Handbook for Local Climate Change Adaptation Planning in the Baltic Sea Region

2nd edition
2026

COUNCIL OF THE BALTIC SEA STATES

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Foreword

THIS HANDBOOK provides detailed guidelines for preparing, developing and evaluating local climate change adaptation plans by the municipalities in the Baltic Sea Region (BSR). The guidelines were initially elaborated by the Council of the Baltic Sea States Secretariat (CBSS) in the framework of CliMaLoc – Climate Mainstreaming Locally in the BSR – project. The project – co-financed by the Swedish Institute – aimed to support local authorities in the BSR countries to mainstream climate change adaptation action at the local level and establish partnerships for cooperation in the future.

The 2nd edition of the handbook integrates new approaches and tools prepared in the framework of Interreg Baltic Sea Programme Project Responsive Local Action for Climate Change Adaptation and Disaster Risk Reduction - ClimaResponse.

ClimaResponse is a project that supports municipalities and regions in the BSR in strengthening their climate resilience (CR) by providing practical solutions, evidence-based approaches, and innovative tools to address climate risks effectively. The ClimaResponse project is led by the Council of the Baltic Sea States (CBSS) and co-funded by the Interreg Baltic Sea Region programme. It brings together twelve project partners, including municipalities and their associations, research institutions, and regional organisations to ensure a holistic and pan-Baltic, transnational approach to climate resilience.

The handbook is most suitable adaptation planning tool for low-capacity municipalities in Baltic Sea Regions due to ease of use, sufficient alignment with ISO standards, focusing on stakeholder engagement and integrating adaptation in local plans and budgets, includes awareness-raising for local officials and does not require high technical skills & data infrastructure.

Introduction

ADDRESSING RISKS generated by climate hazards and planning for adaptation at local government and community levels is essential for bolstering societal resilience as well as for ensuring comprehensive and balanced economic, environmental, and social well-being amongst all members of society and across all governance levels. Changes in the climate are often indicated by floods, heatwaves, droughts, coastal erosion, and other climate-related hazards that have been identified across the globe and have an ever-increasing presence in the Baltic Sea Region countries.

The United Nations Intergovernmental Panel on Climate Change (IPCC) has projected that global warming from past anthropogenic emissions will persist for centuries to millennia and will continue to impact the climate system in the long term, leading to sea level rise, with associated impacts (IPCC, 2022). The IPCC report "Climate Change 2022: Impacts, Adaptation and Vulnerability" presents a comprehensive overview of the observed adverse climate change impacts, projected risks and adaptation options. It identifies 127 key risks posed by climate change and suggests that a "risk can arise from the dynamic interactions among climate-related hazards, exposure and vulnerability of the affected human and ecological systems" (IPCC, 2022, p. 5). A risk introduced by human responses to climate change is a new risk category introduced in the report. The vulnerability of exposed human and natural systems is an important component of the risk concept. Relatedly, adaptation is essential for reducing vulnerabilities and exposure to climate change hazards. In human systems, adaptation is commonly defined as "the process of adjustment to actual or expected climate and its effects in order to moderate harm or take advantage of beneficial opportunities". Meantime, adaptation, in the natural systems, is understood as "the process of adjustments to actual climate and its effects; human intervention may facilitate this" (IPCC, 2022, p. 5).

The importance of assessing and accounting for climate risks while planning municipality actions is recognised in most of the Baltic Sea Region countries. It is especially evident in water management practices (e.g., the implementation of the European Directive 2007/60/EC on the assessment and management of flood risks), responses to emergencies and natural hazard events , as well as spatial planning. However, as of 2018, the obligation to prepare (mandatory) local level Climate Change Adaptation Strategies or Action Plans was recognised in only one out of eleven countries in the region (see Table 1).

This Handbook provides step-by-step guidance for local authorities on preparing climate change adaptation plans and strategies based on existing knowledge, tools and resources, e.g. International Organization for Standardization (ISO) standards. ISO has several standards related to climate change adaptation:

— ISO 14090:2019 Adaptation to climate change – Principles, requirements, and guidelines.
— ISO/TS 14092:2020 Adaptation to climate change – Requirements and guidance on adaptation planning for local governments and communities.
— ISO 14091:2021 Adaptation to climate change – Guidelines on vulnerability, impacts, and risk assessment.

Policy measure / Country	National CCA Strategy	LG-s role specifically determined in NCCAS	Requirement for Local CCA Strategy or Action plan	Requirement for LG climate risks assessment	LG-s networking on CCA	Guidance for LG-s in nat. lang. on CCA	CCA Funding for LG-s	CCA information web-portal for LG-s
Denmark	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Estonia	Yes	Yes	No	No	No	No	Yes	No
Finland	Yes	No	No	Yes	Yes	Yes	No	Yes
Germany	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Iceland	No	No	No	No	No	No	No	No
Latvia	Yes	Yes	No	No	No	No	Yes	No
Lithuania	Yes	No	No	No	No	Yes	Yes	No
Norway	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Poland	Yes	No	No	No	Yes	Yes	Yes	No
Russia	Yes	No	No	No	No	No	No	No
Sweden	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes

Table 1. The role of local governments in adapting to climate change (CBSS et al., 2018; see also Tuhkanen et al., 2019).

The guidelines proposed in this handbook adhere to the logical framework method presented in the ISO/TS 14092:2020 standard and follow a 10-step approach (see Figure 1). These steps are proposed with the acknowledgement that there is no 'one-size-fits-all' approach for communities to anticipate, plan, and adapt to the changing climate. Projected climate impacts are not expected to be the same in every country across the region. Similarly, local awareness of climate change and vulnerabilities differ within and across countries. The availability of financial, technical, and human resources to assess and adapt to climate change varies from one country to another.

The ISO/TS 14092:2020 provides guidance for local governments and communities on how to adequately prepare for climate threats and the associated risks. The impacts posed by climate change differ considerably from one region to another. They directly affect communities' well-being, the efficiency of local governments' actions, including the public services they offer, as well as the safety and security of individuals within their jurisdiction. Therefore, local governments and communities have a major responsibility in providing leadership in climate adaptation planning and preparation to manage such risks. The ISO standard provides guidance on how to develop an adaptation plan at the local government and community levels. It provides a detailed elaboration of why and how to establish an appropriate (well-structured and collaborative) governance structure and the key elements for adaptation planning and implementation processes. This includes establishing a facilitation team, assessing risks, developing an effective plan, monitoring the adaptation progress, implementation, evaluating achievements and adjustments needed with the aim of further improving the plan. The step-by-step process enables tailoring the local adaptation plan to suit the climatic, environmental, and societal local conditions. It is expected that such a step-by-step approach will provide guidance for the development of a robust and effective adaptation plan that serves the needs of local municipalities and communities in the short- and longterm. Notably, considering that climate change is a co-evolutionary long-term process, the planning and implementation of adaptation strategies require continual learning and adjustment mechanisms. This document aims to guide the local governments and communities in taking initial steps to create a safe, socially and economically secure and sustainable society that is resilient to current and future climate change impacts. By making use of the presented 10-step approach, municipalities will be able to rely on a robust and tangible framework that will help them assess local climate risks and prepare well-tailored adaptation actions suited to their local needs.

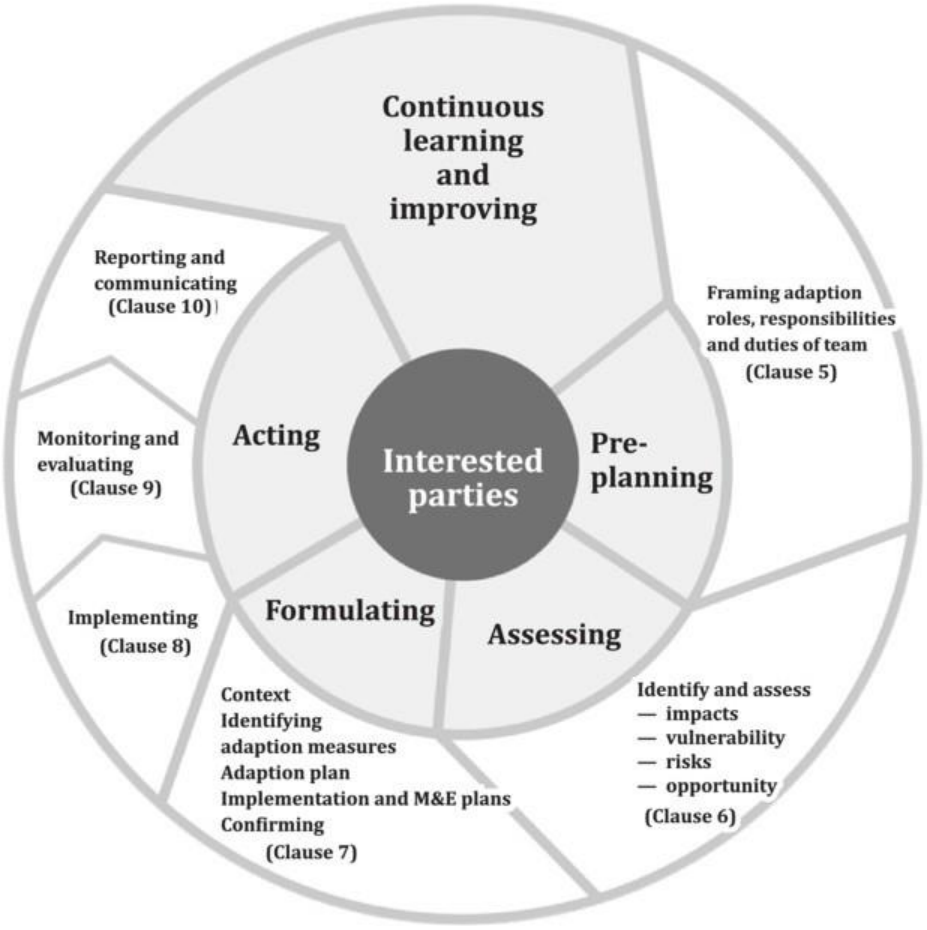


Figure 1. Logical framework approach. Source: International Organization for Standardization (2020).

Step 1:
Assess Local Climate Data and Trends

STEP 1 REQUIRES the assessment of the current climate state in a respective municipality's territory and how various climate aspects have evolved over the last decades. It is recommended to include a list of major extreme weather events that occurred in the past and caused damage to people, environment and critical infrastructure. It should also provide information about disrupted business operations and service availability. The assessment should also include short-, medium- and long-term climate trends, based on publicly available data. In addition, the data sources, data selection criteria, data limitations and uncertainties should be included and described. The list of climate change parameters includes but is not limited to the following:
(i) average and peak temperature (sea and atmosphere), (ii) precipitation, (iii) humidity, (iv) sea level rise, (v) wind speed and direction, (vi) freeze-thaw cycles.

In the Baltic Sea Region countries, local climate trends are usually monitored and recorded by the National Hydrometeorological Services. The data is freely available upon request to authorities or can be accessed directly at the official websites of relevant institutions. Following the EU Climate Adaptation Strategy (European Commission, 2021b), all EU Member States were requested to prepare National Climate Adaptation Strategies including a thorough description of current climate trends, prognoses of climate change impacts until the end of the century, as well as vulnerability assessments. In the BSR context, the major negative climate change impacts are increased precipitation levels and fluvial floods. The EU Floods Directive already requires the Member States to map the flood risk areas (see Directive 2007/60/EC). Accordingly, national flood maps serve as a good source for assessing flood-related risks for local communities. The updated flood data is also accessible via the European flood atlas.[1]

In addition, the national climate adaptation information in the BSR countries can be accessed via the national climate data portals, links given in Endnotes chapter below.

Box 1. Climate trends information

The SMHI and WMO Climate Information portal provides an instant summary reports of climate change for any site on the globe.

Link to create site specific reports:
https://ssr.climateinformation.org/ssr

Step 2:
Climate Risk and Vulnerability. Tips for well-designed assessment

What trends in the BSR should be considered?

Step 2 introduces the main climate change trends that were identified and analysed through the collaborative project BALTADAPT implemented under the umbrella of the Horizontal Action Climate in the EU Strategy for the Baltic Sea Region (EUSBSR) (see Altvater & Stuke, 2013). Step 2 aims to familiarise BSR stakeholders with the trends that are most likely to affect municipalities in the coming decades.

The first recommendation is to remain updated with the newest climate data and long-term prognoses of climate change risks and consequences in one's geographic area. At the global level, the IPCC Assessment Reports provide scientific knowledge on climate change trends. In the BSR, the BALTADAPT project (2012) conducted thorough assessments of regional climate change impacts . The information served as a basis for the Baltic Sea Region Climate Adaptation Strategy[13] and the Action Plan[14]. It also resulted in 14 BALTADAPT Climate Info Bulletins which raise awareness about different topics associated with climate change in the BSR (Climate-ADAPT, n.d.).

AIR TEMPERATURE

Most climate change simulations reveal strong modifications in the air temperature in the BSR. For example, the increase in the mean air temperature is shown to be statistically significant in the upcoming decades, as compared to the recent past. These variations are especially expected to increase in winter. In particular, the forecasts for the North-Eastern part of the Baltic Sea reveal that such temperature variations are coupled with a consistent reduction in snow and sea ice. Temperature extremes in the BSR are also projected to vary more than the long-term averages have shown so far. This means that, in winter, cold extremes, as we experience them in today's climate, will become very unusual in the future warmer climate. At the same time, summertime hot extremes are expected to become more intense in decades to come.

PRECIPITATIONS

The simulations of the precipitation patterns in the BSR show large variations and a wetter climate in the future, especially increasing during the winter periods. While the projected scenarios for the summer period indicate that precipitation is expected to increase in the northern part, the decrease in precipitation is expected in the southern part of the BSR. However, the accuracy of these identified trends is still limited, due to uncertainties in the models' predictions and the definition of what should be considered as a clear parameter for climate change.

Precipitation extremes are also projected to change over time. Models indicate that the varying precipitation rates are increasingly associated with extreme weather events in the entire BSR. This means that extreme weather events are also likely to affect areas which are expected to experience decreased seasonal mean precipitation.

WIND SPEED

Climate change simulations indicate that wind speed will change throughout the whole BSR. Although most projections suggest that the wind speed will increase in the future warmer climate, large uncertainties prevail in relation to exact wind speed patterns.

SEA LEVEL RISE

The regional climate change projections indicate that the sea level is expected to be much higher in the southern and south-eastern parts of the Baltic Sea, while the northern part will be less affected. The consequences of sea level rise will differ along the coastline, with heavier impacts on lowland areas and densely populated regions. At the same time, the sea level in the Baltic Sea is already affected by the local meteorological conditions, which cause sea level rise and consequent flooding. The frequency of such events in the future climate is still uncertain, but we may expect a general increase.

WAVES

The changing climate in the Baltic Sea is also affecting wave patterns, due to the large-scale atmospheric circulation. Model simulations show that maximal wind speed and frequency of extreme events will increase. As a consequence, the wave height and the frequency of the highest waves will also increase, with the effect that soil erosion in shallow areas will further intensify.

WATER TEMPERATURE

All scenario simulations reveal increasing water temperatures in the Baltic Sea. This applies both to the volume average and to the sea surface. The largest change is expected in the Bothnian Bay in summer and in the Gulf of Finland during winter periods. The change in water temperatures is also expected to impact the Baltic Sea ecosystems, affecting both the number and the distribution of species. For example, in summer, these temperature variations are likely to intensify cyanobacterial blooms resulting in negative environmental impacts on other marine species as well as on the coastal economies.

EUTROPHICATION

Eutrophication is expected to increase due to the increased precipitation in the catchment area unless decisive political actions and adequate management measures are taken. Increased plankton production and a further reduction in oxygen concentration may cause even larger desert-like areas in the deeper parts of the Baltic Sea, devoid of macroscopic benthic fauna and increase the areas with changes in species composition. The increased plankton production and biomass in the surface layer will reduce light penetration resulting in negative impacts on eelgrass meadows and seaweed forests on reefs and rocky shores.

OTHER TRENDS

In the Northern Baltic Sea, the expected lack of or reduced ice cover during the winter seasons is expected to affect bird populations, breeding of ringed seals and may contribute to secondary ecosystem impacts whereby species adapted to cold temperatures are replaced by freshwater species tolerating warmer water. To summarize, the Baltic Sea ecosystem is expected to undergo substantial changes in the coming 100 years.

The sea water is expected to become more brackish and warmer, while the sea level is predicted to rise, especially in the southern part. Biological communities inhabiting the Baltic Sea, and the ecosystem connected to them, are expected to change dramatically. The total number of species is expected to decrease. Meanwhile, the freshwater species penetrating the Baltic Sea are expected to increase, at the expense of the marine/saltwater species. Furthermore, rising temperatures, decreasing sea ice cover, sea level rise, changing precipitation and storm patterns are expected to directly impact infrastructure in the Baltic Sea such as coastal protection, maritime traffic, ports, and tourism. Indirect effects of climate change such as shifts in tourism or changes in demand will have further negative consequences on the maritime sector. Also, other sectors important to the BSR economy such as forestry, agriculture, construction, energy production and transport will be affected by climate change.

Climate assessment: tools and reports

There are a number of tools that have been developed to help BSR countries and municipalities analyse and assess their climate vulnerabilities and to set a basis for well-tailored adaptation plans. Below is the presentation of tools, which are simple to use and, at the same time, provide a solid assessment basis.

CASCADE PROJECT

In 2020, the CASCADE project (Community Safety Action for Supporting Climate Adaptation) released a report on climate risk drivers and hazards in the BSR countries (see Tuhkanen & Piirsalu, 2020). The examples showcased in the report draw on national climate risk assessment documents from Denmark (DEMA, 2018), Finland (Ministry of the Interior, 2019), Norway (DSB, 2014), Poland (RCB, 2015) and Sweden (MSB, 2013).

The report provides a useful reference for understanding correlations between climate change drivers, hazards, and their potential direct, indirect and cascading impacts on ecosystems and societies. In addition, it includes a comprehensive methodology on the integrated risk assessment, as well as guiding steps for analysing the local climate trends. Also, the report includes an overview of the climate hazards from the National Risk Assessments (or similar documents) in the BSR countries.

HELCOM ASSESSMENTS

In 2021, the Baltic Earth and HELCOM published the first Baltic Sea Climate Change Fact Sheet aiming to provide a better understanding of climate change effects in the Baltic Sea (Helsinki Commission – HELCOM, 2021). This publication covers the latest available scientific knowledge on the global climate emergency with anticipated impacts on the BSR. The Baltic Sea Climate Change Fact Sheet is an open-access document and is available on HELCOM's website.[15]

BALTIC EARTH ASSESSMENTS

The BALTEX (2015) and Baltic Earth Assessments of Climate Change (BACC) for the Baltic Sea basin were compiled to assemble, integrate, and assess available knowledge of past, current, and expected future climate change trends and its impacts on the Baltic Sea basin environment. The first BACC report was published in 2008; and was followed by the second assessment report in 2015 (the BACC Author Team, 2008; 2015).

Additional open-access research and up-to-date information on climate change in the BSR can be found on the Earth System Dynamics website and its special issue section titled the Baltic Earth Assessment Reports (BEAR).[16]

CLIMATE CHANGE DATA RELEVANT FOR ALL BSR MUNICIPALITIES

The Swedish Meteorology and Hydrology Institute (SMHI), together with the World Meteorological Organisation (WMO) developed a web-based tool (see Box1) helping cities and municipalities to access site-specific climate data. The open-access service and the possibility of selecting very specific geographic areas allow access to climate data forecasts and summary reports of relevance for local municipalities. The platform includes pre-calculated climate indicators, including past, present and future trends. Additionally, the tool provides guidance on how to align local observation with overall global changes.[17]

COUNTRY-SPECIFIC DATA RESOURCES

Some BSR countries developed targeted maps, data and tools related to local climate risks. For example, some countries supply indicators to support local municipalities in setting their goals and targets. Such country-specific data resources are listed below:

- Denmark: Danish National risk map of coastal areas – Data forecasts are available until 2120. In Danish[18].
- Sweden: Swedish Advanced Climate Change Scenario Service.[19]

The Climate Knowledge Portal provides climate projections per country covering all Baltic Sea Region countries.[20]

It is always advisable to check with national authorities to see whether updated data or prognoses are available.

LOCAL WEATHER CENTRE NETWORK

Establishing Local Urban Weather Centers network is an innovative and feasible tool developed and tested by ClimaResponse project for collecting real-time local weather data.

Local Urban Weather Centers are city- or region-based meteorological and climate data hubs that integrate real-time weather observations, urban microclimate modeling, and decision-support services for local authorities, planners, and citizens. Localized, high-resolution weather and climate information, collected, analyzed, and communicated in real time, can significantly enhance urban resilience and adaptive capacity.

Core functions include:
High-resolution weather monitoring via densely sited sensor networks measuring temperature, humidity, rainfall, wind across urban micro zones;

Urban climate modeling using Fine-scale models simulating urban heat islands, flooding, air circulation, and storm impacts;

Forecasting and early warning allowing short-term alerts for heatwaves, heavy rain, or air pollution events tailored to neighborhoods;

Decision support for adaptation when translating data into practical tools and indicators for planners, e.g. heat risk maps, green infrastructure siting, and resilience dashboards;
Citizen and community engagement by making local data available via open platforms to support co-created adaptation measures.

Fine-scale climate data can be used by the municipality for Land use planning, Buildings orientation and materials, Green-blue infrastructure design and designing Urban ventilation corridors.

This aligns with ISO 14090/14091 standards emphasizing risk-based, data-driven adaptation planning.

Examples of usage of local weather centre network for local climate adaptation planning include Tallinn and Pärnu in Estonia and Gävle in Sweden. Guidance for setting up and use the weather centre network can be found from ClimaResponse website https://interreg-baltic.eu/project/climaresponse/ .

How to start a climate risk and vulnerability assessment in your municipality?

Before initiating the development of a local climate adaptation strategy, the municipality is advised to review existing information and assess current and future climate change impacts in their respective territory. The assessment should also consider the climate impacts on regular seasonal weather trends and include scenarios for sudden and extreme weather events.

The assessment should highlight anticipated climate change impacts in within a respective municipality and its surrounding areas. The analysis should also include the assessment of expected climate change impacts on different relevant sectors, and the services provided within the respective municipality, as well as the competences and structures in place to support adaptation. Examples of such sectors are forestry, fisheries, agriculture and food security, water resources and flood protection, terrestrial and marine ecosystems, urban environment (including sports and recreational areas), energy resources (including the production and supply side), business and industry (including tourism), transport infrastructure and services, ICT and telecommunication, human health (including health and social care systems), government and community services, financial services, etc.

IDENTIFY SECTORAL AND CROSS-SECTORAL RISKS AND VULNERABILITIES

After the collection of background information and the review of climate change trends, the next step is the vulnerability analysis. . It includes identifying which social and economic activities, infrastructure, and services are vulnerable to climate change today and in the future. Particular attention should be paid to past climate events that have caused damage (i.e. flooding events, problems with storm water, landslides and erosion, hail, drought, problems related to humidity, etc.) and consider how climate change may exacerbate such events in the future.

One important aspect to be taken into consideration while developing the municipal Climate Change Adaptation Strategy is related to the feasibility of proposed actions. In other words, climate change adaptation strategies should address the climate-related risks and vulnerabilities that are under the controlled and/or influence of a respective municipality. As risk are often transboundary, risk management may require cooperation and coordination with neighbouring municipalities to address shared challenges.

When conducting the climate vulnerability assessments, it is also crucial to consider both direct and indirect impacts. **Direct impacts** include but are not limited to floodings and storm surges, water scarcity, changes in human health, safety and security, as well as heatwave mortality. Meanwhile, the examples of **indirect impacts** may be linked to a loss and damage of critical infrastructure, as well as services which depend on such infrastructure, changes in land cover and use, changes in the provision of ecosystem services, changes in the productivity of crops and livestock, food supply, fuels supply etc. Relatedly, another important aspect to be considered is the possible climate change impacts on **critical infrastructure**, which affects the provision of basic societal services (i.e. electricity supply). In case of major disruptions, the local authorities are advised to consider the need to evacuate people, provide shelter, and ensure the supplies for the basic needs of people who have been evacuated.

To sum up, assessing the characteristics of direct and indirect climate change impacts (in terms of magnitude, likelihood, and urgency) will support municipalities in setting priorities and preparing climate change adaptation strategies on different levels. This will also help ensure the feasibility of planned adaptation measures as well as their correspondence with the municipal budgets.

IDENTIFY GROUPS VULNERABLE TO NEGATIVE CLIMATE IMPACTS

The IPCC defines vulnerability as a function:

Vulnerability = Exposure + Sensitivity − Adaptive Capacity.

Thus, for determining vulnerability, the three components should be assessed. For exposure, identify people or assets that are physically located where climate hazards occur (e.g., flood zones, heat islands, coastal areas). For
sensitivity, determine which groups of people or assets might have conditions that make them more susceptible to harm (e.g., elderly, people with chronic diseases, low-income households, specific plant or animal species). On adaptive capacity find out who has fewer resources to cope or adapt (e.g., renters, informal workers, marginalized communities).

For social vulnerability, key climate-vulnerable social groups might be
Age-based groups: elderly (65+) and children (especially <5 years) because of heat stress, respiratory risks, limited mobility.
Socio-economic groups: low-income households; unemployed or informal workers; energy-poor households; single-parent families because of fewer resources to adapt, higher relative cost burden.
Housing-related groups: renters (especially short-term contracts); informal settlements (squatters);
residents in floodplains, coastal zones, urban heat islands; poor-quality housing (no insulation, no cooling).
Health-vulnerable groups: people with chronic illnesses (cardio, respiratory, diabetes); disabled persons; pregnant women etc.
Geographic / livelihood groups: coastal communities; farmers and forestry-dependent households; fisheries communities; urban poor in dense city districts; indigenous and rural communities.
Socially marginalized groups: migrants and refugees; ethnic minorities (where relevant); people with limited language or digital skills.

The most vulnerable are often multiple-risk groups, e.g.: Elderly + low-income + heat island
Coastal + fishing-dependent + low education
Rural + aging population + poor transport access. However, as vulnerability is determined by a number of factors related to sensitivity and capacity, it is important to remember that vulnerability is always case-specific. People falling into the above categories are not necessarily vulnerable in all circumstances, as their level of vulnerability depends on the specific context, exposure to risk, and their ability to anticipate, cope with, resist, and recover from adverse impacts.
It is recommended for the local municipality to identify and map vulnerable groups relevant to climate hazards. They can do this by collaborating with organisations already working with groups that may be vulnerable to get their insights related to any specific needs that need to be accounted for in planning. Involve these organisations, e.g. NGOs, community networks, and social departments in your adaptaiton planning as they can be key actors for both local knowledge and implementation.
Social vulnerability maps can also be created based on statistics or other knowledge related to social and economic sensitivity and adaptive capacity. These maps can be layered withclimate hazard exposure to visualize “hotspots” of vulnerability (e.g., elderly population in flood-prone zones). As vulnerability is case-specific and thus also hazard-specific, it should be assessed separately for multiple hazards.

Vulnerability maps could be used to:
Prioritize neighborhoods for adaptation investments (cooling, drainage, health outreach, crisis response network development);
Inform stakeholders on urban planning and zoning;
Support climate justice and equity strategies;
Develop targeted early warning systems (e.g., for heat-sensitive populations);
Establish monitoring indicators to track vulnerability change over time.

Mapping vulnerable groups allows municipality to focus adaptation on socially just outcomes, enable evidence-based targeting of resources and integrates climate data with socioeconomic realities.

Mapping vulnerable groups is essential for planning adaptation measures specific to the needs of each group.

IDENTIFY POTENTIAL FUTURE VULNERABILITIES

Municipalities are advised to monitor climate trends in their respective area and make continuous assessments of how the magnitude and frequency of the forecasted extreme weather events are likely to change over time. This will help identify the occurrence of new risks and vulnerabilities.

CLIMATE RISK AND VULNERABILITY ASSESSMENT: KEY ELEMENTS

When designing the climate risk and vulnerability assessment (see Box 2) the local governments should consider and include in a report the following:

- The list of potential climate change impacts on socio-economic activities, assets, ecosystems and services provided by the local government.
- Identification of the degree and likelihood of exposure to climate change impacts (both direct and indirect) to the listed items.
- Determination of the sensitivity of such items to climate change and the expected consequences. This analysis should consider short-, medium-, and long-term aspects.
- Mapping of vulnerable groups and assets
- Capacity analysis to adjust, take advantage and/or respond to the identified changes and related consequences in a respective municipality.

When preparing the climate risk and vulnerability assessment, it is critical to adequately engage all interest groups. Various tools can be used to ensure the recognition of various interests and their meaningful inclusion in the decision-making process. For example, in addition to collaboration with key community organisations, the use of questionnaires, surveys and participatory workshops, etc. can be used to transparently enable identifying the perceptions and concerns of the different interest groups towards climate change and their needs when it comes to adaptation measures.

Data visualization with GIS maps

Presenting easy-to-read information on climate risks and vulnerabilities via, for example, GIS map(s) will allow any interested actor to visually understand complex data. Visual data tools also provide support for setting priorities when undertaking vulnerability assessment work and defining climate adaptation actions. The climate risk and adaptation action maps could also be included in the local governments' strategic climate adaptation plans. One relevant example is how the Danish Coast Administration Authority presents local climate risks and adaptation actions using the GIS tool.[21]

Box 2. Recommended tools

The guidelines prepared by the CASCADE project can support municipalities in preparing a thorough climate risk assessment. The guidelines for integrated climate change and risk reduction management, tailor-made for local authorities in the BSR, are found in the Annexes of the CASCADE project document (Wolanin & Telak, 2021).

Depending on the selected assessment approach, it may be relevant to follow the C40 Cities Climate Change Risk Assessment Guidance (C40 Cities Climate Leadership Group, 2018) available in the C40 Knowledge Hub.[22]

In addition, a number of tools developed by the Danish authorities for local governments, organizations and households can be used as inspiration for assessing vulnerability and support in climate change adaptation planning. [2]

ClimaResponse project toolbox [30]

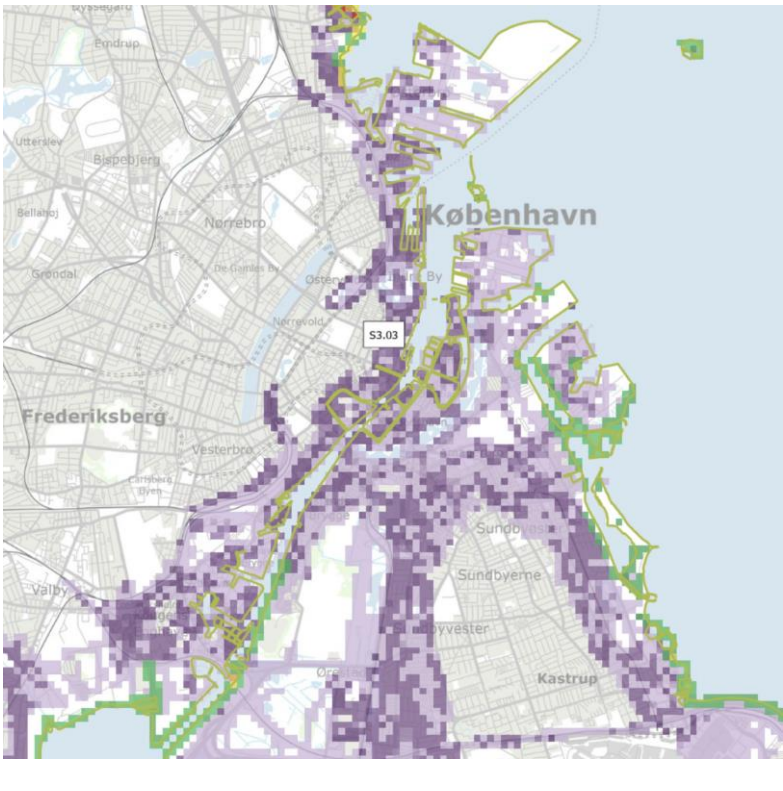


Figure 2. Danish web-tool Kystplanlægger. Source: https://xn--kyst-

planlgger-cgb.dk/kort-om-webgis/

Step 3:
Review existing plans and priorities

LOCAL GOVERNMENTS need to consider climate change when addressing the increasing and ever more complex urban development challenges. If the decisions on how to address these challenges exclude climate considerations (e.g. in urban planning and development), municipalities risk facing greater problems in terms of costs, resource use, socio-economic health and environmental safety. Accordingly, the use of integrated, multi-sectoral and multi-stakeholder approaches is critical for the development of short-, medium-, and long-term planning scenarios. Such approaches provide the most efficient ways to adequately consider climate adaptation at a municipal level ensuring that strategies and plans are co-created and comprise cross-sectoral considerations. Cross-sectoral approach to planning is a common practice in integrated urban planning practices. It considers interrelationships between housing, transportation, economic development, education, environmental sustainability and other policy areas, which are strongly related to and affected by climate change.

The plans that BSR municipalities have in place tend to reflect existing development trends in a particular municipal territory. The plans developed under the leadership and responsibility of a local government also consider the conflicting priorities among different interest groups and describe how these competing priorities provide limitations to local development planning. Accordingly, comprehensive planning must be strategic and consider the local context, needs and challenges while at the same time ensure that the decisions are taken in line with the appropriate roles and mandates of the governance levels which are designing the action.

To address the impacts of climate change, local governments should build an adaptive capacity. They should review if and how existing plans and strategies (including budgets supporting the identified strategic actions) consider climate change-related risks and vulnerabilities. To adequately consider the adaptive capacity in a respective municipality, it is useful to undertake a mapping exercise, whereby a thorough analysis of human, technical, financial and information resources and capacities, including institutional resources is performed. Typically, the planning documents of a municipality include both the long-term, multi-sectoral strategies and other plans (e.g. the development strategy, the general plan) and the short-term, sector-specific and/or operational planning documents (e.g. spatial development plan, energy and climate plan, transport development plan, waste management plan, water management plan).

The review of existing plans and priorities against the backdrop of climate risks and vulnerabilities (identified through Step 2) will help identify and prioritise both adaptation goals and adaptive actions. It will also provide guidance to orienting where the local government should develop and/or allocate more resources to fill existing gaps.

Below are some guiding questions which could support municipalities in reviewing the existing plans:

1. Which measures have worked and which haven't worked in the past?
2. How is the climate change expected to impact the physical and socio-economic environment of the municipality, and how should operations and services be adapted to adequately take into account such changes?
3. How can existing development objectives and priorities be reviewed to better include climate change considerations?
4. Do existing strategy/plan documents contain elements that should be removed and/or added to ensure that the plan includes climate adaptation considerations at its core? What are the key steps helping to implement such a strategic revision?

It is highly important to ensure that the review process follows a collaborative approach starting from the early planning stages. In particular, it is important to include all interested parties, including but not limited to national authorities, neighbouring municipalities, the private sector and citizens' associations, among others. All interested stakeholders should be part of co-designing and co-developing the strategy and ensuring that the required capacities are in place.

Step 4:
Identify HOTSPOTS

TO FACILITATE POLICY DECISIONS on mitigation and adaptation strategies, it is important to understand, quantify, and summarise climate change impacts, including related uncertainties. It is equally important to understand aggregating and cascading climate change impacts and implications to different sectors. Cascading climate change impacts are likely to increase exposure to various risks and are therefore likely to increase the pressure on a respective sector's adaptative capacity.

Considering the above, mapping the climate change "hotspots" in a respective municipality is a very important step in preparing an adaptation plan (see for example Figure 3). Hotspots are areas and/or functions under the control of the local government that are particularly vulnerable to current or future climate impacts, and where single or combined climate events may create or increase risks for the community's assets, services, and economic activities but also for the human health and their wellbeing.

Such hotspots may be, for example, located in coastal areas, where the occurrence of flooding can cause disruptions in the power and water supply, soil erosion, as well as leakage of hazardous substances. Civil security measures should also be accounted for in the mapping of the hotspots, for example, if the hazard prevents the evacuation of elderly and disabled people without external assistance. Another example of hotspots are urban areas, which are densely covered with concrete buildings, roads and sidewalks paved with asphalt. These conditions result in a lack of shade and green areas, which is likely to result in heat islands (and related cascading effects), as well as high demand for cooling, due to extremely high temperatures. This may in turn produce power and water supply disruptions, causing health problems and higher mortality, especially among the most vulnerable groups of the population.

Another important area for local authorities to consider when mapping hotspots is identifying key ecosystem service hotspots. The ecosystem services are not only foundational to most human activities but are also essential in the context of climate change mitigation and adaptation. Accordingly, local municipalities are recommended to identify opportunities and limitations that nature-based solutions can provide when designing climate adaptation strategy. To exemplify, it might be relevant to consider measures that enhance the vegetation cover and green spaces; construct structures that restore natural hydrologic functions, such as stormwater ponds, bioswales, green roofs and riparian zones; restore natural protective habitats along the coastlines.

adaptation action plan (City of Tel Aviv-Yafo, 2020, p. 17).

Step 5:
Prioritise adaptation actions

THE NEXT STEP is setting priorities for short-, medium- and long-term actions. Local municipalities are advised to consider which of the defined actions are able to support the implementation of the set goals in the defined planning cycle (e.g. in the next 5 years). This should also incorporate the forecast of the evolution of climate risks in the medium (5 – 10 years) and long term (>10 years). When prioritising actions, it is crucial to thoroughly analyse and select which actions can be afforded (in terms of costs and resources) but also which ones afford the most benefits to: (i) the greatest number of people, (ii) the most vulnerable part of the population, (iii) the ecosystem and its services, (iv) the long-term development prospects of a respective municipality.

A simple method to prioritize among the identified actions is to consider the social, technical, administrative, political, legal, economic, and environmental opportunities and constraints of each action (see Table 2). The results of such an assessment will guide the planning team in deciding on the benefits and disadvantages of each action. It will also enable them to determine which actions are best suited to a respective municipality's capacities and resources.

A method that can be of help in the process is a classification of the identified climate adaption actions under three different categories, namely 'no-regret', 'low-regret' and 'win-win'.

No-regret actions provide cost-effective solutions in a short term, as well as in the context of a number of future climate scenarios. They generally do not require substantial trade-offs with other policy objectives, or such trade-offs are easily resolved.

Low-regret actions are relatively low cost and provide large benefits under the predicted future climates. These measures might require some further agreements with stakeholders who may experience uneven distribution of costs and benefits from the proposed actions.

Win-win actions contribute to climate change adaptation whilst at the same time ensuring other social, economic, and environmental policy benefits, including positive effects on climate change mitigation.

These types of actions should be identified and analysed across a wide range of sectors, to ensure that crossing and cascading effects are adequately addressed. For example, reducing leakage from a water utility infrastructure should be considered a measure that can both improve water efficiency and help address drought risks.

Table 2. Considerations and key questions for prioritising adaptation action

Consideration	Key Questions
Social	Will the action be socially acceptable? Is it compatible with community values? Are the special needs of vulnerable groups addressed?
Technical	Is the action technically feasible? Will the action reduce long-term loss? Are there any indirect effects? Does maintenance create additional long-term costs?
Administrative	Can the local authority meet the staffing and funding needs of the action, or does it need to be obtained elsewhere/outsourced?
Political	Are the objectives and actions in line with national/regional policy? Is there political support for the action? Is there enough public support to ensure the success of the action?
Legal	Does the local authority have the remit to implement the action?
Economic	Is the action cost-effective and likely to pass a cost-benefit analysis? What benefits will the action provide? Are there no cost or low-cost natural solutions available?
Environmental	How will the action affect the environment? Is the action consistent with environmental goals? Are nature-based solutions preferred over technical ones?

Other methodologies which can be used for prioritising strategies and actions are, for example, Cost-Benefit Analysis (CBA), Multicriteria Analysis (MCA), Benefit-Cost Analysis (BCA) (see Box 3).

COST-BENEFIT ANALYSIS (CBA)

A CBA is a method used to measure the benefits associated with a decision. The measurement is based on calculating the positive aspects of taking an action minus the costs associated with taking an identified action. A CBA, therefore, foresees measurable financial metrics, such as revenue earned and costs saved, thanks to the decision to pursue an action. A CBA can also include the intangible benefits and costs of a decision or its indirect effects. A cost-benefit analysis includes the following key steps:
Step 1: Specify the set of options.
Step 2: Decide whose (i.e. stakeholder groups) costs and benefits count.
Step 3: Identify the impacts and select the indicators for measuring them.
Step 4: Predict the impacts over the life span of the proposed regulation.
Step 5: Monetize (place financial values on) the impacts (both positive and negative).

MULTICRITERIA ANALYSIS (MCA)

A Multicriteria Analysis (MCA) method is a structured approach used to determine the overall preferences among different alternative options, whereby additional value to several objectives is created. The MCA method includes specifying the desirable objectives, corresponding attributes, and indicators. The actual measurement of selected indicators does not necessarily have to be described in monetary terms; it is often based on the quantitative analysis (through scoring, ranking, and weighting) of a wide range of qualitative impact categories and criteria. Different environmental and social indicators may be included side by side with other indicators describing the economic costs and benefits. The multicriteria analysis or multi-objective decision-making is a type of decision analysis tool that is particularly applicable to cases where a single-criterion approach (such as cost-benefit analysis) is insufficient. This is particularly relevant in the case of adaptation measures, where significant environmental and social impacts cannot be evaluated based on monetary values alone. Therefore, the MCA allows decision-makers to include a full range of criteria including but not limited to social, environmental, technical, economic and financial indicators.

BENEFIT-COST ANALYSIS (BCA)

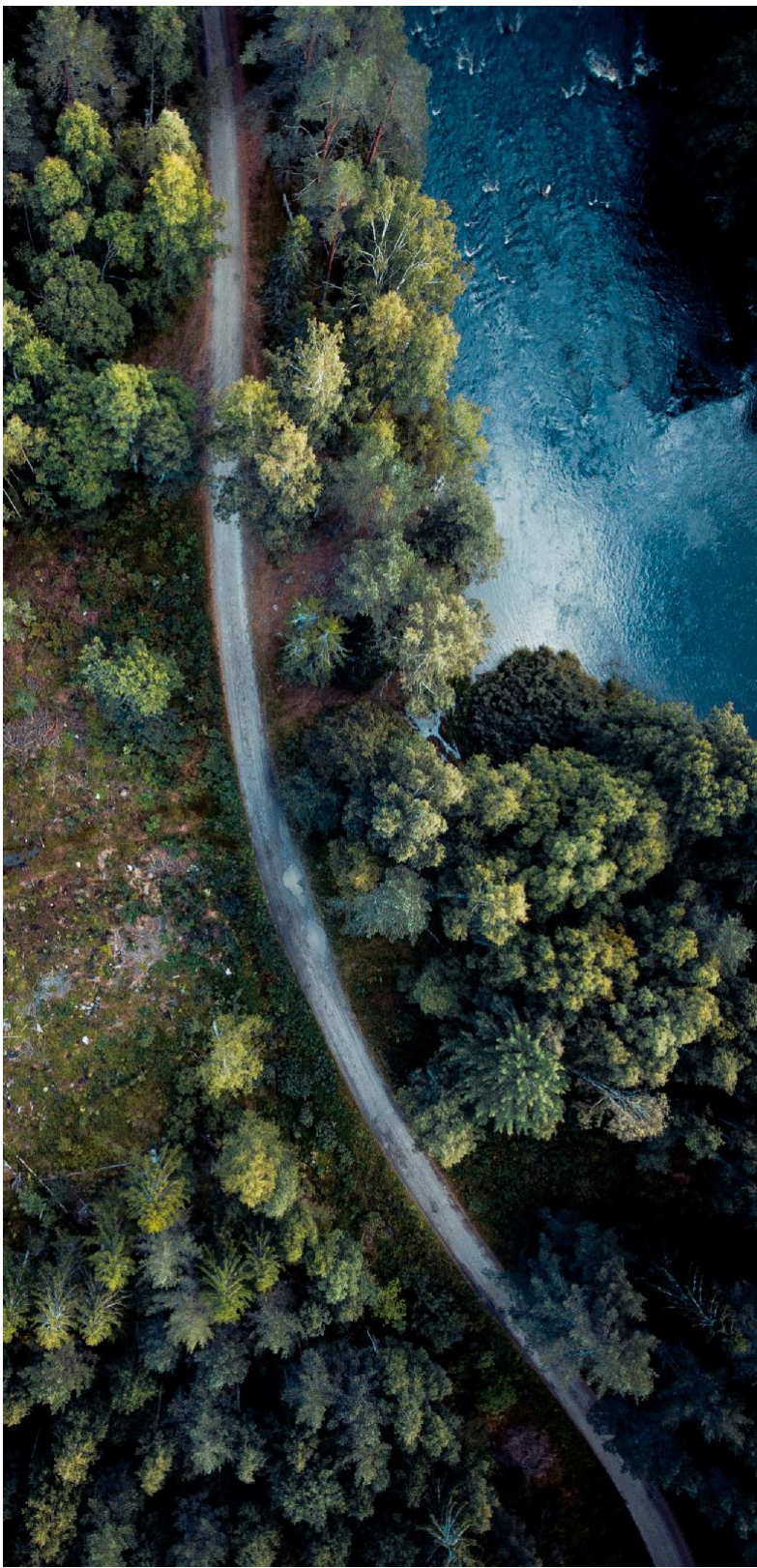
The Benefit-Cost Analysis (BCA) is a method that helps to assess the benefits acquired via a reduced potential future risk. It compares the benefits of a reduced future risk to its potential costs. The result is a Benefit-Cost Ratio (BCR). A project or an activity is considered cost-effective when the BCR is equal to or higher than 1.0.

Box 3. Methodologies for prioritising actions

The European Commission's Cost-Benefit guide.[24]

A short guide on how to undertake and make the best use of multi-criteria analysis.[25]

A primer on the Benefit-Cost Analysis.[26]



Step 6:
Develop an adaptation strategy

ACCORDING TO ISO/TS 14092:2020, the local adaptation strategy should include the following elements:

- the objectives and the scope of the local adaptation plan;
- the ways and means through which the local government intends to achieve the set objectives;
- the actions that are to be implemented;
- the justification for the actions to be implemented;
- the information, data and assumptions on which decisions are based;
- the validity period of the adaptation plan and the deadlines for actions to be implemented;
- the description of who is responsible for implementation.

The local adaptation plan should also include the following:

- state the rationale behind the formulated objectives and actions;
- state the understanding of sustainable development in the local context;
- describe the climate change trends, including the past, present and future forecasts, with a particular focus on those which are of concern;
- identify and specify the climate data – a basis for the plan and other information considered, including the sources used and the methods through which projections, scenarios and models were identified;
- state if and how the greenhouse gas (GHG) emissions scenarios were considered;
- state any other scenarios or projections used (e.g. socio-economic, demographic, etc.);
- state and clearly define baselines, where applicable;
- describe the potential impacts of climate change on the municipality, including the positive and negative ones. Include the direct, indirect and cross-cutting (systemic) impacts of climate change on activities, assets and services of the local government, populations including identified vulnerable groups and businesses;
- document how the most critical climate impacts identified in the plan are addressed;
- document how the adaptation opportunities identified are to be realised;
- document elaborating how prioritised areas and sectors for reducing climate change risks were identified and selected;
- describe the prioritisation process and its outcomes;
- describe the approaches to reducing climate change risks which have been deemed feasible in the adaptation plan, including the combination of green (ecosystem-based adaptation), soft (building adaptive capacity) and grey (infrastructure and technology) options, as well as actions that are incremental and/or transformative;
- state how the climate adaptation process is to be embedded in daily management practice and other policies, strategies and plans of the local government;
- the local adaptation strategy may also refer to other existing national policies and regulations that are relevant to, or influence, the local adaptation process.

Additionally, it is crucial that the adaptation plan describes how and when the local communities will be informed and consulted about the adaptation strategy, as well as how and when the strategy will be made publicly available. The points listed above can be used as a guide for drafting the strategy or plan. However, the structure and the content of an adaptation plan is context-dependent and should be adapted to specific municipality profiles (e.g. rural or urban). Furthermore, the characteristics of the document will also depend on whether the adaptation strategy is developed as a self-standing document or, instead, is foreseen as a part of the local sustainable energy and climate action plan (in line with the Covenant of Mayors for Climate and Energy).

In general, it is recommended to use the Logical Framework Approach (LFA) for designing the local adaptation strategy. This method includes monitoring and evaluation activities in the implementation process. The latter is key for assessing the success of the strategy and can guide planning adjustments and follow-up actions at a later stage.

Step 7:
Develop an adaptation action plan, including budgeting

AN ADAPTATION ACTION PLAN contains a list of prioritised adaptation actions. The list may consist of the following elements:

- title and description of the action;
- cost;
- financing source(s);
- implementation period and agreed deadline;
- a list of organisation(s) responsible for the implementation;
- measurable indicators. Indicators should be designed in a way that helps local municipalities to measure the implementation progress. Indicators should not only consist of quantitative measurements such as “the number of people reached” or “budget allocated” but should also allow for the assessment of the quality of implemented activities.

The Estonian Climate Change Adaptation (CCA) action matrix and its adaptation action program are one example of how local municipalities can develop their adaptation action plans. It includes the following elements (see Lahtvee et al., 2015):

- A list of actions
- Title of the action
- Aim of the action
- Sub-objectives that the action contributes to
- Type of the action (regulation, economic incentive, information, investment, planning, study)
- Climate risks the action addresses
- Climate impacts the action addresses
- Indicator(s) of progress
- Base level
- Target level
- Whether the action is newly formulated or if it is already existing
- Interrelation with/dependency on other actions
- Relevance to legislative acts, at the local, national and global levels
- A list of institutions responsible for the implementation
- Financing sources (state budget, local budget, EU funds, etc.)
- Impact on different stakeholder groups: population, enterprises, public sector (scale: 5 very positive - 1 very negative)
- Impact on different sectors: social, business, environment (scale: 5 very positive - 1 very negative
- Simplicity of implementation (scale: 5 very simple - 1 very complicated)
- Explanation of the implementation challenges
- Geographic scope of the action (5 cross-border relevance – 1 local relevance scale)
- Urgency of the action (5 very urgent – 1 can be delayed)
- Explanation of the urgency
- Cost of the action (5 marginal costs – 1 extensive cost)
- Explanation of (in)action costs
- Score of the Cost Benefit Analysis (CBA) (from 10 to max 50).

Notably, not all municipal adaptation action plans have to contain as detailed information as the one in the example above. However, a well-structured and detailed action plan is helpful for prioritising and selecting the actions and for ensuring a timely and adequate implementation. Accordingly, when developing the action plan, it is key to ensure that the identified actions are relevant and contribute to the objectives of a local adaptation strategy and are sufficient to generate the desired results.

Step 8: Implement

THE LOCAL GOVERNMENT should make sure that the local adaptation plan is embedded into the existing policies, strategies, and processes, as well as the operational and administrative practices of all departments and sections falling under the jurisdiction of a respective local government.

ESTABLISHING INTERDEPARTMENT CLIMATE RECILIENCE WORKING GROUP for better planning and implementation of the local adaptation strategy and action Such group would be a cross-functional team of city officials who collaborate to develop and implement strategies that help a city adapt to climate change impacts, such as heat waves or floods. The permanent working group focuses on integrating climate resilience across different municipal departments like urban planning, transport, and water management to avoid working in silos, ensuring that decisions and plans are made holistically and are effectively implemented throughout the organization.
Key functions of a Municipal Interdepartmental Working Group on Climate Resilience are as follows:
-Cross-departmental collaboration: Bring together civil servants from various departments to work on a common goal, such as developing and implementing a climate action plan.
-Holistic strategy development: Integrate climate resilience into all municipal operations, from spatial planning and building codes to public procurement and waste management.
-Vulnerability assessment: Assess the specific risks and vulnerabilities a municipality faces due to climate change.
-Action plan creation: Develop and implement local strategies and plans to address climate impacts and build resilience, often involving both internal collaboration and external stakeholder engagement.
-Stakeholder engagement: Involve external stakeholders like community groups, businesses, and academic institutions to create robust and well-supported adaptation measures.
-Monitoring and evaluation: Monitor the progress of climate adaptation plans and evaluate their effectiveness, adjusting strategies as needed.

In addition, interactions and synergies between mitigation and adaptation actions are highly important (see Box 4). In particular, it is critical to ensure that the resource allocation to support resilience-oriented climate change action enables the reduction of greenhouse gas (GHG) emissions and vice versa. As noted in the EU Strategy on Adaptation to Climate Change - Forging a climate-resilient Europe:

"Policy coherence must systematically consider adaptation to avoid inadvertently undermining it. Whenever relevant, EU and Member State policymaking should apply the following policy coherence principles: ensure that regulation and funding take into account disaster risk to avoid creating new exposure; reduce existing risk by building up resilience, prevention, and preparedness; manage residual risk. These principles should be integrated, for example, in calls for tender and selection criteria for EU-funded projects as well as taken into due account when designing policies more generally." (European Commission, 2021b, p. 8)

In addition, the municipal annual budget should be scrutinized against the adaptation action plans. Prior to the adoption of the municipal annual budget, it should be verified that all planned spendings either increase resilience or do not make society more vulnerable. For example, the City of Oslo developed a dedicated Climate Budget, which serves as a governance tool for its climate work. The Climate Budget presents reduction targets and mitigation measures which are being implemented to reduce emissions within the Oslo municipality and to achieve the targets set out in the Climate and Energy Strategy. The first City Climate Budget was adopted in 2016 and updated annually. The methods used for the assessments in the climate budget are developed continuously, and there is an ongoing need to further develop, update and improve the underlying knowledge base. Although the Oslo climate budget is mainly centered on reducing GHG emissions, the approach is also valid for implementing adaptation actions. The overview of Climate budget for Oslo can be found here.

To ensure the timely and efficient implementation of local municipal climate adaptation strategies, cooperation with the private sector is important. For example, a local government may consider encouraging the private sector operating in a municipality's jurisdiction to include relevant elements of adaptation strategy in their work on risk management and adaptation planning.

Box 4. Guidelines for climate proofing energy efficiency projects

The guidelines for climate proofing energy efficiency projects developed within the CAMS Project Platform by the CBSS and its partners provide some concrete examples of how to increase synergies between sectoral policy measures and resilience policies during the implementation stage (see Indriksone & Paegle, 2021).

Step 9:
Monitor. Evaluate. Adjust.

MONITORING AND EVALUATION are needed to assess, inform, and review respective local adaptation plans. In doing so, the local municipalities can measure the climate adaptation progress and ensure a timely review of those actions that demonstrate unsatisfactory progress (see for example Figure 4).

In contrast to climate change mitigation measures, climate adaptation cannot be measured with a single metric such as the quantity of the reduced GHG emissions. It is therefore recommended that each climate change adaptation action (hereafter: CCA) has specific outputs, outcomes and tailor-made indicators. The guidelines prepared by the C40 Cities Climate Leadership Group and Ramboll (2019) support local municipalities in measuring progress in climate change adaptation and provide an indicator matrix, including the manual on how to use the matrix (see Box 5).

Monitoring, evaluating, and reporting (hereinafter: MER) activities are designed to assist the local governments in undertaking required adjustments in their respective adaptation actions. MER activities are also aimed to support the communication of the achieved results and enhance transparency and accountability towards stakeholders and citizens. Furthermore, MER activities can facilitate exchange and learning across different municipalities as well as provide lessons learned examples on effective adaptation actions and policies.

Another monitoring system which could be of relevance to local authorities is the Baseline Resilience Indicators for Communities (BRIC) (see Box 6). The BRIC index provides an overall baseline assessment for monitoring existing attributes of resilience to natural hazards (University of South Caroline, College of Arts and Sciences, n.d.). The system has been developed by the University of South Carolina, USA and has been used to assess natural hazard risks and resilience at the county level. The BRIC Index system has also been used to compare the resilience capacities of Norwegian municipalities (see e.g., Scherzer et al., 2019).

According to the information provided at the University of South Caroline website, the BRIC index uses 49 variables and six key community resilience categories. The excerpt referring to community resilience categories is provided below (see Box 7).

Monitoring and communicating implementation of Local Adaptation Plan with Adaptation Progress Dashboard developed by the municipality of the Gävle in the frame of ClimaResponse project could be used to make monitoring simple, structured and accessible also for the stakeholders and general public.

Box 5. The guidelines of the C40 Cities Climate Leadership Group and Ramboll

The step-by-step guide is open to the public.[27]

Box 6. Monitoring system and guidelines

The Baseline Resilience Indicators for Communities (BRIC) BRIC index data platform.[28]

The National Risk Index Technical Documentation report.[29]

The guideline on communicating climate change adaptation (Corner & Clarke, 2017).

Box 7. Community resilience categories

Human Well-Being/Cultural/Social — physical attributes of populations, values and belief systems (educational attainment equality, pre-retirement age, personal transportation access, communication capacity, English language competency, non-special needs populations, health insurance, mental health support, food security, access to physicians

Economic/Financial — economic assets and livelihoods (homeownership, employment rate, racial/ethnic income inequality, non-dependence on primary/tourism sector employment, gender income inequality, business size, large retail with regional/national distribution, federal employment)

Infrastructure/Built Environment/Housing — buildings and infrastructure (sturdier housing types, temporary housing availability, medical care capacity, evacuation routes, housing stock construction quality, temporary shelter availability, school restoration potential, industrial re-supply potential, high-speed internet infrastructure)

Institutional/Governance — access to resources and the power to influence their distribution (mitigation spending, flood insurance coverage, governance performance regimes, jurisdictional fragmentation, disaster aid experience, local disaster training, population stability, nuclear accident planning, crop insurance coverage)

Community Capacity — social networks and connectivity among individuals and groups (volunteerism, religious affiliation, attachment to place, political engagement, citizen disaster training, civic organizations)

Environmental/Natural — natural resource base and environmental conditions (local food supplies, natural flood buffers, energy use, perviousness, water stress).

(Source: University of South Carolina, College of Arts and Sciences, n.d. https://sc.edu/study/colleges_schools/artsandsciences/centers_and_institutes/hvri/data_and_resources/bric/index.php)

Topic	Indicator	Description and Notes	Starting Point / Current Situation	Desired Progress Direction
Cooling the city	Tree canopy in the city	Relative to the entire urban space	To be compiled by 2021	↗
	The average difference between the temperatures measured at the stations in the city and at a station outside the city	The difference in temperature is indicative of the extent of the urban heat island	To be compiled by 2020	↙
	Use of private cars to get to work/studies	A decline in traffic reduces the emission of heat	2017 – 54% used private cars	↙
	Buildings complying with the green building standard or buildings that underwent green retrofitting	Compared to all completed construction	To be compiled by 2021	↗
Water management	Ratio between hotline calls and rainfall	The number of calls is indicative of flood effects	To be compiled by 2021	↙
	Urban sealing index	Tracking infiltration potential in the city	To be compiled by 2022	↙
	Percentage of buildings that independently treat all the runoff on their lot	Pertains to new construction as of 2021	To be compiled by 2022	↗
	Average annual water consumption per capita (m^3)	An indicator of water consumption and savings	2019 = 65.3 m^3	↙
	Percentage of water supply depreciation		2018 = 10.8%	↙
	No. of irrigation months per year	The number of months in which the Municipality waters public gardens	2004 = 6 months 2019 = 10 months	↙
Improvement in the ecological infrastructure	Urban coverage percentage	Ratio between urban coverage and the open space	To be compiled by 2022	↗
	No. of trees chopped down per thousand trees	Ratio between the no. of trees chopped down for construction purposes and the inventory of trees	2019 = 8.74	↙

Figu
(City of Tel Aviv-Yafo, 2020, p. 33-34).

Step 10:
Report. Share. Communicate.

THIS STEP PROVIDES GUIDELINES on key climate change communication principles which can be used by local authorities to communicate about climate change adaptation action within, across and beyond respective municipalities' borders.

Communication is key to inform the local population and all interested stakeholders about climate adaptation actions that a respective municipality is planning to implement. It enables timely planning and preparation for any potential effects that a respective climate adaptation action can bring to individual everyday activities. In addition to the external communication activities, the local municipalities are recommended to develop an internal communication plan. Having the internal communication plan in place provides guidance on how to keep all municipalities' employees and their respective departments informed and engaged in climate adaptation action.

A practical guide to values-based communication developed by Climate Outreach (see Corner & Clarke, 2017) can support the local municipalities in their efforts to design an inclusive and efficient communication plan. Furthermore, it can be easily adapted to the local context and needs of the local municipalities in the Baltic Sea Region. The excerpt referring to key principles of climate change communication is provided below (see Box 8).

Box 8. THE PRINCIPLES OF VALUES-BASED CLIMATE CHANGE COMMUNICATION. Adapted from: Corner & Clarke (2017).

Identify your audience's values

Values are the building blocks shaping attitudes to climate change. The value map provided in the practical guide to value-based communication refers to the following value categories that may be important to consider: universalism, conformity, tradition, security, benevolence, self-direction, stimulation, hedonism, achievement, power. Considering that values may differ within and across different stakeholder groups (i.e., youth, elderly, sectoral organizations, public agencies, businesses) tailor-made communication is central to designing inclusive and effective communication plans.

Design your messages in the right way

Search for overlaps between the values that are important to your specific target group and values that are critical for building a long-term support for addressing climate change challenges and for achieving a more sustainable society (e.g., values focusing on "helping others", "safeguarding environment"). Design and frame your messages to ensure that they build a bridge between the values of your target group and the values focused on climate change and sustainability.

Diminish the 'psychological distance' of climate change

Think of the following questions: Who is your target audience you are trying to engage with? What is your audience passionate about? How can you make climate change adaptation relevant to their lives? Identify the interests, concerns and expectations of your audience and explain how climate change affects them in the short-, medium- and long term.

Focus on positive messages

Emphasising the benefits of climate adaptation policies is much more effective than stressing the risks of not adapting. Positive messages are more likely to lead your audience to embrace climate adaptation actions since they produce "a sense of hope".

Embrace extreme weather as a window of opportunity to increase the understanding of climate change

People do not necessarily "connect the dots" between extreme weather events (a flooding event, hail, severe rainfall) and the overall phenomenon of climate change. Use the occurring severe weather events as an opportunity to increase awareness on climate change and to discuss the importance of preparing for future events. Emphasize the benefits of adaptation using the powerful narratives of resilience, community pride and mutual caring that often emerge when experiencing severe weather events.

Highlight the health benefits of adapting to climate change

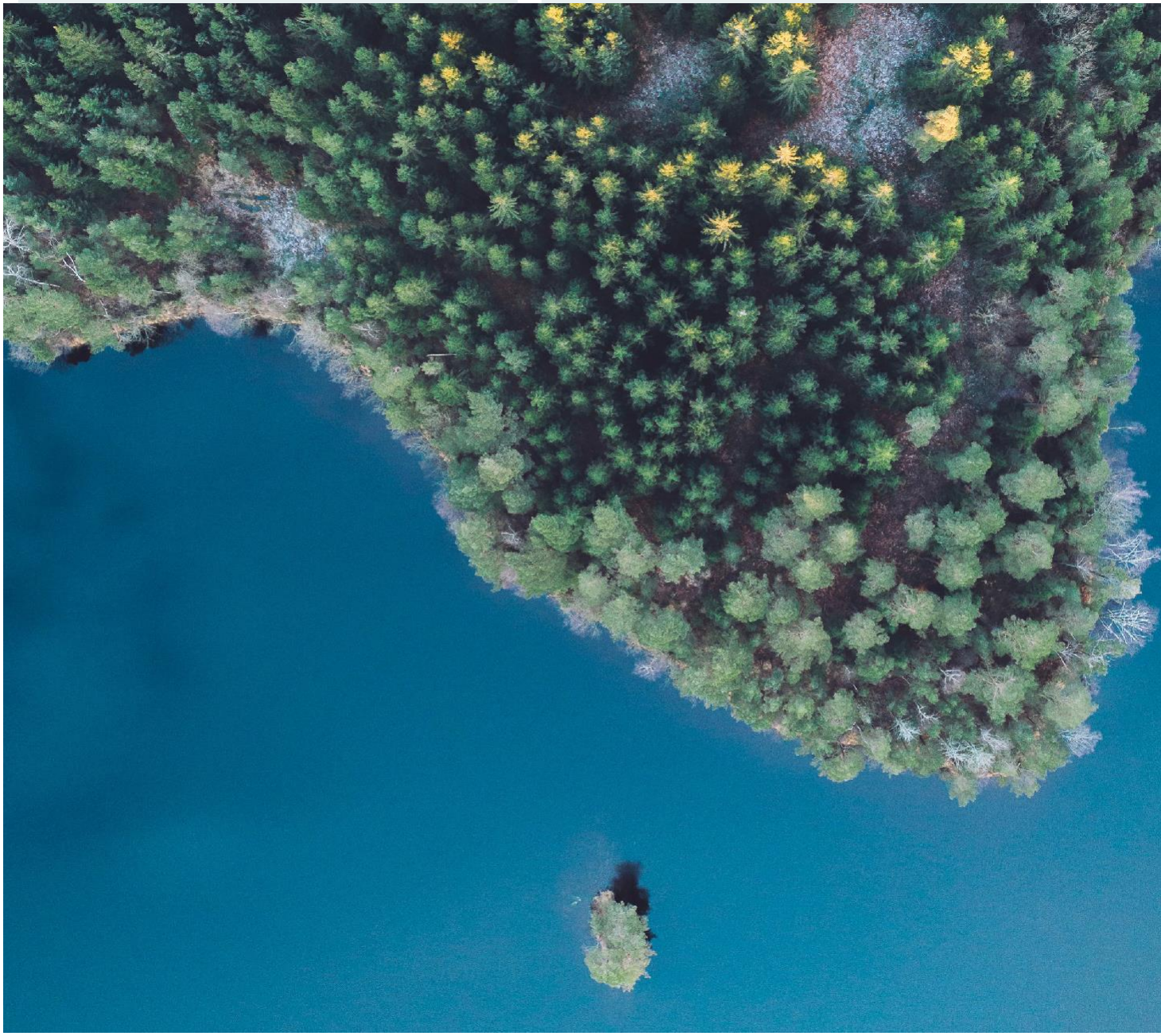
Connecting climate change with health problems – the topic which your target audience can easily relate to (e.g., heat stroke, hypothermia or asthma) – can help increase the personal relevance of climate change risks.

Engage across the political spectrum

Although scepticism about climate change and the relevance/feasibility of adaptation actions tends to be more common among conservative audiences, it doesn't have to be this way. More recently published reports highlight the need to address climate change to ensure benefits for socio-economic systems. To make sure that these arguments are well received, it is recommended to use language and narratives that have been designed to appeal to the followers of different political ideologies. For some audiences, it is more effective to focus on and communicate about the benefits linked to preserving the beauty of the countryside. Meanwhile, others may value the communication targeting the health and well-being of communities or possible reduction of economic losses (e.g., private property protection, a better use of public money).

Embrace the power of social networks

Members of diverse social communities can communicate with their own groups better than any representative from a public authority. People tend to respond well when they can observe that 'people like them' are also taking climate adaptation seriously. Identify who these popular or representative people are for the different communities and engage them to promote social norms on climate change action wherever possible.



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