Baltic Sea Region Strategy for Adaptation to Climate Change

An outline aiming to prepare the ground for political endorsement

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Baltic Sea Region Strategy for Adaptation to Climate Change

Executive Summary
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1. Introduction

Climate adaptation is the process of adjustment to actual or expected climate and its effects, which seeks to moderate harm or exploit beneficial opportunities. For many issues adaptation can reduce harmful impacts and thereby limit harm to existing human and environmental systems. However, “adjustment” should not be interpreted as avoidance of impacts by (mainly) technical solutions that allow a “status quo”. In many circumstances, related both to human and environmental systems, we will have to accept unavoidable changes, in spite of adaptation measures. For such cases, adaptation can rather be a question of finding compensations either elsewhere (like promoting similar ecosystems at other locations or moving human activities) or by preparing affected sectors or individuals by the promotion of substitutes for losses or by promoting opportunities related to climate change.

It is also important that climate adaptation is mainstreamed with other scenarios of change. An important factor to consider in the Baltic Sea Region (BSR) is the demographic changes, with an aging population.

The aim of the Baltadapt project (www.baltadapt.eu) has been to formulate a BSR Strategy and Action Plan for Adaptation to Climate Change. The strategy recognizes that the BSR can adapt effectively to climate change only if the adaptations take proper account of the changing needs of the populations that live in the region.

Macro-regional cooperation within the BSR region is vital due to that:

- We share the Baltic Sea and its River Basin which means that consequences of adaptation or lack of adaptation might have consequences crossing national boundaries
- There is a need for solidarity – to ensure that most exposed and vulnerable regions/sectors/environments/individuals increase their adaptive capacity
- We need to coordinate actions with sectors integrated through EU policies and the single market
- There is a need for a “Common BSR voice” in international contexts to ensure that the specific vulnerability of the Baltic Sea and its river basin to climate change is acknowledged in EU and international policies

This draft strategy document is based on Baltadapt reports related to gap-fit analyses on adaptation to climate change research and policy design, impact and vulnerability assessments, as well as on Baltadapt climate info fact sheets on climate change.

The strategy and action plan are also based on an consultation process among relevant policy-makers and stakeholders during three policy forums (Berlin in April 2012, Stockholm December 2012, and Tallinn May 2013), stakeholder workshops on tourism (Warnemuende in May 2012) and agriculture (Norrköping in May 2012) and through consultations with DG Clima and DG Reggio (June 2011).

Although the Baltadapt project has had a focus on the Baltic Sea itself and its coastal zones, the proposed strategy aims to be relevant for the whole BSR.

However, implementation and sustainability of the strategy and its action plan depend on subsequent political endorsement. This draft Strategy document does thus aim to prepare the ground for endorsement.

2. Aims and Specific Goals

The overriding aim of the BSR strategy for adaptation to climate is a connected region with informed actors on all levels responding to climate change in a way that ensures prosperity, competitiveness, as well as clean water, and rich and healthy wildlife. The strategy aims to ensure that the region can adapt to climate change in an integrated way, with consideration to prosperity, competitiveness, risk handling, and resilience of environmental systems and societies.

The strategy builds on strengthening co-operation and information sharing through mainstreaming climate adaptation as a horizontal action in the Action Plan of the European Union Strategy for the Baltic Sea Region (EUSBSR). It aims to assist stakeholders and policy makers to
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achieve a common view of adaptation needs and actions for various sectors, with recognition to regional differences in natural and societal conditions. When in compliance with EU priorities and positions, also involvement of non-EU countries will be encouraged. The strategy is based on already existing cooperation and networks on all levels for which climate adaptation is relevant, with links to EU, national and local climate adaptation strategies and action plans.

The objective of the strategy is to, through BSR cooperation; facilitate implementation of local, national and EU climate adaptation strategies and action plans. This will be made by clustering and coordination of existing initiatives, as well as on promotion of new initiatives that will contribute to:

- **Raised awareness** of the need for action at all levels
- **Shared macro-regional knowledge bases** with robust, policy relevant, open-access research-based, common knowledge base on exposure, impacts, vulnerabilities and adaptation measures, including handling of risks, uncertainties and estimates of costs and benefits
- Common identification and implementation of research to identify and address gaps of knowledge
- **Science policy dialogues** at all levels by the provision of web-based as well as “in real life” meeting places
- **Disaster risk management reduction** by cooperation on early warning systems, risk reduction, early warnings, awareness-raising and cooperation related to disaster response and recovery
- **Reviewing and mainstreaming** in the light of climate change adaptation concerns (based on research outcomes) across all relevant areas with focus on specific conditions in the BSR, including integration of climate adaptation in relevant EUSBSR Action Plan priority areas
- BSR cooperation between EU and Russia where it has been defined to be of mutual benefit
- Cooperation on all levels with emphasis on horizontal (between stakeholders in the same geographical level) and vertical (e.g. between stakeholders on local, national and macro-regional levels) integration, including platforms for exchange of experiences, with emphasis on “good examples”
- Cooperation between states on the development of national strategies and action plans
- Sector-relevant macro-regional cooperation on adaptation to challenges and business opportunities
- Cooperation to ensure funding of adaptation measures where it is most needed
- Making the BSR a model region for macro-regional cooperation on climate change adaptation

### 2.1. Specific Goals of the Strategy

Three socio-economic sectors (fishery & agriculture, coastal infrastructure, and tourism) as well as biodiversity of the Baltic Sea were in the Baltadap project identified as specifically beneficial to include in the BSR Climate Adaptation Strategy. This selection of these focus areas was based on that climate adaptation within these areas can gain significantly from macro-regional cooperation since impacts are expected in major parts of the region, and since they often are cross-boundary between states or between land and sea. These focus areas are also well corresponding to the objectives of the EUSBSR Action Plan.

The specific goals are to:

- **Adapt to climate change** in a way that ensures that climate impacts on marine biodiversity and habitats, when possible, is limited by “climate proofing” of environmental agreements and directives
- **Adapt to climate change** in a way that ensures that coastal infrastructure (including, e.g., coastal protection, maritime traffic, ports and touristic infrastructure) in a way that ensures prosperity, competitiveness, and connectivity
- **Adapt to climate change** in a way that ensures prosperity and competiveness of fisheries and agriculture, as well as to the “save the Sea” objective
- **Adapt to climate change** in a way that ensures prosperity and competiveness of coastal tourism

However, the climate adaptation strategy for the Baltic Sea region is not limited to these specific goals, which are foreseen to be complemented with new specific goals in re-evaluations of the strategy. Such re-evaluation can partly be based on the methodology for prioritizing issues of macro-regional interest, presented in Chapter 5.1.
3. Links to Other Strategies

3.1. Links to the EU Strategy for the Baltic Sea Region

EUSBSR is the first comprehensive EU strategy to target a macro-region. The eight EU states that make up the Baltic Sea Region (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, and Poland) face several common challenges which are reflected in the jointly-agreed Action Plan of the EUSBSR. Many of these are shared with, and do often need to be addressed in cooperation with the non-Euro States (the Russian Federation, Belarus, and Norway) in the Baltic Sea Region.

The EUSBSR Action plan calls for a Baltic Sea Region-wide climate change adaptation strategy that provides a framework to strengthen cooperation and information sharing within the region. In the EUSBSR Action plan, Climate Adaptation is included as a sub-objective of the goal to increase prosperity and competiveness of the region. This highlights that adaptation is needed in order to gain from opportunities and meet challenges related to climate change. Not taking action can have devastating economic, social and environmental consequences. Although certain benefits can be gained already from adaptation to the present climate conditions, costs for climate adaptation are limited compared to the future costs for non-actions today.

Since Climate adaptation is also mainstreamed into the EUSBSR Action plan objective “Save the Sea”, where it specifically has to be taken into consideration in order to ensure that the targets for the sub-objectives “Clear water” and “Rich and Healthy Wildlife” will be reached. Climate adaptation also needs to be mainstreamed into the EUSBSR Action plan objective “Connect the Region”, where it is emphasized that the EUSBSR Action plan builds on connecting people in the region, either by setting-up new networks and new platforms of cooperation, or by strengthening the existing ones.

3.2. Links to the EU Strategy on Climate Adaptation

A comprehensive EU Strategy for Adaptation to Climate Change was launched in April 2013 with the aim to increase Europe’s resilience and reduce its vulnerability to the impacts of climate change. In order to facilitate knowledge sharing, the web service Climate-ADAPT (http://climate-adapt.eea.europa.eu/) acts as a European Clearinghouse on climate change impacts, vulnerability and adaptation.

The BSR Strategy for Adaptation aims to serve as a role model for the EU Strategy, with regard to facilitating of the implementation of the EU Strategy through macro-regional cooperation, based on a combination of bottom up and top down approaches driven by specific requirements identified by BSR stakeholders on all levels.

The BSR Strategy for Adaptation to Climate Change provides a macro-regional platform for regional implementation of the EU Climate Adaptation Strategy, where a major contribution consists of the establishment of a “Baltic Window” to the EU Climate-ADAPT Clearinghouse platform.

The EU Strategy for Climate Adaptation Strategy addresses the need for macro-regional cooperation as a way to meet identified barriers. Below identified barriers in the EU Strategy and the way they are addressed in the BSR Strategy are presented:

- Insufficient coordination and cooperation for the identification of knowledge gaps and the use of EU funded investments. The BSR Strategy for Climate Adaptation addresses these issues through coordination and cooperation with a BSR perspective.

- Need of further development of Climate-ADAPT. The BSR Strategy for Climate Adaptation addresses this through cooperation on the “Baltic Window” of Climate-Adapt.
Lack of human and financial resources. The BSR Strategy for Climate adaptation provides a ground for a solidarity in pooling of human and financial resources to identified priority areas within the BSR.

Lack of integration of cross-border and cross-sectorial consideration. The BSR Strategy for Climate Adaptation ensures vertical and horizontal cooperation in a BSR context.

Mainstreaming promoted on an ad-hoc basis and lack of guidance and methodologies. The BSR Strategy for Climate Adaptation facilitates common sets of policies, guidance and methodologies adapted for conditions in the BSR.

The visions of the BSR Strategy for Adaptation to Climate change presented in Chapter 7, will all contribute to the fulfillment of the operational objectives of the EU Strategy for Adaption to Climate change.

3.3. Links to National Strategies

All EU countries are at different stages of preparing, developing and implementing national adaptation strategies. With regard to countries with a Baltic Sea coastline, some countries (Denmark, Finland, Germany) are implementing national strategies, whereas other (Estonia, Latvia) have not yet developed such strategies. Sweden has developed an integrated and coordinated cooperation between vulnerable sectors, but not a formal national strategy. Lithuania has approved a National Climate Change Management Policy Strategy (mitigation and adaptation) in November 2012, and action plans will be approved during 2013. BSR states that have already developed national climate on common knowledge bases. Furthermore, regional cooperation can be an impetus for the inclusion and implementation of regional priorities in national strategies/policies thereby ensuring coherence between policies and actions at the national and transnational levels. Moreover, those states that are yet to develop national strategies or that are re-evaluating existing strategies can benefit from the experience, both positive and negative, of those that have already developed and adopted adaptation strategies/policies.

The BSR Strategy for Adaptation to Climate Change specifically recognizes that:

- National strategies for BSR states would benefit from pooled resources to identify priority sectors, major vulnerabilities and impacts, create common databases;
- There is a need for responsible bodies for national strategies to meet regularly;
- Transfer of “good cases”/“good examples” should be encouraged;
- When impact of climate change or of climate adaptation in one state has consequences in other states or in the Baltic Sea the BSR Strategy for Adaptation can serve as a tool to ensure that this is addressed in national strategies.

4. Added Value of a Macro-Regional Strategy

As addressed in Section 3, the added value of the BSR Strategy for Adaptation to Climate Change is achieved through cooperation and information sharing in the region, which will assist in implementation of local, national, and EU strategies and action plans. Since several climate adaptations related issues in the BSR states and the Baltic Sea only can be efficiently handled by cooperation that involves all states in the region, cooperation with Russia and other non-EU states is a significant added value. Below, some specific added values related to BSR cooperation on identification and addressing knowledge gaps, and promoting science policy dialogue, with implications for all levels (from the local to the macro-regional and EU levels) are presented.

4.1. Research cooperation and transfer of best practices

The BSR Strategy for Adaptation to Climate Change aims to promote a robust framework for the development and implementation of macro-regional climate adaptation research and knowledge.
transfer projects. The focus for such projects should have been prioritized at the BSR level, but may not receive support at the national level, due to other priority issues taking precedence. The strategy also promotes mainstreaming of climate adaptation in all BSR research projects where it is relevant.

Regional projects on climate adaptation that focus on fostering the transfer and uptake of "best practice" to other BSR jurisdictions are promoted by the strategy.

As discussed in Section 6, land-sea contrasts and mountains in the BSR are not captured well in global models, and the number of regionally downscaled scenarios is still limited. Therefore, the strategy specifically addresses that, in order to reduce uncertainties in impact assessments, there is a need for further research and cooperation, e.g. within the framework of BONUS, in the provision of ensembles of climate scenarios and decadal forecasts, downscaled to a geographical scales that are relevant for impact assessments.

4.2. Promotion of innovations

The goal of the EUSBSR is to move the BSR towards a low-carbon and climate resilient economy, by promotion of sustainable growth, climate resilient investments and creation of new jobs. Climate adaptation is thus seen not only as costs for the society, but also an opportunity for enterprises to invest in innovations related to climate adaptation.

This concept is also one of the fundamentals of the EU Strategy for Climate Adaptation, which puts strong focus on climate adaptation options that are low-cost, good for the economy as well as the environment and which make sense for a variety of reasons. Climate adaptation is foreseen to stimulate climate-resilient investment and create new jobs, particularly in sectors such as construction, water management, insurance, agricultural technologies and ecosystem management.

The Open Data Strategy launched by the EU Commission, with harmonized to common standards and protocols through the EU INSPIRE initiative will provide the possibility to integrate large volumes of information collected by numerous public authorities and services in the BSR that can be freely used, re-used and redistributed free or at marginal cost. This will boost possibilities for research, as well as for innovations related to climate change adaptation.

The BSR Strategy for Climate Adaptation acknowledge the access to harmonized open source data and will promote involvement of enterprises, in cooperation with policy makers and the scientific community, in the development of innovative adaptation measures with a BSR coverage, including, e.g.:

- Methods for economic valuation of adaptation options
- BSR wide networks for monitoring of observations of climate parameters and impacts on, e.g., ecosystems and health
- Development of communication systems, as well as innovations that increase understandings of need for adaptation:
- “Early warning systems” for extreme events and disasters that are expected to occur more often due to climate change to reduce vulnerability to climate change in various sectors (e.g. infrastructure, agriculture and health).
- Development of agricultural technologies, ecosystem management, climate-proof infrastructures, and water management.
- Delivery of solutions to the challenges of climate change from the insurance sector.

4.3. Science-policy dialogues on all levels

In order to account for macro-regional, national and local decision makers’ perspectives and support better informed decisions, knowledge about climate change, exposure, vulnerabilities, impacts and adaptation measures need to be communicated in a way that is relevant, accessible, transparent, and that take proper account of associated uncertainties. To be relevant for adaptation, climate-related issues need to be mainstreamed with other issues, which require integrations between, e.g., social, economic, technical and environmental disciplines. The strategy will specifically promote adaptation research that facilitates the formulation of policies that promotes win-win solutions.
Increased science-policy interactions are needed to increase policy-makers’ awareness and understanding of climate-related risks and options for adaptation, as well as to improve researcher’s awareness of the policy makers and others’ stakeholder’s realities and perspectives. Interactive communication is thus a prerequisite to ensure that climate adaptation research is relevant for policy making and implementation of adaptation measures.

In addition to authorities on all levels, the BSR Strategy for Adaptation to Climate Change will promote that macro-regional sector-specific networks/organisations make Climate Change adaptation an item on their agenda.

The BSR Strategy for Adaptation to Climate Change will specifically promote that decision-makers among authorities as well as among private actors have access to interactive visualization-based tools for dialogues about climate adaptation. These are part of a well-developed and frequently used access to a combination of web-based on real-life meeting places for researchers, authorities and private actors representing specific sectors, such as the horizontal (between stakeholders in the same geographical level) and vertical (e.g. between stakeholders on local, national and macro-regional levels) dialogues.

### 4.4. Disaster risk reduction

An important part BSR cooperation related to climate change is the development of preparedness for handling of increased risks related to extreme events, e.g. induced by floods or storms. The BSR Strategy aims to, within the region promote activities that are in line with the UN Hygen Declaration and Hyogo Framework for Action (HFA) (www.preventionweb.net):

- Promote common efforts to reduce the risks of natural disasters.
- Common identification, evaluation monitoring of risks, and cooperation on early warning systems.
- Sharing knowledge, innovation and education to improve the safety and sustainability at all levels.
- Cooperation on reduction of the underlying risk factors.
- Cooperate on strengthen preparedness for response and recovery at all levels.

Identification of gaps in currently existing common mechanisms is one of the first steps to take in this process, together with developing reference scenarios for risk assessment information. Not less important, however, is the possibility to share the know-how within the BSR. A common ground is a necessary condition for building a common approach to prevention actions, which in turn is necessary in order to facilitate the rapidness and functionality of risk management operations in the event of cross-border or large-scale disasters.

Finland, Germany and Sweden have established National Platforms for disaster risk reduction in line with HFA 2005-2015 which included climate change adaptation, which could be the basis for extension to BSR cooperation.

### 4.4.4.5. From strategy to action

As mentioned above, with emphasis on the three initially identified sectors and the biodiversity of the Baltic Sea, the BSR Strategy for Adaptation to Climate Change strategy is accompanied by an Action Plan that aims to provide detailed plans of how to reach the goals of the strategy. The action plan thus basically translates the Strategic Plan into implementation steps, by defining measures that ensure that the desirable future situation materializes or draws nearer. For each vision in the Strategy (Chapter 7), there is corresponding information in the Action plan.

### 5. Coordinators and Implementers of the Strategy

#### 5.1. Coordination

Climate change adaptation is one of the three main actions in the EUSBSR under the Horizontal Action “Sustainable Development and Bio-Economy”, coordinated by the Council of the Baltic Sea
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States (CBSS) Secretariat, Unit Baltic 21 for Sustainable Development. CBSS is also coordinating activities related to climate change mitigation. The third main action of this Horizontal Action is bio-economy, which is coordinated by the Nordic Council of Ministers. The Baltadapt project, where this draft BSR Strategy for Climate Adaptation was developed, is a flagship project included under the HA Sustainable Development and Bio-Economy. Consequently, CBSS is responsible for the coordination and monitoring of the implementation of the BSR Strategy for Climate Adaptation and its Action Plan.

To ensure that the strategy is jointly implemented by all BSR states, this draft recommends the establishment of a steering committee, with national representative from all BSR states, representing governmental organization responsible for national coordination of climate adaptation. For states where no climate adaptation strategies not yet are available, representatives should be appointed by the Ministries that have the main responsibility for climate adaptation. In order to ensure a BSR wide cooperation, it is recommended to include a Russian representative, and possible also representative from Norway and Belarus, either as full or as co-opted members to the committee. The committee members are suggested to have the responsibility to communicate and coordinate with their national climate adaptation networks, including authorities, NGO:s, the private sector and research in order to be able to represent the climate adaptation agenda of the state they represent.

Since climate adaptation is a horizontal action in the EUSBSR Action Plan, the CBSS secretariat and the steering group need to communicate and coordinate with representatives from all relevant priority areas in the EUSBSR Action Plan. CBSS will also ensure coordination with a wide network of relevant actors in the Baltic Sea Region active in climate change adaptation work, including CBSS strategic partners, other pan-Baltic, sub-regional and local actors, to ensure a multi-level governance approach. The consistency between the BSR Strategy for Climate Adaptation and the EU Strategy for Climate Adaptation is suggested to be addressed through dialogues between CBSS with its steering committee and the EU Climate Change Committee.

The main tasks of CBSS and the steering group are to:

(1) **Agree on the most important issues to focus on and initiate policy-science and multilevel governance dialogues related to climate adaptation and disaster risk reduction.**

The dialogues should involve a coherent, integrated, cross-cutting spectrum of potential implementers and facilitators of climate adaptation at all levels of governance. Although mainly based on existing networks (c.f. Section 5.2), new cross-cutting meeting places for exchange between natural and social science, policy and the private sector, as well as between various levels of governance should be provided. Issues addressed could be related to adaptation to specific climate risks (e.g., flooding, sea level rise, heat, and drought) and/or adaptation within specific focus areas (e.g., agriculture/forestry, tourism, coastal areas, health, infrastructure, disaster risk reduction, water management, marine environment, biodiversity, or city planning).

(2) **Promote actions based on recommendations emanating from these dialogues or other relevant initiatives.**

CBSS with its steering group is responsible to promote that conclusions from the dialogues are fed into relevant national and transnational policies in the Baltic Sea Region, with the aim to fulfil the visions of the BSR Climate Adaptation Strategy. They do also have the responsibility to, through their national contact points in the EU Commission Climate Change Committee, promote that EU climate adaptation strategies consider specific needs of the Baltic Sea Region. CBSS and the steering committee do also have a responsibility to promote that macro-regional funding is directed in a way that stimulates opportunities and removes obstacles for climate adaptation related to issues of common concern in the Baltic Sea Region, with promotion of cooperation between EU and non-EU actors in the region when of mutual benefit. Specific focus should be on promotion of actions that provides synergies (win-wins) between climate adaptations in different sectors, with climate mitigation, as well as with other environmental and socio-economic goals.

### 5.2. Implementers and facilitators

Implementers represent all spatial levels of governance (local, regional, national, macro-regional), including both the governmental, private and the research community.
Knowledge brokers will have a specific role as facilitators with a mission to bridge the gap between policy/decision-makers (what we do) and researchers (what we know). Knowledge brokering is also needed in order to identify gaps of knowledge, needed for policy decisions.

Actions that emanate from the dialogues coordinated by CBSS and the steering group (5.1.), either directly or, e.g., after political endorsement or financing of projects, will be the core of the implementation of the BSR Strategy for Climate Adaptation and its Action Plan.

In Section 5.1.1, pan-Baltic organisations that will be important actors to implement and facilitate the BSR Climate Adaptation Strategy listed.

The strategy calls for specification of their roles and mainstreaming of the BSR Strategy on Climate Adaptation and its Action plan into the activities within these organisations, as well as for identification of other relevant organisations to involve in the implementation of the BSR Strategy for Climate Adaptation.

### 5.2.1. Intergovernmental international organisations

The **Council of the Baltic Sea States (CBSS)** is an overall political forum for regional intergovernmental cooperation. The members of the council are Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, Russia, and Sweden and a representative from the European Commission. The role of the Council is to serve as a forum for guidance and overall coordination among the participating states on the CBSS long-term priorities. The CBSS Secretariat with its Unit Baltic 21 implementing the CBSS long-term priority Sustainable Development and Environment responsible for the coordination and evaluation of the implementation of the BSR Strategy for Climate Adaptation and its Action Plan as leader of the EUSBSR Horizontal Action Sustainable Development and Bio-Economy.

The **Nordic Council of Ministries** consists of ministerial members from Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland and Åland. Although only covering part of the Baltic Sea Region member states, the council has vast experiences of macro-regional cooperation and are active in the implementation of the EUSBSR Action plan. They coordinate the activities related to bio-economy within the EUSBSR Horizontal Action Sustainable Development and Bio-Economy, which provides the ground for cooperation in the fields of climate adaptation and bio-economy. Within the Nordic Council of Ministers Centre of Excellence initiative, the Nordic Council of Ministries funds the project Nordstar that is developing a white paper on climate adaptation for the Nordic countries, which has the potential to be extended to cover the whole BSR.

The **Helsinki Commission (HELCOM)** is the Baltic marine environment protection commission, which is an intergovernmental organisation of the nine coastal countries of the Baltic Sea and the EU. It is responsible for coordinating the actions and activities of its contracting parties for ensuring the protection of the marine environment of the Baltic Sea. It implements the Helsinki Convention, the Baltic Sea Action Plan (BSAP) and HELCOM Recommendations. In addition, declarations of the meetings of HELCOM ministers and high-level representatives are being put into action. Climate Change is a central question for HELCOM. From HELCOM’s perspective, adaptation means adjustment of the measures to protect the Baltic Sea marine environment as to allow for reaching the vision of a healthy Baltic Sea even in a changing climate.

**Visions and Strategies around the Baltic Sea (VASAB)** is an intergovernmental multilateral cooperation in spatial planning and development of 11 countries of the BSR. It is guided by the Conference of Ministers responsible for spatial planning and development and steered by the Committee on Spatial Planning and Development of the Baltic Sea Region, composed of representatives of respective ministries and regional authorities. VASAB promotes participative spatial planning which aims at achieving sustainable balance between social, cultural, environmental as well as economic goals, including climate adaptation.

**Baltic Sea Parliamentary Conference (BSPC)** is a forum for political dialogue between parliamentarians in the BSR, aiming to raise awareness and opinion on issues of current political interest and relevance for the region. The BSPC Working Group on Energy and Climate Change presented its final report in 2009. In 2011, a Working Group on Green Growth and Energy Efficiency Use was established, linking up to climate change adaptation measures to be taken. The BSPC
5.2.2. Cooperation on the local and sub-regional level

**Union of the Baltic Cities (UBC)** is cooperation between cities surrounding or close to the Baltic Sea to mobilize the shared potential for democratic, economic, social, cultural and environmentally sustainable development of the BSR. UBC has identified the following added value of a macro-regional climate adaptation from a common macro-regional agenda:

- Focused, concentrated activities
- Common and stronger regulation/instructions/recommendations
- Possibility to cross-sectorial, cross-county cooperation and exchange of good practises (with differences and opportunities in efficient implementation of climate change work highlighted).

The **Baltic Sea States Sub-regional Co-operation (BSSSC)** is a political network for decentralised authorities (sub-regions) in the BSR. Its participants are regional authorities (level directly below the national level authorities) of the 10 Baltic Sea littoral states: Germany, Denmark, Finland, Sweden, Norway, Poland, Latvia, Lithuania, Estonia, and Russia. It works under the umbrella of CBSS and shall contribute to a shared knowledge of government and best practice, which will be made available to regional and national authorities, the EU and other decision making bodies. BSSSC is an important actor in climate change adaptation as adaptation is implemented on the local and sub-regional level. BSSSC forms a well suited entry point for increased cooperation on this issue on the sub-regional level and need to mainstream climate adaptation in their agenda.

5.2.3. Cooperation including the business community

**The Baltic Development Forum (BDF)** is focused on the business community and has the mission to position the BSR in the EU and on the global map by advancing the growth and competitive potential through partnership between business, government, and academia. It initiates and facilitates the creation of strategies, provides thematic analyses and offers a wide networking arena for high-level decision-makers. BDF has the potential to be a leading actor in the promotion of innovations that facilitate climate adaptation.

**The Baltic Sea Chambers of Commerce Association (BCCA)** is a network open to Chambers of Commerce in the BSR. It promotes trade and business relationships across the region. Over the years this has been done through actions such as trade fairs and conferences, and other forms of networking, as well as through information and analyses. Trade and innovations related to climate adaptation should be promoted to be on the agenda of BCCA.

**The Baltic Sea Tourism Commission (BTC)** is an international organization for market-oriented tourism companies and organizations in the BSR. The goal is to increase the region’s attractiveness through networking and collaborations. Adaptation to climate change is foreseen to be a vital component in this work.

**The Baltic Sea Action Group (BSAG)** works as a matchmaker between the organizations and specific problems of the Baltic Sea. It acts as an initiator and catalyst behind concrete acts aimed at tackling the complete range of challenges to the Baltic Sea, such as eutrophication, threats imposed by hazardous substances, and risks related to maritime activities. The work is based on constructive cooperation among all levels of society, including the highest political level in all the Baltic Sea countries, public authorities, and the private sector. BSAG inspires the business world to get involved and utilize its innovative skills to solve the problems related to the state of the Baltic Sea. Results can be achieved through commitments to action, and the resulting sustainable and profitable business opportunities benefit also the commitment makers.

5.2.4. Non-governmental organisations

**The Baltic Sea NGO Network** brings together NGOs from different BSR states and from different areas of interest to share experiences, exchange information and improve their knowledge. They
5.2.5. Scientific and educational networks, and knowledge brokering

The Baltic Sea Experiment (BALTEX) is a scientific network based on a voluntary collaboration of engaged scientists from different regions and scientific disciplines around the Baltic Sea, including the human dimensions, but with an emphasis on the natural sciences and with inclusion of the climate change component. A new programme was launched in 2013. This programme can contribute to the BSR Strategy on Climate Adaptation by provision of thematic knowledge assessments and identification of knowledge gaps. The expertise of the BALTEX research community is foreseen to be used more extensively to provide necessary scientific information to stakeholders. A well-founded scientific advice from BALTEX, with integration of climate adaptation, is very much appreciated and requested by stakeholder’s focusing on the Baltic Sea, including HELCOM.

The Baltic Sea University Program (BUP) is a network of about 225 universities and other institutes of higher education throughout the BSR. The aim is to support the key role that universities play in a democratic, peaceful and sustainable development. This is achieved by developing university courses, and by participation in projects in cooperation with authorities, municipalities and others. Climate adaptation is already included in BUP activities, but could be even more integrated as part a necessary part of the sustainable development concept.

5.2.6. Funding of research, cooperation and investments

The Baltic Sea Region Programme funds transnational cooperation in the BSR. A new funding period starts in 2014 and will continue until 2020. The programme specifically calls for links between climate change, risk prevention and management, and competitiveness of small and medium size-enterprises, with focus on development of information and communication technologies. From the perspective of the BSR Strategy for Climate Adaptation, it needs to be ensured that the climate change component in the program considers both mitigation and adaptation to climate change.

BONUS (Science for a better future of the BSR) is a research funding programme that brings together the research communities of marine, maritime, economical, and societal research to address the major challenges faced by the Baltic Sea System. The strategic objectives of BONUS (2011-2017) are to (1) understand the Baltic Sea ecosystem structure and functioning, (2) meet the multifaceted challenges in linking the Baltic Sea with its coast and catchment (3) enhance sustainable use of coastal and marine goods and services of the Baltic Sea (4), improve the capabilities of the society to respond to the current and future challenges directed to the Baltic Sea region, and (5) develop improved and innovative observation and data management systems, tools and methodologies for marine information needs in the BSR enhancing sustainable use of coastal and marine goods and services of the Baltic Sea. Climate adaptation needs to be integrated as a horizontal action in order to obtain these objectives, which also calls for resources to reduce uncertainties in impact assessments by increased access to ensembles of regionally downscaled climate scenarios.

NEFCO (Nordic Environment Finance Cooperation) BSAP Fund is a fund managed by NEFCO and the Nordic Investment Bank (NIB). The fund provides grants for technical assistance to projects that support the implementation of the HELCOM SSAP. Recipients eligible for financing through the BSAP Fund include both public and private entities operating in the agricultural and wastewater treatment sectors, shipping and ports, as well as those working to reduce hazardous waste in the BSR. A key purpose of the fund is to facilitate and speed up the preparation of bankable projects. The fund provides grant financing for the following: “Climate proofing” of the BSAP need to be one objective to consider in provision of grants.

EBRD (European Bank for Reconstruction and Development) is an international financial institution that supports projects from central Europe to central Asia, including the BSR states Estonia, Latvia, Lithuania, Poland and Russia. Owned by 63 countries, the EU and the European Investment
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Bank, the EBRD fosters transition towards open and democratic market economies through investment and technical cooperation. The Bank invests primarily in private sector clients whose needs cannot be fully met by the market, by providing loans, equity participation and guarantees to companies of all sizes and in a wide range of sectors. Climate change is included as an important component. Accordingly, a pioneering technical cooperation assignment was launched in 2009 to develop approaches for integrating climate risk management and adaptation into project appraisal and development. The Bank can build climate resilience into its investments through: “hard” adaptation measures, for example, physical modifications and additional infrastructure/technology, as well as through “soft” adaptation measures, for example, adaptive management such as improved flood or hydrological monitoring, emergency response plans adaptation measures.

6. Climate change in the BSR

The climate of the future in the BSR is not known but may be projected by climate models based on physical principles for how the climate system works and scenarios of changes in greenhouse gas concentrations, aerosol content of the atmosphere and land use changes. Global models cover the whole Earth with a typical spatial resolution of 100-300 km. Due to this relatively coarse spatial resolution land-sea contrasts and mountains are not described in a detailed way, which, e.g., means that the impact of spatial variability of land, sea and topography with the BSR not is well captured. In order to increase the degree of details different downscaling techniques are used in regional models to obtain a spatial resolution of typically 10-50 km.

Projections from global and regional models include uncertainties in emission scenarios and model formulation, as well as uncertainties caused by limited access of historical time series of observations with a global coverage. A way to handle uncertainties is to use a large number of simulations with different climate models and scenarios, and with different reflections of natural variability, which is called an ensemble of simulations.

Existing climate scenarios for the BSR consists of global climate model output from large international climate model comparison projects (CMIP3 and CMIP5) and regional climate model data from European research projects like the FP6 project ENSEMBLES.

The scenarios for the BSR show increasing annual and seasonal mean temperatures in the future (Figure 1). The largest increases are obtained in the north eastern part of the region and in winter, causing a strongly reduced snow cover. The scenarios also show more intense extreme warm temperatures and less intensive cold temperatures. Precipitation is generally projected to increase, especially in winter (Figure 2). In summer, the predicted increase is more uncertain, with a possibility of no change or even a decrease in the southern part of the BSR. In addition, the projections show a general increase in precipitation extremes, i.e. more concentrated precipitation for short time periods, both on a time scale ranging from a few hours to a time scale of days are a few weeks. Wind speed changes are more uncertain and the different model projections do not show a consistent picture of future conditions, both increases and decreases are projected. There is no clear picture of what may happen to wind storms in the future. The only common feature from the different models is an increase in wind speed over areas where sea-ice will disappear.
Figure 1. Simulated temperature change (°C) between 1961-1990 and 2071-2099 with emission scenario A1B (representing intermediate increase of greenhouse gases). The maps show the smallest (left), medium (middle) and largest (right) climate change signal taken from an ensemble of 11 regional models, downscaled from different global models. Upper shows winter (DJF) changes and lower row summer changes (JJA).
Figure 2. Simulated precipitation change (%) between 1961-1990 and 2071-2099 according to emission scenario A1B (intermediate increase of greenhouse gases). The maps show the smallest (left), medium (middle) and largest (right) change from an ensemble of 11 regional models, downscaled from different global models.

The BSR Strategy for Climate Adaptation recognises that the number of climate change simulations covering the BSR region is limited, especially when it comes to regional scenarios with a high spatial resolution. It does further stress that although there is relatively large amount of information related to air temperature and precipitation, information on changes in other variables, including snow and wind, is much more limited. An implication of this is that uncertainties of climate projections are higher in the BSR than in most other marine environments in the EU. A further limitation for much of the work concerning climate change modelling is the lack of good observational data in the area. As high-resolution climate change information is required from the models there is a need for good observational data for model evaluation at those scales. Consequently, the BSR Strategy for Climate Adaptation calls for additional research and monitoring to fill these gaps.

Below and in Table 1, is a summary of the expected change of climate (air temperature, precipitation and wind) and of climate related physical parameters (river discharge, sea levels, sea waves, and sea ice) in the BSR are given, based on Baltadapt Climate Info bulletins. Estimates of certainty and the span of expected time horizon until significant climate change can be detected are based on expert judgements from Baltadapt climate modelling experts.
Direct changes:

- Simulated temperature increase is already statistically significant for the nearest few decades, with the largest changes in winter and most so in the north-eastern parts.
- Temperature extremes will change more than long-term averages.
- Cold extremes will get unusual, while summertime hot extremes are expected to be more common.
- Winter precipitation is expected to increase in the whole region.
- Scenarios for summer precipitation are less certain, but indicate more precipitation in the north and small changes or a decrease in the south.
- More frequent occurrence of extreme precipitation events is expected, also in areas that may experience decrease in mean precipitation.
- Intensification in extreme precipitation is noted for a wide range of accumulation times (e.g. hours, days, weeks).
- A majority of scenarios show an increase of average wind speed, but the uncertainty is large.
- Projected changes in wind extremes are quite uncertain, with a slight tendency to an increase in the south and a decrease in the north.

Indirect changes:

- A reduction in amounts of snow, duration of snow cover and occurrence of sea ice is predicted.
- The mean annual river flow is expected to increase in the northern parts of the basin, but might decrease in the southern parts. The total river discharge to the Baltic Sea is expected to increase which might decrease the salinity.
- The general trends show increases in wintertime river flow coupled with somewhat lower and earlier springtime peak flows due to changes in snow cover.
- Sea levels will rise, especially in the southern part, since land lift will compensate for the rise in the north. In addition, the sea level is affected by local meteorological conditions that can cause extreme sea level rise and flooding. The frequency of such wind-induced events may change in the future, although predictions are uncertain.
- The wave climate in the Baltic Sea is changing as a result of large scale atmospheric circulation. A few model simulations in the Baltic Sea show an increase in maximal wind speed and frequency of extreme events.
Table 1. Certainty that change will occur and geographical coverage and span of expected time horizon until significant climate change can be detected for various climate variables.

<table>
<thead>
<tr>
<th>Climate variable:</th>
<th>Certainty that change will occur and geographical coverage</th>
<th>Span of expected time horizon until significant climate change can be detected:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual air temperature</strong></td>
<td>High certainty for the whole region</td>
<td>0-20 years (already detectable)</td>
</tr>
</tbody>
</table>
| **Higher summer air temperatures with more heat waves** | High certainty for warmer summer, moderate certainty for more heat waves in the whole region. | Warmer summers: 0-50 years
More heat waves: 50-100 years |
| **Increase of high wind speeds, storms and high** | Low certainty that change will occur. Models are not agreeing | 50-100 years |
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<table>
<thead>
<tr>
<th>Event Description</th>
<th>Details</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waves in coastal and marine areas</td>
<td>Neither on direction of change nor on were changes will occur. Some models indicate an increase in extremes over the Baltic Sea, others don’t.</td>
<td>10-50 years</td>
</tr>
<tr>
<td>Reduced ice cover in the sea and along coasts and a shorter season with sea ice</td>
<td>High certainty for change in southern areas there will very seldom be any ice in the future while in for instance in the Bothnian Bay it will still exist.</td>
<td>10-50 years</td>
</tr>
<tr>
<td>Changes in the frequency of freeze and thaw cycles</td>
<td>High certainty that change will occur. No ice (and consequently no changes) in the southern areas, increase of the frequency of freeze and thaw cycles in the northern part of the region</td>
<td>10-50 years</td>
</tr>
<tr>
<td>Increase of extreme precipitation</td>
<td>Moderate certainty that change will occur in the whole region.</td>
<td>10-100 years</td>
</tr>
<tr>
<td>Increase of river discharge</td>
<td>Moderate certainty that change will occur. Increases largest in the north and especially winter. Summer discharge may decrease, especially in the south.</td>
<td>10-100 years</td>
</tr>
<tr>
<td>More severe dry spells in summer</td>
<td>Certainty low in most of the region, but moderate in the southern parts.</td>
<td>10-100 years</td>
</tr>
<tr>
<td>Rising sea level due to global sea level rise</td>
<td>High certainty for change. However, the northern areas will not see a strong increase in sea level in the nearest century due to compensation by land uplift. In the south, the sea is already rising.</td>
<td>0 -100 years or more (already detectable in southern parts)</td>
</tr>
<tr>
<td>Local, temporal sea level rise due to local wind induced storm surges</td>
<td>Low certainty.</td>
<td>50-100 years</td>
</tr>
<tr>
<td>Warmer water in the sea</td>
<td>High certainty in the whole region.</td>
<td>0-50 years (already detectable)</td>
</tr>
<tr>
<td>Lower salinity in the sea</td>
<td>Moderate certainty in the whole region.</td>
<td>10-100 years</td>
</tr>
</tbody>
</table>

### 7. Impacts of and vulnerability to climate change in the BSR

The Baltic Sea and its drainage basin is a specific eco-region with limited water exchange and a projected warming that is higher than the global mean. The vulnerability to climate change in the ecosystems is expected to be high, although uncertainties in climate scenarios (cf. Section 4) exists, which limit the possibility to assess potential impacts. Major changes of the biodiversity of the Baltic Sea, as well as of its drainage basin are therefore expected. Socio-economic impacts are also foreseen to be considerable, with various degrees of adaptive capacity among regions, sectors as well as among individuals, which calls for governance based on solidarity.

Impacts are not limited to biodiversity of the sea itself and the sectors focused on in the Balladapt project (fishery & agriculture, coastal infrastructure, and tourism). Other foreseen impacts, highlighted
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in the EU White paper, include health and social issues, forestry, inland waters, production systems, as well as a wide range of infrastructure issues, e.g. linked to urban planning. A wide set of impact and vulnerability assessments for the BSR are thus called for. In this context, it has to be recognized that climate adaptation also has to consider indirect impacts for the BSR, caused by climate change in other parts of the world, which can have an impact both on world-trade and on security issues.

In climate adaptation cooperation in the Baltic Sea Region, it has to be noted that many identified impacts are influenced or interlinked with other changes (e.g. demographic, economic or environmental). Assessments of the need for adaptation will thus need to be based on integrated analyses of change in a wider perspective than climate. It also needs to be emphasized that adaptation is needed not only to meet environmental, social and economic challenges, but also to take opportunity of possibilities that might come with climate change, thereby increasing the prosperity of the region.

### 7.1. Prioritization of the most relevant issues for macro-regional cooperation

Prioritizing of issues to be focused on in the macro-regional cooperation on climate adaptation in the BSR needs to be based on estimates of potential impacts and adaptive capacities in various parts of the region.

In order to provide a decision-support on what climate change impacts that are relevant for BSR macro-regional cooperation, a tool for visualization of macro-regional expert judgements of four relevant criteria was developed and implemented within Baltadapt (cf Baltadapt Reports Report #9 (will soon be published, e.g., before the presentation of the BSR Strategy on Climate Change adaptation in September 2013). The concept is based on visualisation of the two climate exposure criteria provided in Table 1 (Section 6), based on expert judgements from Baltadapt climate modelling experts:

1. **Certainty**: High certainty that change of the impacting climate factor will occur
2. **Time horizon**: The span of expected time until significant climate change can be detected

These two “exposure” criteria are combined with two criteria based on expert judgements of national concerns from national representatives that are engaged in climate adaptation in each of the BSR littoral states.

3. **Importance** defined as the average ranking of the national concern for each specified impact from change of a specified climate factor (expressed as “high severity without adaptation or high potential with adaptation”)
4. **Coverage**, defined as the number of countries which ranked the severity of a specified impact as high

The first two criteria (“Certainty” and “Time horizon”) are related to the climate exposure, whereas the third and fourth (“Importance” and “Coverage”) in addition to impact are related to the adaptive capacity. Relationships between exposure and adaptive capacity as well as how they influence emergence of climate vulnerability are described in the Figure 3.
Figure 3. Estimates of vulnerability, based on exposure, sensitivity and adaptive capacity.

The concept is illustrated in Figure 4 and described in detail in the Baltadapt Report #9, including the preliminary results from expert judgements of the four factors by climate modelling and climateadaptation experts in the nine littoral states in the BSR.

Figure 4 Example of the integrated visualisation of the two exposure criteria and the two macro-regional concern criteria for one identified climate change challenge and one foreseen opportunity.

Certainty: As stated in Section 4, the certainty that air temperature and sea level rise, already are and will be further influenced by climate change is high, whereas for other variables, including wind speed, the predictions are highly uncertain, which calls for adaptive management. However, even when the direction of change can be predicted with a high confidence, adaptive management is needed since the actual amplitude of the changes is uncertain.

Time horizon: Some changes are projected to be significant already in the near future, whereas others will have significant impacts first in a longer time perspective (Figure 5). However, measures in reaction to, e.g. sea level rise need long political and administrative planning horizons, which mean that they need to be on the agenda for political and administrative planning long before the impacts are visible.

Figure 5. Infrastructure planning to meet changes at different time scales (from Baltadapt Report 5 “Climate Change Impacts on Infrastructure in the Baltic Sea Region”)

Coverage: Although some impacts are critical in some BSR states, to be a main focus in BSR they need to be of concern to several countries since a wide geographical coverage of impacts and vulnerability increases the benefits from cooperation across the region.
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Severity: The foreseen severity or potential of impacts for human welfare and/or ecosystems from taking adaptive measures, evaluated in economic terms or by other criteria, is crucial for decisions to take action to adapt. Due to the limited access to studies related to vulnerability and adaptive capacity within specific sectors for the BSR assessments of severity will have to be based on "expert judgements".

7.2. Framework for acting on climate change vulnerability

The BSR Climate adaptation strategy uses the integrated vulnerability concept of IPCC (cf. the text box below) which clarifies that neither exposure, sensitivity nor adaptive capacity can be neglected in assessments of vulnerability to climate change (cf. Figure 3).

The BSR Strategy for Climate Adaptation is consequently promoting vulnerability assessments based on (i) assessments of a system’s exposure to existing and future climatic stress, as well as to socio-economic stress; (ii) analyses of how sensitive the system is to the changes brought about by the climatic and socio-economic stress, either adversely or beneficially; (iii) analysis of the capacity of the system to adapt to these stresses, with economic resources, technology, information and skills, infrastructure, institutions, and equity as the main determinants or factors. However, also the degree to which available resources is transformed into adaptation need to be considered.

The primary goal of vulnerability assessments in the BSR is to provide decision-making at all levels with identification of causes of vulnerability as well as on the risks following from climate variability and change. However, the goal of integrated vulnerability concept is not only to reach a final outcome. By initiating an iterative process with a wide range of stakeholder groups within the BSR, the process itself will consist of multilevel governance, region-wide engagement in transformation into a climate compatible future for the BSR. Consequently, vulnerability assessments need to be based on a combination of communicating locally defined indices to national and transnational levels, as well as to communicate nationally and transnationally defined indices to the local level.

As highlighted during the Baltadapt stakeholder dialogues (Baltadapt Report No "Baltadapt Stakeholder Dialogues" This report is still only existing as an internal manuscript, but will be published before the launch of the strategy in September), adaptation options appraisals, based on e.g., cost-effectiveness analysis (CEA), cost-benefit analysis (CBA) or multi criteria analysis (MCA), are strong incentives for willingness to take action (thereby increasing the adaptive capacity) and impacts with high environmental or human welfare costs (not necessarily only in economic terms) of non-action need to be prioritized in the implementation of the BSR Strategy for Climate Adaptation.

As further described in Baltadapt Report No? “Guideline on the System Vulnerability” (ready, but still not available at the Baltadapt.eu), integrated vulnerability assessments for the BSR need to overcome five challenges:

First challenge: Adequate scope and goals
Most vulnerability assessments currently available in the BSR are based on a “risk hazard approach”, where exposure and sensitivity are in focus, while the adaptive capacity is downplayed (cf. Baltadapt Report 7: Conceptualization of Vulnerability and Review of Assessments around the Baltic Sea Region). The strategy calls for a significantly increased focus on assessments of adaptive capacity, based on an iterative process with stakeholders on all levels.

Second challenge: Ability to reflect on the context
Climate change will not manifest itself uniformly across the BSR. Impacts as well as capacities to adapt will be uneven both across regions and between individuals in the same region. Vulnerability to climate change needs to be contextualized with recognition of that exposure, infrastructure sensitivity; ability to address climate change, experiences and political support for adaptation differs both between nations, regions and individuals. The strategy calls for solidarity by actions that aim to reduce vulnerability and improve adaptive capacity where it is most needed.

Third challenge: Inclusion of socio-economic stress and change
Assessments of vulnerability to climate change need to acknowledge that not only climate, but also other environmental and socio-economic factors are continuously changing. One of these factors is economic globalisation, which makes it important not to only consider climate change within the region, but also the consequences in the BSR from climate change in other parts of the world. The
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BSR Strategy for Climate Adaptation is therefore based on integrated adaptation to multiple stressors including climate change. This will ensure win-wins between various environmental and socio-economic goals both within and between sectors. It will also ensure avoidance of unexpected negative impacts of climate adaptation.

Fourth challenge: Clear connection between vulnerability assessments and decision-making process

There is a need to link vulnerability assessments to implementation of policies and measures to reduce vulnerability. Consequently, vulnerability assessments explicitly need to be designed to support decision-making, including assessments of adaptation measures possibility to reduce vulnerability. Vulnerability assessments need to meet the dual challenges of integrating, aggregating and combining knowledge produced at different spatial and administrative (vertical) levels as well as from different sectorial (horizontal) or community perspectives. This calls for bridging between cross-sectorial and multi-level gaps to ensure that actors at local and regional level are not exhausted by institutional complexity, but facilitated through national and EU policies, with assistance from BSR cooperation. Consequently, the BSR Strategy for Climate Adaptation calls for vulnerability assessments that relate to political and administrative decisions. The strategy should also work towards the creation of forums that enable integration of policies and knowledge across sectors and administrative levels.

Fifth challenge: Merge top-down and bottom-up approaches

As concluded in Baltadapt Report No 7 “Conceptualization of Vulnerability and Review of Assessments around the Baltic Sea Region”, knowledge and data needed to make comprehensive vulnerability assessments are largely lacking for the BSR. The BSR Strategy for Climate Adaptation calls for a combination of top-down approaches (calculation of BSR wide indexes) and bottom-up approaches (stressing local drivers and barriers). This combination is needed since estimates of national or macro-regional adaptive capacity not necessarily mirrors preparedness for action. Such links can partly be facilitated by ensuring that selected indices are reflecting the underlying socio-economic vulnerability. With regard to bottom-up approaches, the BSR Strategy for Climate Adaptation calls for cross-country local scale assessments with specific consideration to factors such as possibilities to find win-wins with benefits from climate adaptation in several sectors, including both adaptation, mitigation and other benefits, as well as political and technical support and possibility to improve funding for adaptation measures by collaboration of several actors. The BSR Strategy for Climate Adaptation should strive towards becoming a catalyst for (local) political engagement by creating macro-regional incentives to engage in climate adaptation, such as knowledge exchange, promoting participation in macro-regional projects as a way to fund climate adaptation, initiating contests to reward the best local adaptors etc.

7.3. Identified impacts

Identified impacts for which adaptation will be needed are presented below for the three socio-economic sectors (fishery & agriculture, coastal infrastructure, and tourism) as well as biodiversity of the Baltic Sea, which were identified by the Baltadapt project as specifically beneficial to include in a macro-regional Climate Adaptation Strategy.

7.3.1. Marine biodiversity and habitats

Substantial changes in the Baltic Sea ecosystem due to climate change are expected in the coming 100 years (Baltadapt Report No 3: Climate Change Impacts on Marine Biodiversity and Habitats in the Baltic Sea Stressors, their effects and possible measures are presented in Figure 3.}
The sea will become more brackish, warmer and sea level will rise especially in the southern part. Biological communities inhabiting the Baltic will change dramatically. Relative abundances of species are changing as the conditions will favour freshwater species on expense of the marine species. Eutrophication might increase due to the expected climate-change related increase in nutrient loads from the drainage basin unless political action and proper management measures are taken. Increased plankton production and further reduction in oxygen concentration might cause even larger oxygen depleted sea bottom areas in the future (cf. Baltadapt Climate Info #5: Oxygen content). Reduced light penetration caused by plankton biomasses together with rising sea level in the South will affect elgrass meadows and seaweed forest on reefs and rocky shores. Many species are already living close to their physiological salinity tolerance. In the Northern Baltic the expected lack or decrease in ice cover over the winter season will affect e.g., populations of birds and ringed seal.

Below, examples of possibilities and challenges related to biodiversity in the Baltic Sea that need to be adapted to are listed.
7.3.2. Fish stocks, fishery and agriculture

The BSR Strategy for Climate Adaptation calls for a shift away from sector-by-sector management towards integrated management of land, water and living resources in order to sustain biodiversity of the Baltic Sea as well as productivity of both agriculture and fish stocks. The basis to implement such a shift calls for an ecosystem approach based on multilevel governance, that provides space for experimenting and spread of social innovations at local and regional scales, as key elements for stimulating adaptive capacity to deal with ecosystems and ecosystem services.

The vulnerability of fish stocks in the Baltic Sea is high, since it is a species-poor ecosystem with limited possibilities for re-colonization from other marine areas and limited possibilities to “escape” climate change by shifting distribution ranges northwards. Virtually all species live close to their environmental tolerance range. As a consequence of climate change, with impacts including lower salinity and warmer water, fewer species will be present, with more freshwater species at expense of the marine species. Consequently, climate change combined with other concomitant human pressures induce substantial uncertainties for the future development of fish stocks, especially as responses to changes may be abrupt, which need to be considered in exploitation of fish resources. The EU Common Fisheries Policy (CFP) regulates all aspects of fishing. Since the fish stock and fishery in the Baltic Sea is particularly sensitive for the impact of climate change, the BSR Climate Adaptation Strategy calls for inclusion of an “adaptation tipping point approach” into the fisheries management. A tipping point is when changes caused by climate change reach a magnitude when the existing management strategy will not anymore meet the agreed objectives. Identification and characterization of such tipping points or triggers as “warning signs” could help fisheries management to take into account possible climate change impacts. An analysis towards identification of the tipping points should take an ecosystem approach as the climate change can induce dramatic food-web and ecosystem changes that affect also the fish stocks in the Baltic Sea. Impacts on fisheries and adaptation approaches are further elaborated in Baltadapt Report # 4 Climate Change Impacts on the Baltic Sea Fish Stocks and Fisheries.

Choice of land use and crops, drainage and irrigation practices will have an impact on nutrient emissions to the sea. Land use and possible also nutrient losses will also be influenced by climate mitigation policies, such as promotion of agricultural production of renewable energy. In this context the combined consequences of policies related to climate (mitigation and adaptation) and environmental concerns (e.g. eutrophication) need to be understood and considered in order to avoid that measures towards one goal not counteracts another (cf Baltadapt Report No 3: Climate Change Impacts on Marine Biodiversity and Habitats in the Baltic Sea – and Possible Human Adaptations and Baltadapt Climate Info #8: Biodiversity and habitats).

With regard to agriculture production, climate change might impose both possibilities and challenges. Increase in temperature can bring opportunities to reap for the agricultural sector. A challenge, however, is to avoid introduction of new pests and diseases when new crop varieties are introduced. The expected increase of both evapotranspiration, as well as foreseen increased precipitation is for

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**BIODIVERSITY IN THE BALTIC SEA**

*Examples of possibilities:*
- Possible decrease of phosphorus loads from northern drainage basins due to less ground frost
- Decreased risk for anoxia in coastal areas due to improved mixing of water

*Examples of challenges:*
- Loss of original flora and fauna
- Nutrient losses in times of high rainfall intensities/floods will increase eutrophication
- Increased discharge is a factor that probably will increase nutrient transport to the sea
- Changes in nutrient loads; for southern parts probably increased phosphorus loads cause increased algae production and cyanobacteria blooms
- Anoxic sediments due to accelerated eutrophication lead to loss of communities of organism that live at the sea bottom
- Change of composition of algae belts under the shore from brown/red algae filamentous green algae
- Higher survival rates of invasive species, from warmer seas (transported, e.g., by ballast water)
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the most parts of the BSR linked to challenges that need to be adapted to. Excess of water calls for improved drainage systems, but at the same time there is a need to adapt with an integrated landscape perspective, where water is kept in the landscape to avoid downstream flooding and eutrophication, at the same time as avoiding it at productive agricultural fields. A goal of the BSR Climate adaptation strategy is therefore identification of opportunities for greater coordination/integration of agricultural and environmental policy actions, including adaptation to climate change. In addition, the BSR Strategy for Climate Adaptation calls for macro-regional cooperation to meet challenges and to prepare for opportunities. The threat of new pests and weeds following the introduction of more southern crops opts for the need of a surveillance system for controlling the spread of pests. Consequently, the BSR Strategy for Climate Adaptation calls for the development of a cross-border system including cross-border learning about new diseases and pests as well as methods to mitigate the impact of these on crop yield. Another possible macro-regional cooperation is establishment of an insurance system for economic losses during extreme events, which preferable should be handled by macro-regional cooperation, based on solidarity and risk reduction concepts. Insurance schemes could also be coordinated with a pest and animal disease monitoring system so that they could benefit on each other. The section agriculture is based on the Baltadapt Report #? Stakeholder dialogues. (will soon be published).

Below, examples of possibilities and challenges related to fishery and agriculture in the BSR that need to be adapted to are listed.

FISHERY AND AGRICULTURE:

Examples of possibilities:
- Fishing of roach for fodder, fertilizing agent and biofuel, favouring of roach as human food.
- Potential for higher crop yields
- Possibilities to introduce new crops and have a larger crop variety
- Possibilities to take advantage of longer vegetation periods
- Cattle farming can take advantage of longer periods for pasture grazing

Examples of challenges:
- Decline of cod due to decrease of salinity and oxygen conditions
- Thinner and smaller herring and sprat due to the decline of cod which induces competition between sprat and herring
- Risk of higher survival rates of invasive species from warmer seas (transported with e.g. ballast water)
- More low-value freshwater fish, e.g. roach, due to lower salinity
- Species such as salmon, trout and whitefish will disappear
- Higher risk and introduction of new animal and plant pests and spread of weeds
- High soil mineralization with increased leaching of nutrients
- Ventilation problems in big pig farms
- More problems with flooding - keep the water within the landscape to avoid nutrient transport, but avoid it on productive agricultural fields
7.3.3. Coastal infrastructure

The term infrastructure refers to the basic physical/technical and organisational structures that support a society and its economy, such as roads and waterways, water supply, sewers, electrical grids, and telecommunications. Regarding the coastal area and the sea, coastal protection, maritime traffic, ports, lighthouses, radio-locators and other navigation and defence related technical installations for communications, freshwater resources, waste water treatment, canalisation, roads, railways, cycle tracks, waterways, defence, settlements, and energy supply (wind power, power plants, transformer stations) are of special importance. However, also medical infrastructure needs to adapt to meet increased needs for acting on heat and extreme weather events, as well as e.g. intensified UV radiation, increased exposition of allergens and hygiene problems of food and water supply. The demand for an intensified medical infrastructure will be strengthened by the predicted ageing of Western societies as a consequence of demographic change.

As discussed in Baltadapt Report #5 (Climate Change Impacts on Infrastructure in the Baltic Sea Region), rising temperatures, decreasing sea ice cover, sea level rise, changing precipitation and possible also (although highly uncertain) changed storm patterns can be expected to have a direct impact on infrastructure such as coastal protection, maritime traffic, ports and touristic infrastructure.

Climate change adaptation will require planning on different time scales: from immediate actions e.g., with cooling systems in response to heat waves, to new technologies or long term planning and construction of protection schemes in response to sea level rise. The BSR Strategy for Climate Adaptation calls for political acknowledgement that the time frame for planning should determine if decisions are based on current, near-future or distant-future climate projections.

The BSR Climate adaptation strategy also calls for cooperation within the region in order to ensure that adaptation to climate change is integrated with policies related to a set of other relevant issues, including trade and economic growth. It is also important that such assessments are made with a
Baltic Sea Region Strategy for Adaptation to Climate Change

global perspective where e.g., influences in the BSR from possible impacts of climate change on global trading and shipping are considered.

Not only exposure, but also adaptive capacity differs regionally with the BSR. Consequently, the BSR Strategy for Climate Adaptation calls for actions to ensure that the whole region has an acceptable level of (a) funded coastal protection measures, (b) implementation of spatial planning instruments, (c) willingness to establish multifunctional use of coastal zones, (d) environmental awareness, etc. risk communication and other relevant information distribution, as well as (e) other flexible and innovative approaches through the creation of new knowledge and the transfer of best policy options available.

Below, examples of possibilities and challenges related to coastal infrastructure in the BSR that need to be adapted to are listed. In addition to these, the health infrastructure need to adapt to heat and extreme weather events, intensified UV radiation, increased exposition of allergen- and air-pollutants and hygiene problems of food and water supply.

COASTAL INFRASTRUCTURE:
Examples of possibilities:
- Less demand for heating
- Less sea ice will decrease stress/damage to constructions, and facilitate and reduce sailing distances and shipping times for maritime transports

Examples of challenges:
- Damage to buildings due to increased growth of fungus and mould
- Damage to coastal protection structures due to flooding caused by sea level rise
- Loss of coastal territory and built up structures due to landslides/soil erosion
- Damage to buildings/infrastructure due to rise of sea and groundwater levels
- Increased need for refrigeration in ports and cooling of buildings and public traffic systems
- Increased need to safeguard summer water supply
- Dune movement due to damage to vegetation in dry periods

7.3.4. Coastal tourism

In a general sense climate change can be seen as a possibility for the BSR coastal tourism since the BSR will experience more pleasant summer temperatures than other regions were temperatures will become too high. Secondly, more tourists will be expected due to the prolongation of the summer season. In these respect positive developments can be expected, but is a need for adaptation to the possible environmental impacts from an increased number of tourists,

As presented in Baltadapt Report No x (Baltadapt Stakeholder Dialogues”), and Baltadapt Report nr X (the tourism impact report) (these reports are not yet published but will be before the launch of the strategy in September), a changed climate in the BSR might also include unpleasant components for tourists, including more days with heavy rains, as well as heat waves. In addition, the impacts of the changed climate are further affecting the quality of two of the most valuable resources for the summer tourism in the BSR; the beaches surrounding the Baltic Sea and the sea itself. Thus climate change impacts on beach erosion and possible increase of eutrophication and biodiversity loss is a challenge, which can compromise touristic value of natural areas. Also impacts on freshwater resources, e.g. through dry spells in summer or through saltwater intrusion into groundwater and other fresh water sources could be a threat to tourism. Impacts on health (cf section 5.3.3) are especially critical since the ageing of the population also will be reflected in the tourism sector. Specific health concerns for coastal tourism are associated with increases in toxic algal blooming, jellyfish occurrence, and bacterial outbreaks, tic and mosquito-borne diseases. Health issues might decrease the popularity or even the safety of coastal tourism throughout the BSR.
In order to motivate adaptive strategies among tourism industry stakeholders, it is important to provide economic valuation of environmental resources and remediation costs. This could be based e.g. on identification of concrete investments or costs arising in recent years, such as beach cleaning equipment or repairs from major weather events that can be attributed to the effects of climate change. Such analyses of concrete examples would motivate adaptive behaviour in industry stakeholders, if presented in terms of potential for avoided future costs.

However, the tourism industry in the BSR does mainly consist of “microenterprises”, not even of small or medium size, with a planning horizon that only spans over a few seasons. Their possibility to include climate change adaptation in their own business models is low. Consequently, there is a need for policies that increase adaptive capacity to meet possibilities as well as challenges such as increased insurance outlay, increased real estate costs, if coastal areas become unsuitable for building, and smaller-scale annual recurring costs, such as mechanical beach clean-up, re-sedimentation, and dredging.

In order to increase adaptive capacity of the tourism sector, the BSR Climate adaptation strategy also calls for the following:

- Increased cross-sectoral integration with the tourism sector and the transport and the energy sectors, which are the two sectors which the tourism draws the most resources from.
- Development and implementation of risk assessment systems, as well as information sharing systems, including financial risk assessments, and monitoring systems for coastal algae, bacteria, or jellyfish proliferation.
- BSR wide systems to forecast major environmental events, and to present these results in terms of their impacts on the tourism industry; as well as monitoring systems to predict and inform about more localized and specific climate-change related challenges, such as algal blooms.
- Training and preparing rescue services for increased occurrence of forest fires and floods, as well as the necessity for regions or cities to have emergency plans for evacuation of tourists in case of extreme environmental events.
- Marketing of sustainable tourism to ensure that the potentially increasing visitor load in the BSR will not increase the environmental impacts proportionally.
- Preparing visitor capacity assessments for islands and natural areas, to determine the maximum number of tourists the given destination’s environment can support.

Below, examples of possibilities and challenges related to coastal tourism in the BSR that needs to be adapted to are listed:
8. Reaching the visions of the BSR Climate Adaptation Strategy through implementation of the Action Plan

In Table 2, visions for the year 2020 are provided. The action plan provides ways forward to reach the theses visions. However, the strategy and action plans are flexible, which means that in addition to monitoring of if we have come closer to realisation of the visions, the visions will also be re-evaluated in connection to evaluations. The evaluations of the progress in realisation the visions will have a main purpose to assist in identification of the main actions to focus on.

Table 2. Visions for the BSR Climate Adaptation Strategy for the year 2020, using 2013 as the baseline and showing the relation to goals in the EU Strategy for Climate Adaptation.

<table>
<thead>
<tr>
<th>Sub-criteria</th>
<th>Vision (2020)</th>
<th>Baseline (2013)</th>
<th>Relation to goals in the EU Strategy for Climate Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raising awareness</td>
<td>Awareness of climate change and its potential impact on society and the environment, as well as the possibilities of adaptation permeates macro-regional agreements, regional education and training collaborations, as well as regional cooperation between authorities at all geographic levels, researchers, and private parties.</td>
<td>Scattered fulfilment</td>
<td></td>
</tr>
<tr>
<td>Sharing a macro-regional knowledge base</td>
<td>A &quot;Baltic Window&quot; linked to &quot;the European Climate Adaptation Platform&quot; includes relevant information or links to information on climate change adaptation, including access</td>
<td>Work initiated.</td>
<td></td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research cooperation in order to identify and address gaps of knowledge</td>
<td>An interdisciplinary approach to climate adaptation is included as a horizontal aspect of all scientific cooperation in the region, where it is relevant.</td>
<td>Scattered fulfilment</td>
<td>2020: Priority knowledge gaps identified in 2013 have been closed</td>
</tr>
<tr>
<td>Facilitating science-policy dialogues on all levels</td>
<td>Decision makers among authorities as well as among private actors have access to interactive visualization-based tools for dialogues about climate adaptation. These are part of a well-developed and frequently used access to a combination of web-based on real-life meeting places for researchers, authorities and private actors representing specific sectors, such as the horizontal (between stakeholders in the same geographical level) and vertical (e.g. between stakeholders on local, national and macro-regional levels) dialogues.</td>
<td>Scattered fulfilment</td>
<td>2020: Communication tools allow for available information on climate change adaptation to be accessible for decision-makers, including Member States, local authorities and firms</td>
</tr>
<tr>
<td>Cooperation to prepare for increased risk of disasters due to climate change</td>
<td>Access to operational warning system in the region relevant to climate-change induced increased exposure in different sectors (such as infrastructure, agriculture, health) either by common BSR systems or through other types of cooperation between different warning system services in the region.</td>
<td>Scattered</td>
<td></td>
</tr>
<tr>
<td>Mainstreaming adaptation in BSR relevant policies</td>
<td>All BSR relevant policies are integrated with climate adaptation (mainstreamed) in a manner that reflects the specific nature-given and socio-economic conditions of the BSR.</td>
<td>Initiated</td>
<td>2020: Adaptation considerations have been mainstreamed in a consistent and comprehensive way in key EU policies</td>
</tr>
<tr>
<td>BSR cooperation between EU and Russia</td>
<td>Cooperation in the Baltic Sea region has also increased awareness and implementation of climate change adaptation in Russia. Russia also carried out initiatives that have increased the possibility of climate adaptation in BSR EU states.</td>
<td>Exists in some contexts, e.g. through CBSS, HELCOM</td>
<td></td>
</tr>
<tr>
<td>Cooperation on all levels in regional implementation of the EU Strategy on Climate Adaptation</td>
<td>Collaboration on climate change adaptation between the BSR states exists both at the macro-regional, national, and local levels with functional communications between levels.</td>
<td>Scattered</td>
<td></td>
</tr>
<tr>
<td>Cooperation related to national strategies</td>
<td>National climate change adaptation strategies available in all BSR states, with the exchange of information through collaboration on the &quot;Baltic Window,&quot; as well as through other established forms of cooperation in the preparation and updating of climate adaptation strategies and action plans.</td>
<td>Scattered</td>
<td>2017: All Member States have adopted (an) Adaptation Strateg(y)ies, complemented by regional or local adaptation strategies when</td>
</tr>
</tbody>
</table>
**Baltic Sea Region Strategy for Adaptation to Climate Change**

<table>
<thead>
<tr>
<th>Promoting sector-relevant macro-regional cooperation on adaptation to challenges and business opportunities</th>
<th>BSR relevant cooperation within all business sectors in society where this is relevant (e.g., agriculture, tourism, fisheries, energy, construction of infrastructure).</th>
<th>Sporadic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro-regional cooperation in order to ensure funding of adaptation measures</td>
<td>Access to the estimates of the cost related to climate change adaptation in different sectors. Access to finance in the BSR that enables prioritization of action on adaptation to the most exposed and vulnerable parts of the region, as well as to the most vulnerable sectors and individuals.</td>
<td>Limited</td>
</tr>
</tbody>
</table>

### 9. References

#### 9.1. Baltadapt Reports

[A number of Baltadapt reports are still missing – to be complemented – including the report on prioritization of impacts to address in BSR cooperation and the stakeholder report – they will be published before the launch of the BSR Strategy for Climate Adaptation in September 2013]


Baltadapt Climate Info Bulletins ([www.baltadapt.eu](http://www.baltadapt.eu)):
- Baltadapt Climate Info #1: Air Temperature
- Baltadapt Climate Info #2: Precipitation
- Baltadapt Climate Info #3: Wind Climate
- Baltadapt Climate Info #4: Sea Level Rise
- Baltadapt Climate Info #5: Oxygen Content
- Baltadapt Climate Info #6: Salinity
- Baltadapt Climate Info #7: Water Temperature
- Baltadapt Climate Info #8: Biodiversity and Habitats
9.1. Documents referred to in the BSR Climate adaptation strategy


10. List of abbreviations

**BSAP:** The Baltic Sea Action Plan is an initiative from the Helsinki Commission (HELCOM). It addresses the major environmental issues that influence the Baltic marine environment. An agreement among the countries around the Baltic Sea specifies some actions to taken to achieve a healthier Baltic Sea, e.g. better waste water treatment and changed agricultural practices.

**BSR:** The Baltic Sea Region includes the EU member states Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Sweden and northern parts of Germany, as well as the neighbouring countries of Norway, the north-west regions of Russia and Belarus.

**EUSBSR:** EU Strategy for the Baltic Sea Region. EUSBSR aims at reinforcing cooperation within the BSR in order to face several challenges by working together as well as promoting a more balanced development in the area. The Strategy also contributes to major EU policies and reinforces the integration within the area.

**INSPIRE:** (Infrastructure for Spatial Information in Europe) is an initiative launched by the European Commission and developed in collaboration with Member States and accession countries. It aims at making available relevant, harmonized and quality geographic information to support formulation, implementation, monitoring and evaluation of Community policies with a territorial dimension or impact. INSPIRE intends to trigger the creation of a European spatial data infrastructure that delivers to the users integrated spatial information services linked by common standards and protocols.