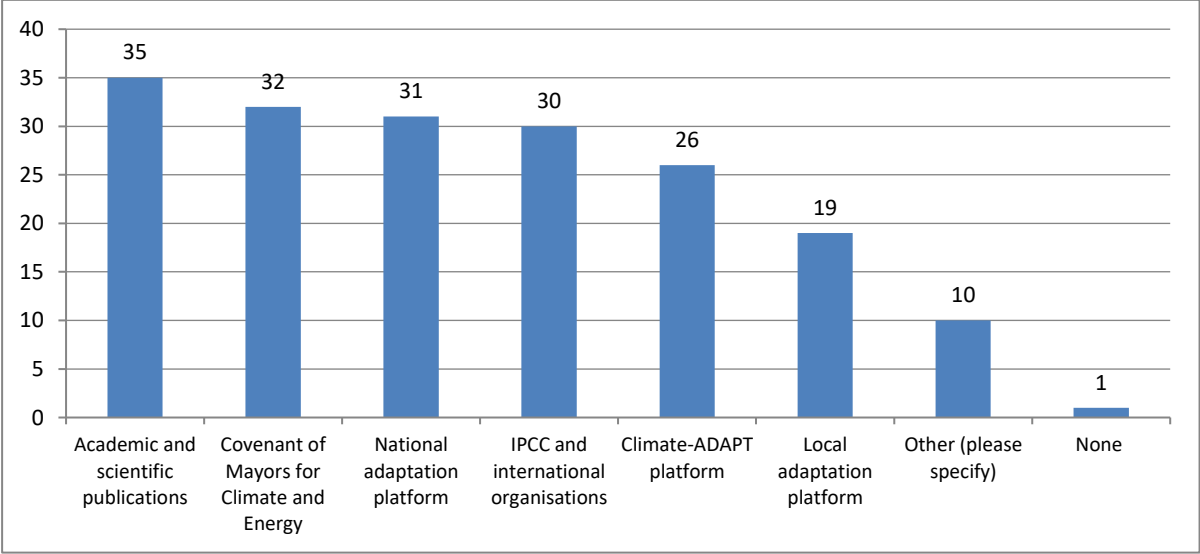
local impacts to tools for integrating cost-benefit analysis into decision making process. Respondents mention the need for specific climate projections for impacts such as precipitation, drought and heat impacts at the local level, as well as modelling climate impacts on socio-economic systems, such as agricultural production (for instance economic impacts of water shortage). A detailed understanding of likely impacts at the local level is needed to be able to carry out risk and vulnerability assessments.

In terms of knowledge gaps related to the design of adaptation responses, respondents reported the need for more cost-benefit analyses of adaptation measures and noted that a better understanding is needed of the costs non-action, to be able to better make the case for climate adaptation.

### Sources of information about climate change impacts and adaptation

LRAs report that scientific publications are the most important source of information on the impacts of climate change and adaptation. The Covenant of Mayors, national adaptation platforms, the IPCC and other international organisations are other important sources with similar number of mentions. The EU’s [Climate-Adapt](#) platform is used less, followed by local adaptation platforms. The respondents also mention other sources of information which focus mostly on social learning in the form of conferences, workshops and cooperation with other LRAs or stakeholders. Participation in global initiatives ranging from Habitat III to Urban Agenda is mentioned as another way of learning about climate change and adaptation.

**Figure 16: Q17: What sources have you used to find out information about climate change impacts and adaptation?, N=49 (multiple responses possible)**



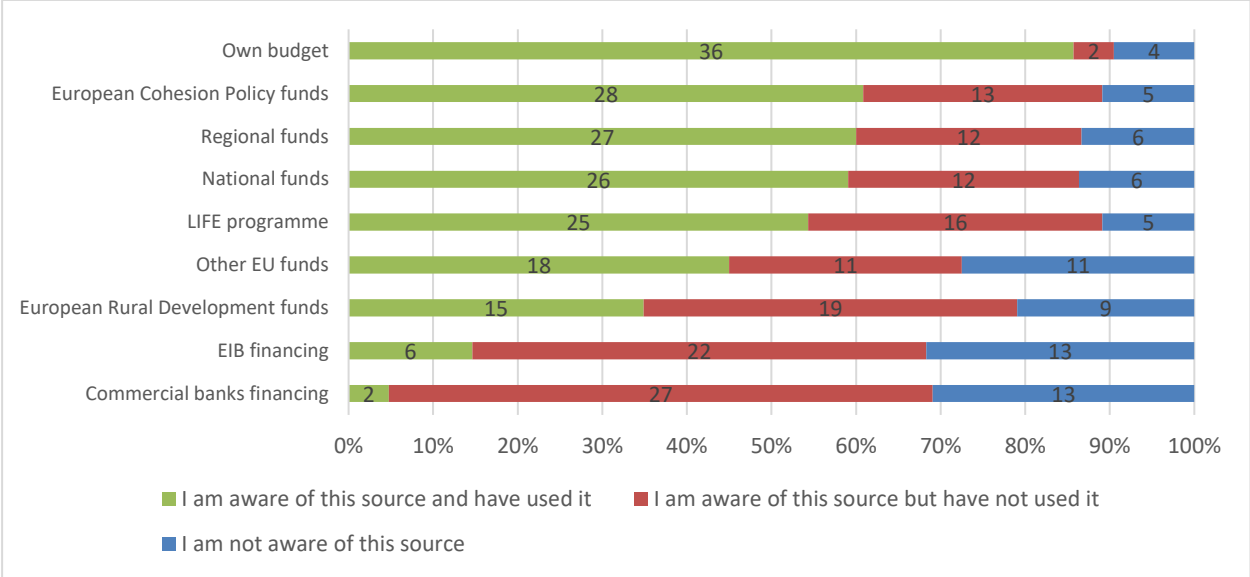
# Financing adaptation at the local and regional level

## Financing adaptation measures (Q11)

Lack of financial resources is the most frequently mentioned obstacle for design and implementation of climate adaptation measures. It is therefore important to understand how the LRAs tackle this challenge, their level of awareness about different financing solutions and the uptake of such solutions. Findings suggest that public budgets are still the main financing source for climate adaptation measures. Furthermore, Cohesion funds, Regional funds, Rural Development Funds and LIFE programme are important, funding sources with most of the participants are aware their existence and a majority having used it for adaptation action. EIB (European Investment Bank) and financing via commercial banks are used much less, only by a very small number of LRAs.

There is also a greater number of respondents who are not familiar with these financing mechanisms. When asked about other financing used for climate adaptation, respondents also mention public-private partnerships, sometimes at local level, regional credits, soft loans<sup>158</sup> and exploitation of land for revenues.

**Figure 17 Q11: Which sources of adaptation financing are you aware of and/or have used? (excluding blanks), N= 49**



<sup>158</sup> In the absence of further detail from respondents, it is assumed that soft financing refers to financing mechanisms that use interest-rates below the market level, usually provided by public authorities or national or international promotional banks.

### ***Financial needs specific to adaptation (Q15)***

An open question asked participants about their specific financing needs for adaptation. Their responses are diverse and often broad in nature, suggesting that LRAs need more financial support in a wide range of areas. Interventions in the built environment are the most frequently mentioned, with several respondents mentioning need for investments in water infrastructure and coastal protection.

Others mention the need for investments in blue and green infrastructure, and the tourism and agriculture sectors. Beyond physical interventions, some respondents also mention the need for funding for research and training of staff, the need to respond to new infectious diseases, and support for innovative projects. More broadly, respondents mentioned the need to invest in broader measures to achieve system-wide change and build social resilience to climate impacts.

Combined, these needs will require substantial investment and some respondents underline that mobilising these resources is beyond the capacity of LRAs. Respondents note that some adaptation investments will not generate profits, but will help avoid future costs, and so public investment is needed. Some respondents state that local budgets are too small and often dedicated to more urgent, short-term problems that come into competition with adaptation. As a solution, some suggest that dedicated long-term adaptation funding should be available at local level to address specific local needs. Adaptation needs should also be integrated into local and regional budgets for the maintenance of infrastructure. Furthermore, there are calls for consistent, sustainable EU level and national level investment which would be then distributed to regional authorities. The need for creating new solutions in financing (for instance new types of PPPs, tax measures, subsidised loans) and a better understanding of funding available is also mentioned.

### ***Insurance as an adaptation measure (Q12 and Q12B/C/D)***

Only eight respondents state that insurance is part of their adaptation response. This confirms the earlier findings about the low uptake of insurance schemes as a tool to support climate adaptation efforts. Respondents were also asked why insurance schemes are not part of their adaptation plans. Out of 29 responses which provided an answer, 11 report that they are currently exploring how insurance can be integrated into local adaptation measures.

Responses provide insights into why insurance is not seen as a part of adaptation responses: Some underline the lack of knowledge about the possible uses of insurance as the main obstacle; Others mention barriers in the local legal or policy framework to using private insurance as a government adaptation measure. In

other cases, insurance is recognised as an appropriate mechanism for private actors to reduce climate risk, while government action is focused on preventative action. Lack of funding and lack of appropriate products from the insurance sector are also mentioned as possible obstacles. Some respondents note that the government takes the role of insurer of last resort, and note that, given the likelihood of growing costs of climate-related events, more efforts should be made to encourage private citizens and companies to insure against climate risks.

## **Local and regional adaptation in the national and EU context**

### ***Importance of national and regional adaptation strategies (Q18)***

The importance of national and regional adaptation strategies is clear, with almost all the respondents stating that both are either very or somewhat important to local and regional adaptation responses (38 out of 49 for both).

The comments from LRAs focus mostly on the complementarity of all levels of policy making. The majority of respondents emphasise the need for national and regional adaptation policy-making to come together to deliver effective solutions. A coherent approach from all levels is seen as a precondition for successful interventions. The national level is seen as important for providing the general framework and direction to policies as well as financial and political support, but the regional plans are more precise and adapted to the local context.

In the same vein, some issues such as economic challenges cannot be addressed at local level and necessitate national or even European or global solutions.

### ***Role of the national policy in facilitating regional and local adaptation plans (Q19)***

Respondents tend to see two broad roles or functions for adaptation policy at the national level: national adaptation policy is a means of providing strategic leadership, while also supporting local implementation of adaptation measures.

The first function relates to national policy and legislative frameworks that enable adaptation efforts at local and regional level. More than half of the respondents refer to the importance of a strong and ambitious policy framework at national level. These frameworks should provide strategic direction (with or without setting up targets and objectives to be met at local level) and support better governance, removing legislative barriers that might hinder efforts at local level.

National frameworks may also set out concrete plans and measures, set a clear definition of roles for different levels of government, and may help to integrate adaptation into sectoral policies at the national level.

The second function is related to support to the implementation of adaptation measures at the local and regional levels. Once a general direction is set, the national government should provide means for LRAs to implement measures. This support can take many forms: one frequently mentioned instrument is providing financial support specifically focusing on adaptation. Providing technical assistance (for instance, supporting the development of local climate scenarios, guidance and decision-making tools, such as methods for cost-benefit analyses or risk and vulnerability assessments), and training of staff are other important support instruments mentioned by the respondents. Furthermore, national governments play an important role in providing scientific knowledge and data to LRAs, in a way that is usable and downscaled for decision-making at local level. At a later stage, the national government can also play a role in supporting knowledge exchange between different local authorities, identifying and sharing good practices.

### ***Role of the EU in facilitating the development of local or regional adaptation strategies (Q20)***

According to the LRAs who participated in the survey, EU institutions can play a role in supporting the development and implementation of local and regional adaptation strategies. According to respondents, this role can take the form of setting the strategic framework, supporting implementation, and supporting knowledge exchange. The EU's policy-making role gives it the power to set a strategic framework for adaptation, enabling action at the national, regional and local levels. Action at the EU-level helps to establish adaptation as a policy priority, driving action in Member States where political will may be absent.

The EU can also help to ensure that adaptation is mainstreamed into different policy fields. Several participants suggest that the general framework at the EU level should include specific targets to achieve which can be adapted to local and regional context. As also indicated by some respondents, given the significant role of LRAs in adaptation responses, EU adaptation strategy-making should draw on the views and experiences of LRAs.

Another important role concerns the implementation of adaptation measures. Several respondents point to the important role of the EU in supporting research and technology and providing technical assistance to promote the better use of available scientific and technical knowledge. The EU can help to make research and knowledge accessible, providing tools, training and guidance. The important



role of the EU in funding adaptation action was also mentioned by a number of respondents.

Supporting the cooperation between different levels of government and facilitating knowledge exchange is another recommended role that respondents expect the EU to play. Respondents specifically mention the need for the sharing of good practices and initiatives such as city twinning programs. It was noted that within Covenant of Mayors efforts should be made to ensure that adaptation is given adequate focus.

### ***Looking ahead: the new EU Adaptation Strategy (Q21)***

When asked what specific needs of LRAs should be taken into account in the new EU Adaptation Strategy, the respondents pointed to several themes. The first is a call for an integrated approach: the new strategy should aim at promoting coherence and creating synergies across relevant policy areas such as agriculture, water management, urban planning, energy efficiency, health policy, and climate change mitigation. Examples where respondents report that such efforts should be focused to help build synergies include supporting nature-based solutions (for example, green infrastructure for rainwater retention) and building renovation schemes that deliver adaptation benefits (cooling) and mitigation benefits (energy efficiency).

Respondents also mentioned the need for the new EU strategy to focus on the social dimension of adaptation, going beyond economic or technological adaptation responses. In this regard, designing the new adaptation strategy to ensure consistency with initiatives like the Urban Agenda and Sustainable Development Goals is thought to be promising. Some respondents noted that efforts to strengthen the health and social system would reduce climate vulnerability as well as broader social vulnerability.

Supporting better governance was a theme in the responses. Several participants state that the new strategy should ensure stronger links with LRAs and better integrate their experience in the implementation of adaptation measures. This also refers to recognising the diversity of needs among LRAs across the EU: a challenge for the new adaptation strategy is ensuring it recognise the specific needs and priorities of each region. In addition, it should aim to empower the LRAs in their role as adaptation leaders.

In terms of how the strategy can empower LRAs, several responses frequently mentioned the need for financial support. Several respondents state that the new strategy should make sure that the LRAs receive the necessary funding for implementation and that the resources reach the local level. An important aspect, as put forward by some participants, is to develop financial tools or products

adapted to small scale projects. Several participants refer to the role of the EU in promoting insurance as a risk management measure, and building a legal and policy framework that would support the development of insurance products specifically.

Another supporting role repeatedly mentioned by the participants is coordination and cooperation, particularly with regard to knowledge sharing. Ensuring there is sufficient attention paid to coordination in the new adaptation strategy would be useful to streamline efforts across the LRAs, enforce mutual learning (for instance among regions which have similar risk profiles), identify best practices so they can be replicated elsewhere and optimise resources. Other types of implementation support mentioned by the participants are capacity building (technical assistance, training and education, providing data for scenarios and modelling), support for frontrunners to develop example-setting experiences and support to LRAs in finding solutions where competing objectives become a barrier (for instance historic buildings and renovation).

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