Baltadapt Report # 6

Climate Change Impacts on Coastal Tourism in the Baltic Sea Region

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Climate change impacts will have both positive and negative consequences for the tourism industry in the Baltic Sea Region (BSR). Based on existing knowledge and new knowledge obtained as part of the Baltadapt project, this report identifies various aspects of climate change that may impact the tourism industry in the BSR. Research findings on climate change impacts on tourist comfort and behaviour, tourism flows, destinations and activities are reviewed for the BSR. Coastal and cold-climate-dependent tourism are highly vulnerable to climate change-related risks. A future warmer climate can also bring new weather-related opportunities to the BSR. The regions’ tourism industry has longstanding traditions and innovative enterprises; although tourism adaptive capacities with relation to climate change vary in different parts of the BSR. Most vulnerable will be low income regions, less populated coastal areas and those that depend on wildlife tourism. Possible adaptation measures relevant for coastal and cold-climate tourism destinations are reviewed. Finally, research and knowledge gaps are identified and discussed with the aim to support research as well as cooperation between science and industry in relation to climate change adaptation and tourism in the BSR.
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1 Introduction

1.1 Scope of the coastal tourism review

This review has been prepared with the objective to compile and analyse existing knowledge on climate change impacts and adaptation relevant for coastal tourism and recreation in the Baltic Sea Region (BSR). Coastal tourism and recreation are complex sectors that are vital contributors to the quality of life, employment and the economical wellbeing of the region. This review aims at demonstrating the diversity of challenges and opportunities that the coastal tourist sector in the BSR is facing as a consequence of climate change. The review focuses on tourist comfort and behaviour and changes to tourist flows, coastal tourism destinations and activities in the region (for coastal tourism infrastructure see Krämer et al., 2012). In the review a rather flexible approach is used to frame the geographical scope and focus of existing research studies with relevance for the BSR. Only brief insight is given to climate change impacts with relevance to tourism supporting sectors, such as: public health, food, transport, insurance services, construction and indoor climate.

The review focuses on water-based tourism as a crucial element that links national or sub-regional tourism markets of the BSR. The regional identity of the BSR is not only imbedded in the experience of using coastal and marine resources for tourism and recreation but and in longstanding traditions of nature tourism and outdoor activities, including regional knowledge to cope with contrasts in recreation activities and tourism opportunities in all four seasons.

Climate change impacts and possible adaptation measures are identified and discussed with relevance to water-based tourism, winter tourism (with the exception of mountain-based tourism), nature tourism and outdoor recreation in the BSR. While the highest volumes of tourists are participating in urban and beach (summer resort) tourism, for local economies of scarcely populated areas nature tourism is an important contributor. Due to the limited scope this review is not providing detailed study on climate change impacts to urban and indoor tourism. To summarise, the tourism climate impact assessment is designed to answer the following research questions:

1. What are the direct and indirect impacts of climate change on environmental conditions and on uses and functions, in particular concerning
   a) tourist comfort and behaviour,
   b) tourist flows,
   b) tourism destinations (for coastal tourism infrastructure see Krämer et al., 2012),
   c) tourism and recreation activities with emphasis on outdoor, winter, water-based and beach activities?
2. Which adaptation measures are possible and suitable for the BSR?
3. What knowledge gaps exist and what are the research needs?
1.2 Relevance of climate change impacts and adaptation to tourism

Climate change is perhaps the most pressing environmental issue in the world today, although the tourism sector is a latecomer to the discussion of challenges and opportunities due to climate impacts. The EU Strategy for the Baltic Sea Region calls for the development of a “regional adaptation strategy at the level of the Baltic Sea Region”. The Inter-Governmental Panel on Climate Change (IPCC) has reported that warming of the global climate system is “unequivocal” and that it is “very likely” that anthropogenic (human-made) greenhouse gases (GHG) have caused most of the observed global temperature rise since the middle of the 20th century. While the Intergovernmental Panel on Climate Change (IPCC, 2007; Nicholls et al., 2007) only mentions tourism in passing (in relation to transport, coastal systems and regional overviews). Thus a scientific lead for the sector was missing (Burns & Bibbings, 2009; Schott et al., 2010), however today studies and publications on climate change impact and adaptation relevant for tourism is growing rapidly in numbers.

Traditionally, the seasonal contrast drives demand for summer vacations; and the climate and weather contrast between the source and destination countries of tourists creates major tourism flows at global, European, the BSR and national scale (Viner, 2006; Alcamo et al., 2007). Tourism has traditionally been considered to be a highly climate-sensitive economic sector (UNWTO & UNEP 2008); some tourism, e.g. beach and skiing, destinations are particularly climate-dependent; since climate is their principal resource (UNWTO, 2009). Perch-Nielsen (2010) notes that “the attractiveness of a region for touristic activities depends strongly on the local weather and climate the influence of climate (change) on tourism has only been investigated in few studies, while other affected economic sectors such as agriculture and the insurance services have received far more attention”. Climate and weather are important factors for tourism demand at their origin areas, and for tourism destinations that influence destination image and tourism resources, long-term tourism demand, the timing of travel, the length and quality of tourism seasons, tourist experience and satisfaction and tourism industry operations and profitability (Polovitz Nickerson et al., 2011; Denstadli et al., 2011; Day et al., 2013; Goh, 2012; Becken & Hay, 2007; Bigano et al., 2008; Gössling & Hall, 2006; UNWTO & UNEP, 2008; Scott & Lemieux, 2009; Scott et al., 2010; UNWTO, 2009; OECD & UNEP, 2011; Gössling et al., 2012; Nicholls, 2006; Lohmann & Kaim, 1999). Climate directly affects various facets of tourism operations (e.g. water supply and quality, heating-cooling costs, snowmaking requirements, irrigation needs, pest management, evacuations and temporary closures) that affect profitability (UNWTO, 2009). Climate also influences environmental conditions that can deter tourists, including infectious diseases, wildfires, algal blooms, insect or water-borne pests (e.g. jellyfish), and extreme events such as hurricanes, floods or heat waves (UNWTO, 2009).

Tourists’ decision-making depends on the weather and climate conditions at the destination (figure 1) and also at the point of origin. Climate change may influence tourism directly through the decision-making process to choose destinations or activities; and indirectly as a result of the changes in the destination itself resulting in the loss of the tourism recourses and attractions (Agnew & Viner, 2001). Tourists can be found in all types of climates and natural landscapes worldwide as tourism
operators have adapted to provide tourism services in every climatic zone on the planet (Scott & Lemieux, 2010). Each major global tourism market segment has specific needs, opportunities and constraints regarding climate and weather. As well characteristics of domestic and international travellers and their motivations for travel are diverse and changing with time. Thus tourists’ adaptation capabilities to changing weather conditions differ depending from their information and experience. However evidence shows, that the decision to return to a destination is largely unaffected by past experiences of poor weather (Scott & Lemieux, 2010).

1.3 Socio-economic trends of tourism

When dealing with climate change adaptation in relation tourism it is crucial to consider the complexity of tourism industry development trends. Tourism industry is constantly changing and not only affected by the climate system such as its seasonality, inter-annual variability, extreme events and long-term changes, but also to but also due development trends that are derived from overall society changes in the future (Williams & Shaw, 2009; Yeoman et al., 2009), e.g. macro-scale sectoral influencing factors such as economic growth or recession, transport access and cost, political stability or security, demographic, and technological, cultural and political change, currency exchange rates, border agreements (Scott & Lemieux, 2010). Tourism is a phenomenon characterised also by a high level of dynamism, at least on the extremes. Forms of tourism have continued to multiply, e.g. increase in nature tourism, wellness and health tourism (Butler, 2009). Destinations change in response to changes in tourism demand as a result of reinvestment in original attractions such as beaches, scenery, culture and climate, and adding post-modern attraction (Butler, 2009). The temporal aspects of tourism is changing, e.g. gradual decline in relative importance of the summer holiday and the length of holidays, the increase of second and multiple holidays per year (Butler, 2009). Fixed in space and in the usage of existing technical utilities the tourism destinations are transformed at slower speed to respond to tourism demand changes in the form of reinvestment, renovations and building new attractions (Butler, 2009). The basic purpose of tourism has been remaining the same for long time and it is expected to do so in the future - the pursuit of enjoyment and relaxation, in a multitude of forms, away from home for a limited period of time; what has changed significantly is where that pursuit takes place, to a lesser extent when it takes place, and most particularly, how it takes place (Butler, 2009). Location of tourism depends on the technology and costs of transportation; particularly long-distance travel depends on energy prices and implications of climate change mitigation policies. The BSR tourism market does not dependent on long-haul travel as it is dominated by domestic tourists and tourists from neighbouring countries and overnight stays (see table 3 and appendix 1).

The current structure of tourism flows in the BSR suggests that future developments of climate change mitigation policies will not have so detrimental impacts to local tourism industry in the region in comparison with consequences that have been predicted for long-haul travel dependent destinations. A decline of long-haul travel would promote domestic and continental travel, e.g. Europeans will stay within Europe. At the same time the UNWTO predicts tourism growth as result of modern consumer
mentality and hypermobility (Peeters, 2006). In the future Europeans will be interested in more holiday trips per year, but shorter stays (weekend trips) near to place of residence, i.e. in “proximity” tourism (EC & Eurostat, 2008). There are also growing interest to travel independently, interest in low-cost offers, flexible travel schedules and tourism activities, desire for authentic experience of places and contact with nature and interest in adventure (EC & Eurostat, 2008). Demographic change will transform the characteristics of tourists; aging tourists will probably prefer convenience, safety, luxury and city trips and short breaks outside the peak seasons (ECORYS, 2012a). Older people will still wish to escape the dark, dreary winters of northern Europe, and in hot weather tourists will expect air conditioned indoor places, thus giving preference to premium price (Perry, 2006). As a counter acting trend to luxury will be the growing low cost business models. Tourists will seek tailor-made products or will switch easily from one niche groups or specialized tourism product to another; loyalty towards one or a few destinations and repeat visits will decrease. Greater number and diversity of different destinations can have a better position in the tourism market. The desire of holidays is driven by prosperity and affordability and middle classes of China, India and Eastern Europe will become the travellers of tomorrow (Yeoman et al., 2009).

The fragmentation and geographically dispersed value chain of tourism industry contributes to the complex nature of the interactions between tourism, climate system, environment and society (Simpson et al., 2008). More than 90% of all enterprises in the tourism sector employ less than 10 persons that are mainly located in the tourist destination itself and this trend will continue. Due to changes in information technology the tourism industry is undergoing organisational changes and becoming a dynamic, interactive and demand-centred economical activity, where consumers can
directly ‘assemble’ a ‘customised’ offer, while tour operators are loosing their dominance and these
 tour operators which remain are becoming global and larger-size enterprises (ECORYS, 2009 and
 2012a). Individualisation of tourism will limit distinguishing homogeneous and recognisable target
groups of tourists. Packaged travel will become smaller in terms of participants per group. There will
be a lower loyalty towards one or a few destinations, repeat visits will decrease, while greater number
and diversity of different destinations can more successfully compete in the tourism market (ECORYS,
2009). An increasing number of first–time visitors will depend more on information resources and
travel product advertisements, that will increase their role in the influencing the tourist decision
behaviour, and thus consequently tourism advertisements will dominate in framing the public debate
about tourism, mobility and climate change (Burns & Bibbings, 2009).

Individualisation trend will be confronted with ‘connectivity’ trend that refers to meaningful
relations and to enjoy meaningful experiences and this includes also an increased demand for
ecologically responsible consumerism where the concerns about climate change, environmental
pollution and sustainable resource management are integrated (ECORYS, 2009). The future tourists
that will be better educated will have more focus on their health, food fitness, and wellness. In the
future, anxiety society characteristics will dominate the tourism industry. This means that there will be
consumers with two courses of action: fear leads to risk-minimisation and safety concerns; and at the
same time complacency leads to risk-taking and the increase of participation in adventure or hazard
tourism (Yeoman et al., 2009).

Coastline tourism and yachting will grow, but there will be a polarisation between places
(ECORYS, 2012a). Coastal tourism destinations are affected by complexity of changes - primary
drivers are tourism itself, the expansion of the built environment, industrial development and trade,
fisheries and aquaculture; and secondary drivers for the changes in coastal zone are as listed climate
change, provision and supply of energy and agriculture (Rochelle-Newall et al., 2005). Maritime and
coastal tourism is considered to be a catalyst for economic development of coastal areas. Previously
these areas were depended extremely on fisheries and industries related to that, but this is now in
decline (EC, 2010). Polarisation is also expected among winter destinations, where only more
successful ones will stay in the tourism business. In the industrialised world there is transition from the
service economy to the experience economy, and thus the emphasis on the tourism destinations’
identity and the desire for authenticity (includes specific weather and climate conditions) is growing
(Yeoman et al., 2009). This tourism trend based on the real world rather than on something that is
artificial has implications for climate change adaptation strategies utilised in the destinations, for
instance preferences for outdoor versus indoor activities.
1.4 **Tourism system in the BSR**

Europe, particularly Mediterranean countries are among the top destinations globally. The tourism sector accounts for approximately 5% of the total workforce in Europe and generates more than 5% of European GDP, and this figure has been steadily rising (ECORYS, 2009). Coastal destinations are the most popular destinations in Europe and worldwide (EC, 2000). In the BSR there are no mass tourism sites comparable to the Mediterranean area, but the concentrations of tourists in some areas is very high, e.g., on the German coast (Donges et al., 2013). Tourism is an important economic sector not only for the southern coastal areas of the Baltic Sea, but also for other coastal urban regions (coastal resorts), islands and archipelagos. In 2011, the BSR's tourism industry contributed EUR 267 billion to the total GDP and employed around 7.8 million people in the region (BASTIS, 2013). In 2011 the BSR had 72 million tourism arrivals (increase by 33% since 2002), 190 million overnight stays (increase by 20% since 2002), and 20,000 tourism establishments (increase by 5% since 2002) with 2.5 million beds (increase by 8% since 2002) (Eurostat data, cited in BASTIS, 2013) (table 1). Tourism economic contribution among the BSR countries differs; as well there are large disparities in volumes, intensity and the growth of tourism infrastructure, e.g. accommodation (table 2, 3 and 4). Most of the tourists in the BSR are domestic or from neighbouring countries (Annex 1). In the Baltic States, international tourists and overnight stays in hotels dominate; in other countries domestic tourists and overnight stays in campsites and other than hotel accommodations dominate, except Finland where hotel overnight stays dominate (table 2, 3 and 4).
Climate Change Impacts on Coastal Tourism in the Baltic Sea Region

**Figure 2:** Structure of tourism sector in the BSR (authors, modified from Klint et al., 2012; Jopp et al., 2013; Aall & Høyer, 2005).

- **Demand**
  - Tourists from the BSR and outside (from/outside Europe, South – North tourism flow)
  - Type of travel and holiday experiences:
    - Mass tourism, individual tourists
    - Luxury, business, budget tourism
    - Senior tourists, families with children
    - Urban, rural, nature tourism, outdoor (aquatic, winter, field) sports, recreational fishing, beach, wellness, experience tourism

- **Climate at source**
  - Time of the year (season) of travelling
  - Length of stay
  - Volume of travelling
  - Decision making factors of the choice of destination (costs, culture, history, climate/weather, nature, accessibility, beaches, accommodation, catering)

- **Communication, branding, marketing of the BSR image (including climate, season and weather)**

- **Transport to the BSR**
  - Sea-based transport/ accommodation
    - Cruise ships
    - Ferries
    - Yachts
  - Ports and marinas
  - Air and land-based transport

- **Supply**
  - BSR, national, sub-regional tourism associations and government offices
  - Local businesses and communities / Tour operators / Travel agents and guides
  - Natural attractions (ecosystems/wildlife/beaches/bathing waters/fishing/forests/open landscapes)
  - Infrastructure and services (indoor/outdoor)
  - Built-up areas (accommodations, attractions, urban and cultural landscapes)

- **Tourist experience**
  - Perception; expectations; past experience; thermal comfort, physical, physiological and psychological adaptation; weather (temperature, precipitation, wind, humidity, sun); extreme weather events; length of daytime; type of outdoor activities; services, costs, safety, host community attitude, hospitality

- **Weather events**


<table>
<thead>
<tr>
<th>Countries</th>
<th>Tourism direct contribution to GDP, %</th>
<th>Tourism direct contribution to GDP, billion EUR</th>
<th>Tourism total contribution to GDP, %</th>
<th>Tourism direct contribution to employment, %</th>
<th>Tourism direct contribution to employment (jobs)</th>
<th>Tourism total contribution to employment, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>1.4</td>
<td>18.5</td>
<td>5.9</td>
<td>1.3</td>
<td>954,000</td>
<td>5.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.8</td>
<td>7.1</td>
<td>5.5</td>
<td>1.7</td>
<td>110,000</td>
<td>5.6</td>
</tr>
<tr>
<td>Poland</td>
<td>1.9</td>
<td>6.9</td>
<td>4.8</td>
<td>1.9</td>
<td>306,000</td>
<td>4.7</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1.6</td>
<td>0.5</td>
<td>4.2</td>
<td>1.6</td>
<td>22,500</td>
<td>4.0</td>
</tr>
<tr>
<td>Latvia</td>
<td>2.9</td>
<td>0.6</td>
<td>7.7</td>
<td>2.8</td>
<td>27,000</td>
<td>7.3</td>
</tr>
<tr>
<td>Germany</td>
<td>1.6</td>
<td>41.9</td>
<td>4.6</td>
<td>1.8</td>
<td>709,000</td>
<td>4.9</td>
</tr>
<tr>
<td>Finland</td>
<td>2.1</td>
<td>4.1</td>
<td>6.2</td>
<td>2.2</td>
<td>58,000</td>
<td>6.5</td>
</tr>
<tr>
<td>Estonia</td>
<td>3.3</td>
<td>0.5</td>
<td>12.7</td>
<td>3.4</td>
<td>18,000</td>
<td>12.4</td>
</tr>
<tr>
<td>Denmark</td>
<td>1.8</td>
<td>4.4</td>
<td>6.0</td>
<td>7.0</td>
<td>217,000</td>
<td>11.3</td>
</tr>
<tr>
<td>Belarus</td>
<td>2.0</td>
<td>0.4</td>
<td>4.5</td>
<td>1.8</td>
<td>86,000</td>
<td>4.1</td>
</tr>
</tbody>
</table>

<p>| Table 2: Number of bed places in collective tourism establishments by kind of accommodation in countries of the BSR (Eurostat, 2012). |
|---------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|</p>
<table>
<thead>
<tr>
<th>Countries</th>
<th>Bedplaces in hotels and similar</th>
<th>Bedplaces in tourist campsites</th>
<th>Bedplaces in other collective accommodation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>87,000</td>
<td>21 %</td>
<td>276,000</td>
</tr>
<tr>
<td>Germany</td>
<td>1,749,000</td>
<td>53 %</td>
<td>888,000</td>
</tr>
<tr>
<td>Poland</td>
<td>253,000</td>
<td>42 %</td>
<td>21,000</td>
</tr>
<tr>
<td>Lithuania</td>
<td>26,000</td>
<td>69 %</td>
<td>3,000</td>
</tr>
<tr>
<td>Latvia</td>
<td>27,000</td>
<td>76 %</td>
<td>3,000</td>
</tr>
<tr>
<td>Estonia</td>
<td>31,000</td>
<td>61 %</td>
<td>7,000</td>
</tr>
<tr>
<td>Finland</td>
<td>122,000</td>
<td>55 %</td>
<td>79,000</td>
</tr>
<tr>
<td>Sweden</td>
<td>225,000</td>
<td>28 %</td>
<td>480,000</td>
</tr>
</tbody>
</table>

<p>| Table 3: Number of nights spent in hotels, campsites and other collective accommodation establishments by residents and non-residents in countries of the BSR (Eurostat, 2012). |
|---------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|</p>
<table>
<thead>
<tr>
<th>Countries</th>
<th>Total nights spent in country by residents</th>
<th>Total nights spent in country by non-residents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>million nights</td>
<td>%</td>
</tr>
<tr>
<td>Denmark</td>
<td>18.2</td>
<td>67</td>
</tr>
<tr>
<td>Germany</td>
<td>265.8</td>
<td>82</td>
</tr>
<tr>
<td>Estonia</td>
<td>1.5</td>
<td>32</td>
</tr>
<tr>
<td>Latvia</td>
<td>0.9</td>
<td>32</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1.2</td>
<td>43</td>
</tr>
<tr>
<td>Poland</td>
<td>45.7</td>
<td>82</td>
</tr>
<tr>
<td>Finland</td>
<td>14.2</td>
<td>74</td>
</tr>
<tr>
<td>Sweden</td>
<td>36.7</td>
<td>77</td>
</tr>
</tbody>
</table>

<p>| Table 4: Tourist accommodation in hotels, campsites and other collective tourist accommodation in coastal regions (Eurostat, 2012). |
|---------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|</p>
<table>
<thead>
<tr>
<th>Countries</th>
<th>Number of bed places in coastal regions, 2010</th>
<th>Change in the number of bed places in coastal regions, 2007–10</th>
<th>Share of hotels in the total number of bed places in coastal regions, 2010</th>
<th>Coastal region (NUTS 3 regions) with the highest number of bed places, 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU-27</td>
<td>28 077,500</td>
<td>2.6 %</td>
<td>43.8 %</td>
<td>Venezia</td>
</tr>
<tr>
<td>EU-27 coastal regions</td>
<td>16 437,700</td>
<td>3.6 %</td>
<td>41.3 %</td>
<td>Venezia</td>
</tr>
<tr>
<td>Denmark</td>
<td>393,400</td>
<td>4.0 %</td>
<td>20.7 %</td>
<td>Sydjylland</td>
</tr>
<tr>
<td>Germany</td>
<td>636,400</td>
<td>0.8 %</td>
<td>32.4 %</td>
<td>Ostholstein</td>
</tr>
<tr>
<td>Estonia</td>
<td>39,800</td>
<td>11.7 %</td>
<td>63.6 %</td>
<td>Pohja-Eesti</td>
</tr>
<tr>
<td>Latvia</td>
<td>27,300</td>
<td>32.0 %</td>
<td>80.5 %</td>
<td>Riga</td>
</tr>
<tr>
<td>Lithuania</td>
<td>10,900</td>
<td>– 5.6 %</td>
<td>50.7 %</td>
<td>Klaipėdos apskritis</td>
</tr>
<tr>
<td>Poland</td>
<td>194,200</td>
<td>– 4.2 %</td>
<td>21.1 %</td>
<td>Koszaliniski</td>
</tr>
<tr>
<td>Finland</td>
<td>130,400</td>
<td>– 1.0 %</td>
<td>57.1 %</td>
<td>Uusimaa</td>
</tr>
<tr>
<td>Sweden</td>
<td>591,900</td>
<td>6.3 %</td>
<td>30.2 %</td>
<td>Vastra Gotalands lan</td>
</tr>
</tbody>
</table>
Climate Change Impacts on Coastal Tourism in the Baltic Sea Region

2 Environmental Consequences of Climate Change Relevant for Tourism in the BSR

Climate and weather as a motivator for travel and a component of the destination image (Polovitz Nickerson et al., 2011; Denstadli et al., 2011; Day et al., 2013; Goh, 2012; figure 2) have an impact on tourist demand which will affect destination choice, attraction to particular tourism activities and the timing and the duration of travel. Thus climate and weather can be both an asset for the destinations as well as a disruptor of tourism activities (Day et al., 2013). Climate and weather is more often considered a “pull” factor for travel decisions, while “push” factors for travel out of unfavourable conditions at home are rarely analysed, as poor weather often are accompanied with other environment hazards (Day et al., 2013) (figure 2). Weather and climate are an intrinsic component of the travel experience (Wall & Badke, 1994; Scott & Lemieux, 2010). Several tourism and recreation activities directly depend on particular climate elements, e.g. the beach tourism depends on the hours of sun and high temperatures, skiing depends from snow or gliding and surfing depends from characteristics of wind and waves (Gomez-Martin, 2005). Empirical studies show that weather independent facilities will not be able to compensate fully for a low attractiveness of the outdoor weather, if tourists are looking for specific weather conditions, e.g. sun and warm temperatures (Lohmann & Kaim, 1999) or ideal weather for winter sports (König, 1998).

Since tourism is a multidimensional economic sector the climate change impacts are extremely diverse (figure 3). The characteristics of the impacts can vary at different geographical scales. Local conditions are still important factors which influence perception and behaviour of tourists and host communities (Simpson et al., 2008; Donges et al., 2013). The impacts of climate change on tourism can be classified as either physical (e.g. the loss of biodiversity, damage to tourism infrastructure), economic (e.g. reduced tourism expenditure, reduced employment opportunities, increased costs for businesses and society, increased costs for insurance), or social (e.g. health impacts, change of lifestyle, place identity and destination brand) (Buultjens et al., 2007).

![Figure 3: A model for analysing the relations between climate change, adaptation and tourism (modified from Aall & Høyer, 2005).](image-url)
2.1 Average air temperature rise

According to climate model projections, temperatures in the Baltic Sea area are expected to increase with a mean of 2.6°C by year 2100, and this increase is generally larger than the increase in global mean temperature. It is expected that North European summers will become ‘better’ and appear ‘more reliable’ (Mather et al., 2005). However expected temperature rise will not change the BSR’s core markets, the major change will be on high tourism season (summer) extension, the potential to increase the attractiveness of marine destinations and enhancing the BSR as all-year-round short break destination. Irrespective of improvements, the seasonality in the BSR will remain one of the main challenges for the tourism business. The physical “signals” of changes in temperature due to climate change are weak in value compared to variation in temperature due to daily, seasonal, and regional variations. This creates physiological barriers for climate change adaptation measures (Schott et al., 2010). Perception and experience of climate and weather do not depend only on temperature, but on ‘thermal comfort’ that is defined in combination with radiation, wind, humidity, precipitation and the appearance of the sky and quality of light of a location (de Freitas, 1990). The BSR's temperate climate will be more favourable for the family and senior citizen tourism, particularly during periods when other parts of Europe will have higher and intolerable temperatures (EEA, 2012a). The tourist industry is mainly interested in daytime temperature and its changes, rather than in daily mean as nights are normally spent indoors (Førland et al., 2013; de Freitas, 2003). Interviewed tourism industry representatives underline that ability to identified shorter periods with particular pattern of temperatures responding to the most popular global tourism destinations, e.g. “Paris spring” or “Mediterranean summer”, are crucial for successful marketing of destinations, particularly in communication with foreign and long-haul travel tourists.

Countries around the Baltic Sea have already experiencing a decrease in the number of cold nights and days and a slightly increase of the number of summer days with daily maximum temperatures of above +25°C (Moberg & Jones, 2005). Warming can not only impact the ‘thermal comfort’ of tourists, but also their behaviour (Gössling et al., 2008) and the decisions concerning destinations or activities. Rise of temperature might increase the number of people switching from cars and public transport to bicycle and the visitation in national parks and taking part in nature tourism activities (OECD & UNEP, 2011). However, the same process can change natural ecosystems and thus nature tourism resources. With milder winters the likelihood of road accidents might be reduced (Koetse & Rietveld, 2009; Jaroszweski et al., 2010). With a possible increase of tourist numbers in summer months, railways, streets and airports could reach their maximum capacity in the peak season and coastal regions might require new and expanded traffic systems, as well as basic and supra-infrastructure for accommodation, catering, retail and tourism attractions need to be adjusted to increased tourism numbers.

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1 Baltadap Climate Info #1, http://climate-info.baltadapt.eu
2.2 Average water temperature rise\(^2\) and the shrinkage of sea ice\(^3\)

Different climate simulations predict a 2–2.5 °C increase of the water temperature for the coming 90 years. The warming in the BSR will occur strongest in the northern regions in winter and in the southern regions during the summer months (Störmer, 2011). In coastal waters of the north eastern part of the Baltic sea up to Riga Bay there has been observed the increase in sea surface temperature in the period form 1981 to 2011 from 2-3.5°C; while Swedish coastal areas south from Stockholm experienced a slight decrease of sea surface temperature in the same period (ESaTDOR, 2012). The Baltic Sea surface temperature has large seasonal, interannual and regional variations. Water and air temperature rise combined with less rain in summer have positive impacts on beach tourism, due to a longer bathing and water sports season in the BSR. However, increased water temperatures in summer might also negatively impact tourism with the occurrence of and distribution of various water species like cyanobacterial blooms, jelly fish (Wenk & Janßen, 2011; Donges et al., 2013), aliened species, and pathogens like vibrio-related diseases (e.g. Cholera) (Störmer, 2011; Donges et al., 2013). Due to summer temperatures raise, the existing water quality standards are challenged by increased algal blooms, viruses/ pathogens, eutrophication, sea weed – beach wrack, unsightly, odour issues, and decreased water transparency; it is also a risk to eco-label certification such as Blue Flags (Yeoman & McMahon-Beattie, 2006).

Water and air temperature rise will lead to a shorter period and coverage of sea and coastal surface water ice (EEA, 2012a). The maximum sea ice extent in the Baltic Sea has been decreasing since about 1800 and the extent of the maximal cover is projected to shrink further; water and air temperature rise will lead to a shorter period and lesser coverage of sea and coastal surface water ice, although predictions are made with uncertainty (EEA, 2012a; Störmer, 2011). The resulting changes in the freezing conditions of water bodies and the formation of snow cover are connected to several climatic factors that are hard to predict (Heikkinen et al., 2011). Estonian study proves that due to temperature increase, that is particularly evident from January to May, the extent of sea ice has significantly decreased by 1–2 months over the last 60 years, (Kont et al., 2011). The first-order climate change prediction argue that an increase in mean atmospheric temperature by 1°C would delay the freezing date by 5 days and lead to ice break-up 5 days earlier in the Baltic Sea (Haapala & Leppäranta, 1997 cited in Dalidiené et al., 2012). There will still be a large inter-annual variability spanning between almost ice free winters and severe ice winters. There is uncertainty concerning the reduction of ice extent in the Baltic Sea; predictions vary from 30% to 57–71%, additionally, the length of the ice season will decrease between 1 and 3 months depending on the region (Störmer, 2011). Ice-free conditions will be beneficial for water sports, cruise lines and water transport. Reduced ice cover can lengthened season for shipping and for float planes in coastal water bodies (Hyman et al., 2010). Negative environment consequences can be expected with cruise sector expansion, e.g. higher amount of sewage, wastes and air pollution produced by the cruise lines, use of electricity from land

\(^2\) Baltadapt Climate Info #7, http://climate-info.baltadapt.eu

\(^3\) Baltadapt Climate Info #14, http://climate-info.baltadapt.eu
Environmental Consequences of Climate Change

(Klein, 2010). Ice-fishing and other types of recreation and sports on ice, e.g. ice-yachting, can expect negative impacts from temperature rise (Järvinen et al., 2010; Ekelund, 2007). Milder winters are also likely to cause significant negative consequences in the operation of ice roads, that are used as temporary roads during the frozen period of winter time created either from a mixture of soil, snow and/or ice or on the frozen surface of lakes, rivers (Hudecz, 2012) or coastal sea water to connect islands. In Northern Finland there are growing uncertainty of the freezing of water bodies and wetlands and increasing security risks brought on by the increased variations in weather conditions that have negative impact for winter tourism (Heikkinen et al., 2011).

2.3 Change in precipitation patterns

On an annual mean basis the precipitation in all of the Baltic Sea runoff regions is projected to increase and there is a strong correlation with the increase in temperature. The projected increases are largest and most consistent during winter. In summer the scenarios generally show more precipitation in the north. In the south, with large uncertainty precipitation is projected to change only little, or even decrease. The volume and the type (rain, snow or fog) of precipitation are crucial for tourism attraction and tourist experiences and for the image and marketing of a tourism destination. Snow reliability in Scandinavia will remain higher than in many parts of the Alps, the region could "increase its market share in alpine and Nordic ski sports" (Ehmer & Heymann, 2008). Large volumes of snow due to light reflection capability can create idyllic winter destination even in dark sky conditions, while ‘cloudy, windy and rainy winters would not have the same draw’ (Yeoman & McMahon-Beattie, 2006). As a result of intensive precipitation landslides and flooding can affect not only tourism accommodation, but also cultural and natural heritage. More intense precipitation events, increased humidity, higher microbial activity, increased growth of fungus and mould can be cause of increased decay processes (e.g. in wood), decreased durability of materials, damaged or flooded buildings and structures (Penney, 2012). Increased incidence of extreme rainfall events and flash floods mean bathing water quality is repeatedly lost as are participation in Blue Flags scheme (Yeoman & McMahon-Beattie, 2006). Negative impacts expected for road maintenance in winter and thus road deterioration, particularly with gravel surfaces (Hudecz, 2012). The increases in rainfall intensity and frequency in winter as well as accumulated length of the thawing period will lead to greater supply of water to local catchments, higher groundwater levels, greater infiltration of surface water into road structures, and increase of erosion of roads and bridges and the frequency of quick clay slides (Hudecz, 2012). As result of intensive precipitation landslides and flooding can affect not only tourism accommodation, but also cultural heritage (Lollino & Audisio, 2006).

More precipitation, high humidity and fog events can cause lower visibility that will have negative impacts for sightseeing (Førland et al., 2013; Yeoman &McMahon-Beattie, 2006), as well as for safe travel, particularly aviation. Weather was found to be a cause in 70% of aviation delays and 23% of accidents (Kulesa, 2002, cit, in Koetse & Rietveld, 2009). With the rise of precipitation more

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4 Baltadapt Climate Info #2, http://climate-info.baltadapt.eu
Climate Change Impacts on Coastal Tourism in the Baltic Sea Region

attractive will be indoor tourism activities, that are traditionally are located in large urban centres. With less rain in summer, destinations get more attractive, since the risk of rainy holidays will be reduced. An increase in the duration of sunlight slightly increases a shift from car/public transport to cycling/walking (Inturri & Ignaccolo, 2010).

2.4 Increase of extreme weather events and the variability of weather

It is likely, that extreme weather events such as floods, droughts, heavy rains (snowfall) and storms will increase in a future climate. Extreme seasons (exceptionally hot, dry summers or mild winters) or short-duration weather hazards (windstorms, heavy precipitation leading to flooding or snowfall, fog or extreme heats or cold) are crucial for tourism and recreation, particularly to outdoor activities. Population health is sensitive to isolated extreme events (e.g. heavy rainfall and flooding, high and low temperatures, strong winds) through direct impact of through damage to the public health infrastructure, although inferring causal relationships from a single weather event is usually not possible due to lack of sufficient reliable data at relevant spatial and temporal resolution (Kovats & Bouma, 2002). Increased occurrence of weather extremes could directly affect tourists, host communities and the tourism industry through basic infrastructure damage, additional emergency preparedness requirements, higher operating expenses (e.g., change of travel plans, increase of insurance costs, awareness campaigns, backup power and water systems, food supply and health care systems and evacuations), tourism business interruption (UNWTO & UNEP, 2008) and to tourists to either shifting to other destinations or simply staying at home. From supply side extreme weather events could affect the hotel infrastructures as well as tourist attractions, while on the demand-side a change in climate elements could lead to a shift in visitor patterns (Moore, 2010), particularly with larger availability of last minute on-line booking or tools of social media permitting tourists respond easily to weather events. It is expected that in the future tourists may rely more on last-minute bookings, once they are more certain that the weather in their preferred destination is appealing (Pang et al., 2013). Extreme weather events are also a reason for lowering visitor satisfaction (Pang et al., 2013). About three-quarters of interviewed winter tourism enterprises in Finland replied that they are affected by weather events such as high or extremely low temperatures or high wind that cause cancellations, and that they do not perceive the changes of the length of the snow season as critical (Tervo, 2008).

There is reported shortcoming is the lack of applicable local wind and wave projections that is important for tourism development (Førland et al., 2013). The lack of applicable local wind and wave projections that is important for tourism development is reported as shortcoming (Førland et al., 2013). Wind speeds over 15 km/h were found to be inconvenient to fishing or water skiing, whereas motor boating could be undertaken up to wind speeds of 50 km/h (More, 1988 cit. in Becken, 2010); wind is

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5 Baltadapt Climate Info #3 and #10, http://climate-info.baltadapt.eu
used as essential resource for surfing and kiting. Strong winds will negatively impact fishing, water skiing, motor boating, cruise and ferries. It may for instance impact the timetables of inter-island ferries (Yeoman & McMahon-Beattie, 2006). In the BSR, climate change simulations reveal a large spread in changes in wind speed. Projected changes in wind extremes are quite uncertain, with a slight tendency to an increase in the south and a decrease in the north of the BSR. Estonian empirical research shows that storminess in winter has increased: for the time period 1950–1969, the mean number of storm days per winter amounted to 6.4, while for the time period 1990–2009, it increased to 11.3 (Kont et al., 2011). The climate simulations indicate that the changes in storm surge height in the scenarios can be consistently explained by an increase in mean sea level and variation in wind speed (Gräwe & Burchard, 2012). The largest changes are expected in the extreme values in wind speed and in the increase of wave height and frequency. As a consequence, shallow areas can expect more severe erosion events, although additional studies are needed to understand the local effects of changes in wave conditions in the Baltic Sea now and in the future. Coastline areas tend to be most vulnerable to storm surges, given that the majority of the tourists reside close to the coast and temporal variations in tourism can cause peak moments which make tourists extra vulnerable to flooding (Kellens et al., 2012). Vulnerability is also induced by tourists’ behaviour during storm surges that are often not frightened by bad weather (Kellens et al., 2012). Perrels et al. (2010) note that the worst climate change impacts will occur during winter, while tourism is busiest during the summer time.

Rising sea levels, combined with storm surges and other extreme weather events have negative impact, particularly on safety aspects on walking, cycling and motoring activities, and cause weather-related traffic disruption and delays, damage to rail-bed support structures and to roadside infrastructure by high winds, flooding and erosion of roadways, as well as landslides and mudslides that damage roadways and tracks (Jaroszeweski et al., 2010; Hudecz, 2012, Inturri & Ignaccolo, 2010). The most severe impacts might occur during peak hours and on already congested routes; adverse weather can also lead to less walking and cycling trips, and this can encourage a shift to motorised transport, although for short trips, particularly in urban areas, the impacts of extreme weather are expected to be rather low (Eichhorst et al., 2010). At the same time it is expected that the number of tourists that consume hazard events and their consequences (e.g. storm chasers and observers, canoeing in flooded rivers) is rising. Trees damaged by the storms and/or costal erosion and left undisturbed by human activities (often in national parks and other nature protection areas) create attractive landscape in coastal nature protection areas preferred by nature tourists. Extreme weather events and infrastructure failure can damage tourism destination image through negative press and feedback from visitors on their return (Yeoman & McMahon-Beattie, 2006). Coastal tourism in the BSR are highly affected by seasonality, with summer having a high season, and thus the majority of tourists will not be affected directly by the increase of winter storms, but they may cause damage to coastal infrastructure and thus indirectly affect tourism. Also a smaller number of tourists in coastal resort
Climate Change Impacts on Coastal Tourism in the Baltic Sea Region
towns or budget tourists using off-season price advantages might be affected by coastal storm and flood events in winter or spring.

With a projected rise of air temperature there will be an increased risk of long, frequent, and intense heat waves (>35°C daytime) and the occurrence of tropical nights (>20°C), and consequent risks of droughts in the BSR (IPCC, 2007; EEA, 2012a). The increase of the number of days with maximum temperatures above 25°C is another indicator used to measure regional climate extremes and has from territorial perspective relevance for the tourism sector as well as for human wellbeing (ESPON-IRPUD, 2011). Heat waves have twofold role for coastal tourism, on the one hand destinations have to be well prepared for such weather events as they will have negative effects on human mortality (Diaz et al., 2006; Beniston et al., 2007; Wardekker et al., 2012); and on the other hand, warm weather will bring more tourist to the sea coast from nearby urban areas, as well as from more distant places. In periods of droughts and heat waves the most vulnerable tourists seem to have been campers and caravanners. People can decide to take domestic holidays or short-haul (e.g. within the BSR) if the region will have weather favourable for the comfort of tourists (Perry, 2006). During extreme heat local people, especially those living in large cities, tended to abandon their cities whenever possible and retreat to the coasts and rural areas joining the normal tourist influx and increasing congestion on roads and beaches (Perry, 2006). Often foreign tourists do not receive advice or warning on extreme weather events before their departures, assistance is expected from tour operators and guides with little medical knowledge (Perry, 2006). Droughts can create dangerous wildfire conditions (see below). Droughts can also have a negative impact on recreational fishing and the length of river-rafting season (Scott & Lemieux, 2010), while heavy rains and even floods can have a positive impact on rafting.

2.5 Change of the length and characteristics of seasons

Regional climate influence the characteristics of seasons. The combination of the length of the daytime, temperatures, precipitation and other climate parameters create seasons that have been traditionally important for public and school holidays and thus for tourism and recreation activities. According to climate model projections, the length and characteristics of seasons is expected to change. In the BSR global warming will result in longer summer tourism season versus shrinking winter tourism season. For the 2080s, the spring season all climate model results at the European scale show a clear extension toward the north of the zone under good conditions, and the autumn season have comparable changes, while in summer, the zone of good conditions also expands toward the north but at the expense of the deteriorating climatic conditions in the south (Ciscar et al., 2011). Tourism seasonality or temporal changes of annual concentration in tourist demand and supply are defined by natural and institutional factors and are a reason for traditional holiday seasons, seasonal traditions, the high season and off-season (Ahas et al., 2007; Bender et al., 2007; Higham & Hinch, 2002). Thus the majority of tourism destinations are seasonal and are dependent from the interplay of natural and institutional seasonality (Scott & Lemieux, 2010; Koenig-Lewis & Bischoff, 2005; Butler,
Tourism operations’ seasonal tendencies in the destinations are influenced from (1) dependency from school holidays; (2) the product itself is associated with seasons; (3) marketing of off-peak products may be inadequate; (4) outdoor activities dominate in tourism product at the expense of less-seasonally affected attractions and activities (Duval, 2007). Spatial and temporal patterns at a destination are influenced (1) by climatic factors at the tourism generating area and the pattern of social and cultural factors there and (2) by climatic factors at the tourist receiving area and the distribution of social and cultural factors at the destination (Butler, 2001), see also table 5. Factors causing seasonality can be grouped as (1) push-factors from tourism generating area to receiving area (institutional like holidays, calendar like public holidays, inertia and tradition, social pressure and fashion, access, including transport costs, time and climate in tourism generating area) and (2) pull-factors from tourism generating area to receiving area (climate in tourism receiving area, events and sporting season, including hunting, fishing, golfing, skiing) (Koenig-Lewis & Bischoff, 2005, based on Lundtorp et al., 1999).

In Europe the volume of tourism in the future might be twice as high in the summer as in the winter season (ESPON-IRPUD, 2011); increased air and sea temperatures and less precipitation in the summer are likely to encourage a longer season of outdoor activities, particularly will be beneficial for the northern part of the BSR. Summer tourism’s season conditions will be enhanced and its length will be prolonged by warmer temperatures and less precipitation in the summer; the northern part of the BSR are likely to benefit from improved conditions. Warming-up will also shift the tourist season into spring and autumn, although more likely in southern European destinations. Although improvements of the relative conditions in the shoulder seasons will not change, conditions for beach tourism at a large scale in Europe (Amelung & Viner, 2006; Moreno & Amelung, 2009). Tourism business is particularly dependent on the variability of weather conditions in the most popular public and school holidays. Fluctuating tourism demand affects tourism flows and thus has an impact also on other sectors like construction, agriculture, and crafts (CM, 2009b). The variability of weather conditions affects also tourism infrastructure. Road network in cold climates are affected by the frost damage as result of seasonal changes and freeze-thaw cycles; although winters are predicted to get warmer, and frost penetration in pavements is predicted to decrease as shorter frozen periods are expected, frost actions will inevitably continue as the result of more freeze-thaw cycles depending from the local climate and precipitation rates (Hudecz, 2012). Increased and more freeze-thaw cycles in cold winter climates, accompanied with higher temperatures can cause premature deterioration of road network, pavement and concrete, increased corrosion, accelerated deterioration of building facades, premature weathering, fractures and spalling (Penney, 2012; Hudecz, 2012). Uncertainties related to tourist climate preference and destination loyalty require attention if projections of the geographic and seasonal redistribution of visitor flows are being prepared (Simpson et al., 2008). Climate change is likely to alter tourism demand seasonal pattern and patterns of seasonal attractions (Hall & Higham, 2005). Any changes in the length of the operating season will have considerable implications for the short- and long-term viability of tourism and recreation enterprises, and will allow...
quicker returns on investment with more intensive utilisation of facilities over a longer period (Perry, 2006). Seasonality co-determines the suitability of locations for a wide range of tourist activities, and has an important influence on the profitability of tourism enterprises and their operating costs, such as heating-cooling, snowmaking, irrigation, food and water supply, and insurance costs (Simpson et al., 2008). Tourism stakeholders consider a shift of seasonality and the changes of seasons’ characteristics and length such as belated and shorter winters or earlier summers as of high significance (Tervo-Kankare, 2011). The length of season is also seen as a crucial element in the social construction of tourist destinations and tourism product development and for market communication (Tervo-Kankare, 2011). Any changes in the length of the operating season would have considerable implications for the short- and long-term viability of tourism and recreation enterprises (Duncan et al., 2001). With a possible increase of tourist numbers in summer months, railways, streets and airports could reach their maximum capacity in the peak season and coastal regions might require new and expanded traffic systems, as well as basic and supra-infrastructure for accommodation, catering, retail and tourism attractions need to be adjusted to increased tourism numbers.

Table 5: Categories of causes of tourism seasonality (after Baum & Hagen, 1999; Frechtling, 1996; Butler, 1994; Baron, 1975).

<table>
<thead>
<tr>
<th>Cause of seasonality</th>
<th>Tourism examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural seasonality:</td>
<td>Climate, particularly seasonal variation, weather</td>
</tr>
<tr>
<td></td>
<td>Summer vacations, snow skiing, ice-fishing, spring flower or tree blossom or autumn foliage tours, berry and mushroom picking, popularity of tropical destinations in the winter, cruise line departures, ocean resort demand, transport access</td>
</tr>
<tr>
<td>Institutionalised seasonality:</td>
<td>Sociological and cultural causes: social customs, holidays, inertia or tradition</td>
</tr>
<tr>
<td></td>
<td>Christmas/New Year holidays, Midsummer celebrations and holidays, school breaks, industrial holidays or ‘fortnights’, travel to visit friends and relatives, fairs and festivals, religious observances, pilgrimages</td>
</tr>
<tr>
<td>Economic causes: business customs,</td>
<td>Conventions and trade shows, government assemblies, political campaign tours, sports seasons and events, recreational marine fishing seasons</td>
</tr>
<tr>
<td>fashion</td>
<td></td>
</tr>
<tr>
<td>Calendar effects</td>
<td>Number of days in the month; number of weekends in the month, quarter, season or year; date of Easter (Western and Eastern Church calendars)</td>
</tr>
<tr>
<td>Institutionalised/ natural seasonality</td>
<td>Supply side constraints</td>
</tr>
<tr>
<td></td>
<td>Destination image based on seasonal differences (positive/negative image seasons due to marketing), opening hours/seasons of tourism facilities and attractions (indoor/outdoor), availability of tourism labour (school holidays, competition from other sectors, i.e. agriculture), alternative use of local facilities for tourism purposes (schools to hotels), high or low price season of tourism facilities and transport to destination</td>
</tr>
</tbody>
</table>

2.6 Sea level rise

Coastal areas have been identified as the most vulnerable when it comes to climate change (Petersell et al., 2013; Nicholls & Kebede 2012; Moreno & Becken, 2009; IPCC, 2007; McLean et al., 2001; Kont et al., 2008; Kont et al., 2003). Sea level due to global warming is not rising uniformly at all locations. The Baltic, besides Mediterranean and Black Sea coasts are most vulnerable to sea-level rise due to

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6 Baltadapt Climate Info #4, http://climate-info.baltadapt.eu
their low tidal range (Nicholls & Klein, 2005). Coastal impacts also depend on the vertical movement of the land, which can either add (the south of the Baltic Sea) to or subtract from climate-induced sea-level change (the north of the Baltic Sea) (EEA, 2012a), see figure 10. The consequences of rising sea levels will differ along the coastline, with lowland areas and densely populated regions being more affected. Other climate-influenced changes such as alterations of streaming patterns, wave and wind motions and extreme weather events can intensify the impact of sea level rise. The total rise will be much larger in the southern and south-eastern parts of the Baltic Sea (up to 60cm) while the northern part will be less affected due to on-going land rise. As result coastal change, that can be both a relatively slow or very rapid process, is a complex result of interaction of climate-driven sea level change, vertical crystal movements, hydrodynamic and aeolian processes as well as human activities (Satkūnas et al., 2013). Particularly low-lying and sandy seashores and coastal lagoons (Störmer, 2011) will be affected. In Lithuania sea-level data for the Klaipeda Strait for the 1898-2000 period indicated that the sea level rose annually by 1.3 ± 0.2 mm year⁻¹ (Dailidienė et al., 2006) or 14.9 cm during the 20th century (Satkūnas et al., 2013). At least once per year sea levels exceeded 50cm and the highest value ever measured were 186cm during the storm of the 17th October, 1967. Coastal monitoring in the period of 1993-2011 demonstrates that morphology of the Karklė beach, Klaipeda (Lithuania) changed rather insignificantly, and even the impacts of storms in the 4th December, 1999 and the 8/9th January, 2005 were not hazardous (Satkūnas et al., 2013). Large natural variability and lack of good quality long observational records makes detecting long-term changes in trends in extreme coastal sea levels difficult (EEA, 2012a). The Baltic Sea on shorter time-scales is affected by the local meteorological conditions which may give rise to storm surges and floodings. The rise of sea-level will cause loss of land territory, e.g. beaches, nature and culture heritage and coastal constructions (Rochelle-Newall et al., 2005). In some cases the increase of water surface and water table can be used with the purpose of landscaping and nature restoration, e.g. creating green infrastructure. Tourism infrastructure, e.g. hotels, restaurants, access roads etc. and resources e.g. archaeological sites, cultural heritage sites, historic landscapes and coastal habitats, might be threatened or damaged by the rise of sea water level (Rochelle-Newall et al., 2005). Coastal cultural heritage that includes ecological heritage (e.g. high coast, grottoes, parks and protected areas), cultural heritage (e.g. civilian and military settlements, ports, roads, bridges, lighthouses, defence walls), land- and sea-scapes and non-physical heritage (traditions) (Vallega, 2003) is highly vulnerable to sea level rise, erosion and storms as often relocation is not feasible without loosing the sense of place and authenticity of the site.

The infrastructure of coastal protection can confine the attractiveness of coastal views. Infrastructure of ports and marinas, waterfront developments and coastal greenways are sensitive to sea-level rise that in combination with erosion can cause shrinking of beaches and the relocation of tourist attractions inland. At the same time some coastal areas might experience an enlargement of beaches due to accumulation processes as a part of morpho-dynamic process (Lapinskitis, 2012). Rising sea levels can also cause salt-water intrusion into low-lying aquifers and endanger coastal
ecosystems, wetlands and drinking water supply (Petersell et al., 2013). Higher flood levels increase the risks to life and property, including sea dikes and other infrastructure, with possible follow-up effects on tourism, recreation and transportation functions. Damage associated with sea-level rise would frequently result from extreme events, such as storm surges, the frequency of which would increase as the mean sea-level rises (EEA, 2012a).

2.7 Coastal and beach erosion

Several studies report that extreme erosion events caused by increased storminess in the eastern Baltic Sea and the decline in the occurrence of sea ice are observed more frequently (Ryabchuk et al., 2012; Žilinskas, 2008; Kont et al., 2008; Lapinskis, 2012). BSR-wide projections for coastal erosion are not available (EEA, 2012a). There is an uncertainty whether climate change is the cause for increasing cliff erosion in the southern BSR (Wenk & Janßen, 2011). The local effects of erosion in different parts of the Baltic Sea should be studied in detail as several factors are affecting coastal erosion (Swedish Government, 2007): 1) sea level relative to land elevation; 2) wave conditions – height, frequency, direction, extreme conditions; 3) wind and current conditions – direction, intensity; 4) geology/soil types on land and seabed; 5) topography and morphology – heights of dunes and areas behind the beach as well as the form of the shoreline; and 6) bathymetry – seabed depth and gradient.

Numerous studies classify the segments of the Baltic Sea coastline in accordance to vulnerability to erosion (Uscinowicz et al., 2004; Fenger et al., 2008), but a BSR-wide effort is missing to coordinate these studies. For instance, in Poland three types of coast are distinguished - cliffs (101 km), barriers (380 km) and wetland coasts (salt marshes) (17 km), where cliff coasts suffer from mass movements, and coasts with low and narrow barriers are under the serious risks related to erosion; and these barriers could be easily broken during storm surges (Uscinowicz et al., 2004; Zeidler, 1997). In Denmark both impacts and proposed adaptation measures are analysed for two types of coastal ecosystems – saltmarshes and sand dunes (Fenger et al., 2008). Current coastal tourism is fairly diversified to the scale and services offered, and it is adapted to various types of coastal zone (Zeidler, 1997). This flexibility of coastal tourism sector needs to be taken account when climate change adaptation measures are proposed.

Coastal and beach erosion can be intensified by cleaning beaches from litter (and beach wrack) as well as dredging of marinas, that can cause the removal of sand, a highly valuable touristic resource. The results of plant and animal species richness showed that even extensively used beaches suffer dramatically under tourist activities (Schierding et al., 2011; Grunewald, 2006) and thus with beach-cleaning and armouring that might increase due to climate change impacts the status of the biological diversity and thus nature-tourism resources might be deteriorating.

Some types of tourism and recreational infrastructure (such as restaurants, entertaining centers, yacht-clubs etc.) can cause an acceleration of erosion processes (Ryabchuk et al., 2012). The most

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7 Baltadapt Report #5, http://reports.baltadapt.eu
extreme erosion events are observed when three hydro-meteorological factors act together: long-lasting westerly or south-westerly storms, high water levels, and the absence of stable sea ice. The coastal erosion processes have become more intensive as the frequency of these combinations has increased (Ryabchuk et al., 2012; Ryabchuk et al., 2009; Dailidiené et al., 2012). The measurements indicate that from 1935 to 1992 retreat at an average rate of 0.5-2.0 m/yr-1 has occurred in wide areas in the western part of Kurzeme, Latvia and in some short sections in the Gulf of Riga (Lapinskis, 2012; Eberhards & Lapinskis, 2008). The most extreme erosion events are observed when three hydrometeorological factors act together: long-lasting westerly or south-westerly storms, high water levels, and the absence of stable sea ice. The frequency of these combinations has increased over the last decade due to late freezing (Ryabchuk et al., 2012). In Western Latvia as effects of five major storms (1993, 1999, 2001, 2005, 2007), the width of eroded coastline reached 30–64 m (Lapinskis, 2012). Estonia, particularly the western archipelago, has experienced at least 10 violent storms since 1954, which – according to historical probability – should occur once in a century (Kont et al., 2008). Most beaches have been eroded due to storms; in only a few places (e.g., Ruhnu Island) accumulation process occurred as thus recovery of beaches occurred (Kont et al., 2008). Studies indicate that increasing erosion and changes in the sedimentation would cause serious disturbance for sandy beaches and dunes, particularly in south-western and north-eastern Estonia and thus vanishing sandy beaches will have a negative impact on recreation (Kont et al., 2003). At the same time the direct destruction of the coast will not be so strong in the western part of Estonia (including the large islands) (Kont et al., 2003). According to the Swedish Geotechnical Institute's general survey, the necessary conditions for beach erosion exist along about 15 percent (about 1,800 km) of Sweden's coastline (Rydell et al, 2006), e.g. the shoreline at Löderup has moved 150 metres inland over the past 30 years (Swedish Government, 2007). In Sweden it is recognized that values that may be in the risk zone are developments and infrastructure such as roads, railways, water supply and sewage systems, tourist facilities, valuable land, valuable natural environments and recreational areas (Rankka & Rydell, 2005). Coastal lagoons are especially sensitive towards climate changes due to their comparatively fast reaction (Störmer, 2011): due to sea level rise and enforced erosion of soft glacial material, a land bridge, which separates them from the open sea, is endangered. Furthermore, due to the vertical movement of the earth crust the southeast of the Baltic Sea coastline is sinking. As result of these consequences a local ecosystem might shift due to the inflow of saline sea water into a coastal lagoon (Störmer, 2011).

Most beaches have been eroded due to storms (Tonisson et al., 2008); in only a few places accumulation processes have been observed as thus recovery of beaches occurred (Kont et al., 2008). Beach and dune erosion, coastal damages and protection systems may lead to less attractive shoreline, negative impact on coastal destination image (Bigano et al., 2008; Jennings, 2004; Phillips & Jones, 2006; Raymond & Brown, 2011; Uyarra et al., 2005; Buzinde et al., 2010a; Buzinde et al., 2010b; Mangone, 2010; Garcia & Servera, 2003; Defeo et al., 2009; Cambers, 2009; Matteucci et al., 2013; Alonso & Cabrera, 2002; Sherman et al., 2002; Jedrzejczak, 2004; Schlacher et al., 2008; Kont
et al., 2008) and tourism industry as tourists do not prefer artificial coastlines or groynes (Hamilton, 2007; Meyer-Arendt, 2001). Coastal erosion might affect roads, railways, water supply and sewage systems, tourist facilities, valuable land, valuable natural environments and recreational areas.

The low and sandy seashores of Lithuania, the hydrotechnical installations in the port of Klaipeda, and the lowlands of the Nemunas River, including the delta region in the central part of the Curonian Lagoon, will be strongly affected by the sea-level rise (Dailidiené et al., 2012). Lithuanian researchers note that during the latest decades, the coastal erosion processes have become more intensive, and the sand pool along the Lithuanian coast has decreased (Dailidiené et al., 2012). Thus due to the rise in sea level, increase in air and water temperatures, and decrease in ice cover, change of precipitation, and intensification of extreme storm event the coastal vulnerability has been increasing (Dailidiené et al., 2012). Several studies stresses that the Curonian Spit National Park is particularly vulnerable to extreme storm events that might cause spit breaching as it has “weak points” where storm waves can break through the sand body (Ryabchuk et al., 2012; Dailidiené et al., 2012). In 1983 as a result of a storm event, the spit was breached along 50–60 m of the coastline near Lesnoy (Boldyrev et al., 1990, cit. Ryabchuk et al., 2012). The Curonian Spit is well-known as tourism attraction due to drifting dune landscapes and changes in dunes like overgrowing with forests or coastal erosion can have an impact on its tourism destination image. Although the dune advance will gradually slow down, and with it, the sand input to the coastal zone will decline, some coastal segments will experience erosion, others will change their morphodynamic trend - from accretion to erosion, while in some coastal segments more rapid accretion will occur (Armaitienė et al., 2007). Thus the grading of the shoreline and development of an equilibrium profile in the littoral will counter-balance the increasing impact from the erosion agents on majority of the lagoon shore strips in the Curonian Spit (Armaitienė et al., 2007). The annual amplitude of water level in Lithuanian coasts varies from 90 to 240 cm, therefore during one year respectively erosional impact also varies (Satkūnas et al, 2013). Measurements in Karklė beach, Klaipeda indicate that during stormy autumn-winter period, the beach is suffering the strongest erosion impact – it becomes narrow and flat; while during the calm periods, sand accumulation prevails on the beach, keeping it with almost the same width during summer season suitable for recreation (Satkūnas et al, 2013).

There are several reports on coastal impacts brought by the extratropical cyclone known as Gudrun that reached hurricane strength; maximum wind speeds has been measured in Denmark and southern Sweden (34 m/s, gusts up to 46 m/s) and in Estonia (28 m/s and wind gusts up to 38 m/s). As a result of high initial sea levels in the Baltic Sea and strong SW–W winds, the highest storm surge in Estonia’s history was measured in Parnu (275 cm) and sea level reached 150–207 cm along the coasts of Saaremaa Island (Tonisson et al., 2008). The Saaremaa Island sand from the beach has been transported up to 50 m inland from the edge of the dunes by swash, in Kelba high rate of erosion resulted in the elongation of the spit by 75 m and at Kiipsaare a scarp receded by 10–20 m, elevating and widening the beach. This recession at Kiipsaare is particularly noteworthy when compared with the total recession of 50–70 m measured over the period from 1980 to 2004 (Tonisson et al., 2008).
2.8 **Risk of salt water intrusion into groundwater**

Sea level rise and floods may cause this problem in coastal regions and on islands, leading to the intrusion of salt water into the fresh water supply system. Potentially most exposed here are the southern sandy shores and less so the rocky shores of the Baltic Sea. The results of modelling indicate that shallow groundwater level in Klaipeda region will be decreasing as result of climate change (Arustienė et al., 2013). In Estonia the causes for increased mineralization in the coastal free-surface groundwater/subsoil water are varying (Petersell et al., 2013). In addition to water directly infiltrating from the sea, free-surface groundwater pollution occurs also by flooding and by sea water sprayed in the atmosphere during storms, at same time if these processes will result in the groundwater mineralization depends from the type of coastal rocks, e.g. Silurian and Ordovician carbonate rocks are more exposed to the risk of the salt water intrusion then Devonian terrigenous rocks (Petersell et al., 2013). Salt water intrusion into groundwater will require investments in new fresh water supply system (Arustienė et al., 2013) and maybe leading to limited capacity to accommodate tourists.

2.9 **Increased risks of forest fires**

Longer fire seasons and the occurrence of dry and hot summers are expected to result in increased forest fire activity and wildfires have already impacted tourism destinations, particularly the eastern part of the BSR, Russia (Hall et al., 2011; Hall, 2011; Mortsch, 2006). Wildfires have negative impacts on attractiveness and tourist perception, health effects of air pollution, and can cause the loss of recreation opportunities (access to certain areas, ban on open fires, damaged infrastructure, cancellation of nature walking, hunting, berry and mushrooms picking) and the loss of attractions (cultural heritage, landscape and wildlife) (Hall et al., 2011; Brown et al., 2008). As cases in the Eastern Europe and other areas (Scott & Lemieux, 2010) show the wildfire and smoke can have significant negative impact on summer tourism in areas affected by the wildfire and a positive impact in other neighbouring areas that are not under such risk of the wildfire. Metropolitan, tourist and second-homes areas are more often affected by wildfires, and that can also negatively affect the air quality. In the affected tourist areas due to climate change preventive measures are necessary, e.g. more efficient fighting of forest fires (Heymann & Ehmer, 2009). Forest fires might threaten or actually destroy camp sites, making campers and caravanners most vulnerable to high risk of wildfire (Perry, 2006).
2.10 Less fresh water input in summer and increased nutrient loads to the sea

Changes in precipitation may lead to less fresh water influx during summer. Fresh water is needed for direct consumption in a variety of tourist infrastructure and services, including food production (Miraglia et al., 2009), bathrooms, for laundry and cleaning, swimming pools, spas, irrigated gardens or golf courses (OECD & UNEP, 2011; Gössling, 2001; 2002; 2005; Perry, 2006; Yeoman & McMahon-Beattie, 2006). Increased precipitation in winter in turn leads to more river discharge and there will be a risk of more nutrients leaching to the sea, leading at a later stage to more algae blooming during summer time and influence the quality of the sea bathing water (Wenk & Janßen 2011; Mossbauer et al., 2012; Mossbauer et al., 2013; Swedish Government, 2007).

2.11 Rising prices of water and energy

Tourism can make strong seasonal pressure on water use on coastal regions (EEA, 2012b). Less fresh water in summer in combination with potential growth of demand could increase the price level of fresh water. In very dry summers it may even lead to water shortage and a limitation of water-intense touristic activities (i.e. golfing, indoor swimming or snow-making). There are large differences between countries of the BSR in current average availability of freshwater resources per capita. Latvia, Finland, Sweden and Estonia have the highest rate of freshwater availability. Lithuania and particularly Poland and Germany have comparably low availability of freshwater resources per capita, and thus can expect even more freshwater availability related problems in the future. However even in the countries with average high availability of water resources, warmer summers can create geographically and temporally problematic aspects with quality and quantity of water resources (Swedish Government, 2007).

The need for cooling in hot summers in buildings and public transport can raise energy consumption and price. The BSR has experience with heating, while the need for cooling requires new knowledge; it can affect the costs of existing and new buildings. Higher energy prices can have a negatively influence on costs of long-haul travel and thus can decrease the number of long distance international tourists.

2.12 Changes in marine and coastal flora and fauna

Climate is one of the key conditions for the regional biodiversity. With a change of climate new species will appear, others will disappear or move to other locations. Thus nature attractions and nature-based tourism especially in peripheral regions will be affected by species loss and ecosystem changes (Hall & Higham, 2005; Gössling et al., 2008; Hall, 2010; Bell et al., 2007; Walther et al., 2002). Coastal tourism can be negatively affected by the eutrophication of the Baltic Sea that may worsen due to

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8 Baltadapt Climate Info #12, http://climate-info.baltadapt.eu
9 Baltadapt Climate Info #8, http://climate-info.baltadapt.eu; Baltadapt Reports #3 and #4, http://reports.baltadapt.eu
climate change (Marttila et al., 2005; Störmer, 2011). While new and exotic interpreted species may attract tourists, e.g. in parks, gardens, agro-tourist farms, the viniculture at the Baltic Coast (Schernewski, 2011), the propagation of other species may lead to direct health risks (blue-green algae, ticks, mosquitoes) or to problems for coastal infrastructure (naval shipworm) and resources (increase of jellyfish). Climate change modelling for 2050 indicates that south and south eastern parts of the BSR will be characterized with novel viticulture suitability and with low water stress; although vineyards may move faster than wild species in response not only to climate change but also due to commercial and cultural interests (Hannah et al., 2013). Recreational sea and coastal fishing might have negative impacts due to changes in species of fish; higher value game fish will be replaced by fish that are not perceived to be of the same value (Swedish Government, 2007). Tourism might be affected by the loss of local fish species that are considered as the iconic emblems and used in tourism destination image building and branding such as wild salmon (Yeoman & McMahon-Beattie, 2006).

Climate change can reformulate natural landscapes if species or biotopes are changed, and this can have a visual effect on vegetation and landscape that is important issue for scenery-based tourism industry (Yeoman & McMahon-Beattie, 2006). Event-based tourism and recreational activities, e.g. in spring and autumn, depend on phenological phases of plants (blossoming or fall foliage seasons) (Menzel & Fabian, 1999; Walther et al., 2002); and changes due to climate impacts might have negative implications for tourists and the tourism industry with reference to the timing of trips and their promotion (Scott & Lemieux, 2010; Ge et al., 2013; Sakurai et al., 2011); studies with relevance to Europe or the BSR are missing.

Coastal forests, particularly dry pine forests and high bogs, are well known as recreational resource with opportunities for walking, wild berry (Pouta et al., 2006) and mushroom picking. Bird-watching as an activity of nature tourism is widely developed in coastal areas, including saltwater meadows, wetlands and lagoons of the BSR. Negative climate change impacts might be expected for bird-watching due to the loss of the breeding grounds for birds (coastal meadows, flooded meadows and reed beds) (Kont et al., 2003), although more studies are needed. Serious decline of biodiversity in European coastal areas are predicted because of fragmentation of ecosystems and the lack of migration possibilities (Vries, 2010). Change of biotopes and the distribution of species can have an impact on hunting that is a part of rural life style and tourists’ activity, particularly in scarcely populated areas; however more studies are needed for assessment. A report by the Swedish Government (2007) suggests that opportunities for hunting should improve with climate change, due to greater production of forage. However, the elk may decline in southern Sweden, thus hunting opportunities will be reduced here. Warmer temperatures, insect (mosquitoes and ticks) disturbances (Epstein, 2002) and drought in summer are documented negative impacts on reindeer herding (Keskitalo, 2010; Swedish Government, 2007) and thus can have an impact on wildlife and nature tourism in the northern parts of the BSR. Despite some reductions, relatively snow-rich winters in the BSR’ northern part can offer various tourism activities combined with reindeer husbandry and thus in a European
Climate Change Impacts on Coastal Tourism in the Baltic Sea Region

perspective, will become increasingly unique in line with the changes in climate (Swedish Government, 2007).

With warmer and drier summers it is projected that tick-borne encephalitis will be driven into higher altitudes and latitudes (Semenza & Menne, 2009). The northern limit of the distribution of important tick vectors moved north in Sweden between 1980 and 1994 (Talleklint & Jaenson, 1998) as changes in the distribution and density of tick species over time have been correlated with changes in seasonal daily minimum temperatures (Lindgren et al., 2000; Lindgren & Gustafson, 2001, cit. in Epstein, 2002). Tick-borne encephalitis has fluctuated considerably from year to year in many countries of the BSR, the increase in incidence are explained by a number of factors, including climate change, and increased travel and outdoor pursuits, placing people in increased contact with infected ticks (Petri et al., 2010). The abrupt increase in reported tick-borne encephalitis incidence in the Baltic States has been attributed to a combination of factors, including improved public health practices, increase of habitat for ticks as result of afforestation of farmland, and increased human exposure to woodland, based on changed socioeconomic and recreational factors (Petri et al., 2010; Godfrey & Randolph, 2011; Sumilo et al., 2008; Sumilo et al., 2007). The distribution of tick, accelerate the spread of Lyme disease; still, higher temperatures are on balance with preferences for public health in northern Europe, “where sicknesses surrounding cold weather greatly outweigh any inconvenience of incidental heat peaks in the summer and tick bites” (Vries, 2010).
3 Consequences of Climate Change on Coastal Tourism

There is a limited understanding of how climate change impacts will interact with other long-term social and market trends influencing tourism demand and development (Scott & Becken, 2010; figure 4). Changing preferences and demands for tourism and recreation due to climate change can be studied at the macro level (which demands insights into climatic influences on patterns of mobility) and at the micro level (analysis of specific venues and settings taking into account geographical and climatic diversity) (Higham & Hall, 2005). Despite of problems with assessing the relationships between climate change and tourism (Simpson et al., 2008) the only direction towards diminishing uncertainty is to contribute to new issue-relevant research and to review and discuss the existing research findings in order to design proper adaptation measures.

**Figure 4:** The Climate Change Impact Model (after Prideaux et al., 2013; Prideaux et al., 2010; Becken & Hay, 2007).

### 3.1 Climatic impacts on tourist comfort and behaviour

Although researchers, particularly geographers have been ‘undoubtedly recognized that weather and climate have pervasive effects on human activity’ (Sewell et al., 1968) climate change debate has activitated the scientific interest in climatic impacts on human comfort and behaviour (table 6). There is
an effort to explain differences in self-reported levels of happiness by reference to temperature and precipitation and how high-latitude countries might benefit from temperature changes in the future (Rehdanz & Maddison, 2005). There has been a longstanding interest to capture, assess or measure the climatic suitability of a potential or existing tourist destination (Becken, 2010). Another aspect that has been studied as an important factor for tourism industry is weather stability is (Agarin et al., 2010). Climate is a resource exploited by tourism; from tourism industry to individual tourist there is an interest in criteria for ideal, suitable, acceptable or unacceptable weather conditions that the selection of such criteria is admitted as one of the major problems. De Freitas (2005) summarizes that ideal atmospheric conditions for humans are those producing ‘slightly warm’ conditions in the presence of scattered cloud (0.3 cover) and with wind speeds of less than 6 m/s.

Northern European tourists can have different preferences for ideal beach tourism weather (Morgan et al., 2000). Climate as perceived by tourist industry result largely from individual tourist and employees’ sensitivity to a range of climate variables (Agarin et al., 2010; de Freitas, 2003). Climate preferences may also change in time (e.g., through acclimatization to a warmer climate) (Moreno & Amelung, 2009). For any human body physical, physiological and psychological factors will determinate the acceptable climatic range, while aesthetical, cultural, social and economical factors will play a role when choosing a tourism destination, product, activity or venue.

Due to rise of adventure and alternative tourism, often weather parameters that may cause risks to the human body have high appeal and can thus be considered an asset (de Freitas, 2003). Although due to technological, societal and environmental changes, suitability of different climates to different forms of tourism is becoming increasingly dynamic and thus will have implications on the future development of the tourism industry (Higham & Hall, 2005). The relationship between weather and recreation is highly dependent on the kind of activity that is assessed, with beach recreation or walking requiring different weather conditions; this feature has been ignored in many previous assessments, which may have led to over- and under-estimations of the impact of climate change for specific tourism segments (Moreno & Amelung, 2009).

Table 6: Climate as a factor that satisfies tourist needs (Martín, 2005).

<table>
<thead>
<tr>
<th>Maslow’s basic needs</th>
<th>Tourist needs</th>
<th>Climate as a factor that satisfies tourist needs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Primary, organic and physiological needs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physiological and psychological needs</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Cultural needs</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Need for entertainment and relaxation</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Safety needs</td>
<td>Safety needs</td>
<td>X</td>
</tr>
<tr>
<td>Safety needs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social or affiliation needs</td>
<td>Social and communication needs</td>
<td>X</td>
</tr>
<tr>
<td>Social or affiliation needs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esteem needs</td>
<td>Status and prestige needs</td>
<td>X</td>
</tr>
<tr>
<td>Self-actualization needs</td>
<td>Self-actualization needs</td>
<td>X</td>
</tr>
</tbody>
</table>

Indoor climate plays an important role versus time spent outdoors, e.g. people are spending around 10% of time outdoors in summer and about 4% in winter, according to an epidemiological survey conducted in the United States and Canada (Höppe, 2002, cit. in Shiue & Matzarakis, 2011).
Traditionally tour operators influenced greatly the choice of destinations. Today due to changes in information and communication technologies tourists can adjust their travel to particular destinations and participation in activities according to their individual preferences. Differences in preferences need to be taken into account when portraying climate for potential customers as tourists tend to be more vulnerable to climate than locals, although various segments of tourists have different characteristics with relevance to climate comfort, e.g. age, fitness, cultural background and previous experiences (de Freitas, 2003).

Uncertainty on how precisely climate influences tourism will increase. Standard meteorological or climate station data are often not representative for the recreational area, a particular microclimate or location, e.g. valleys, hills, coast or a beach (de Freitas, 2005). Incidence of unacceptable weather, extreme weather events and changing visitor perceptions and preferences will change the status of destinations once commonly associated with images of ideal climate (Higham & Hall, 2005). Climate change is happening both on global and local scales (Matzarakis, 2010) and tourists are acting upon actual weather conditions perceived as short-term events (such as temperature or precipitation extremes or complex events, such as storms, floods or droughts) rather than climate. Kovats and Bouma (2002) draw attention that health impacts of short-term (daily, weekly, monthly) variability of weather/climate are studied predominantly due to the limitations of health data and existing epidemiological methods. Averages of climate parameters have no physiological or psychological meaning, since tourists respond to the integrated effects of the atmospheric environment (de Freitas, 2005). The thermal conditions experienced will vary depending on the relative influence of wind, humidity, solar radiation and level of a person’s activity (de Freitas 2005). Although weather extremes are hard to predict, nevertheless they are highly relevant for tourism activity, perhaps even more important than the changes in mean conditions projected by climate models (Moreno & Amelung, 2009; Taylor & Ortiz, 2009). At the same time climate variables can play various roles when tourists choose their destinations: some climate variables are entirely physical (e.g. rain), some are physiological (e.g. air temperature), some are psychological (e.g. clear blue skies) and some are combinations of all three (de Freitas, 2003; Matzarakis, 2006; Endler & Matzarakis, 2011). Other approach is to assess aesthetic, physical, and thermal comfort parameters of changing climate (see table 7).
Since most physical and aesthetic factors are subjective, more often the thermal factor (Lin & Matzarakis, 2011) is used for assessing changes in tourist flows. When tourists experience thermal conditions that are close to their thermal comfort zones, then tourism destinations are more visited in relation to outdoor thermal condition opposite to conditions that cause thermal stress (Lin & Matzarakis, 2011). The simplest approach is to assess a thermal environment using a single climate factor such as air temperature, relative humidity, or number of sunshine hours, heat waves or sea surface temperatures (Lin & Matzarakis, 2011).

There is widespread approach to single out the thermal component (air temperature) of climate (Bigano et al., 2006) as the most important element and use it in tourism demand modelling, however ‘within a broad range of moderate or “non-extreme” thermal conditions, other factors assume greater importance in determining the pleasantness rating of a given weather or climate condition’ (de

<table>
<thead>
<tr>
<th>Facet of climate</th>
<th>Significance</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunshine duration /cloudiness</td>
<td>Quality of experience, sports/ tourism and leisure activities</td>
<td>Enjoyment, attractiveness of site</td>
</tr>
<tr>
<td>Visibility</td>
<td>Quality of experience, sports/ tourism and leisure activities</td>
<td>Enjoyment, attractiveness of site</td>
</tr>
<tr>
<td>Day length</td>
<td>Quality of experience, convenience</td>
<td>Hours of daylight available, enjoyment, attractiveness of site</td>
</tr>
<tr>
<td>Snow</td>
<td>Quality of experience, sports/ tourism and leisure activities</td>
<td>Enjoyment, attractiveness of site, place image, personal injury, damage to property, hindered mobility</td>
</tr>
<tr>
<td>Wind and waves</td>
<td>Quality of experience, sports activities</td>
<td>Enjoyment, attractiveness of site, place image, personal injury, damage to property, hindered mobility</td>
</tr>
<tr>
<td>Physical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td>Annoyance, charm, water sports/ tourism and leisure activities</td>
<td>Blown belongings, sand and dust, waves, hindered mobility</td>
</tr>
<tr>
<td>Rain</td>
<td>Annoyance, charm</td>
<td>Wetting, reduced visibility and enjoyment, hindered mobility – slippery terrain</td>
</tr>
<tr>
<td>Snow</td>
<td>Annoyance, charm, winter sports/ tourism and leisure activities</td>
<td>Participation in sports/ tourism and leisure activities, hindered mobility</td>
</tr>
<tr>
<td>Ice</td>
<td>Danger, charm, winter sports/ tourism and leisure activities</td>
<td>Personal injury, damage to property, hindered mobility</td>
</tr>
<tr>
<td>Severe weather events</td>
<td>Annoyance, danger</td>
<td>Personal injury, damage to property, hindered mobility</td>
</tr>
<tr>
<td>Air quality, odours and noise</td>
<td>Annoyance, danger</td>
<td>Health, physical wellbeing, allergies</td>
</tr>
<tr>
<td>Ultraviolet radiation</td>
<td>Danger, attraction</td>
<td>Health, suntan, sunburn</td>
</tr>
<tr>
<td>Day length</td>
<td>Convenience</td>
<td>Hours of daylight available for outdoor activities</td>
</tr>
<tr>
<td>Thermal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated effects of air temperature, wind, solar radiation, humidity, short- and long-wave radiation, metabolic rate, clothing</td>
<td>Thermal comfort, therapeutic, restorative, sports/ tourism and leisure activities</td>
<td>Environmental stress, heat stress, physiological strain, hypothermia, hyperthermia, potential for recuperation</td>
</tr>
</tbody>
</table>

Table 7: Climate and the potential impact on tourism (after de Freitas, 2003; de Freitas, 2005; Becken, 2010; Becken & Hay, 2007; Endler & Matzarakis, 2011).
Consequences of Climate Change on Coastal Tourism

Freitas, 2003). Shiue and Matzarakis (2011) argue that general public is, in fact, more sensitive to air temperature than to other weather elements in weather forecasts values. Most studies are constrained by data availability thus use a single climate factor such as air temperature, relative humidity, or number of sunshine hours, heat waves or sea surface temperatures as a proxy for climate although combined effect remains unexamined (Eugenio-Martín & Campos-Soria, 2010; Hamilton & Tol, 2007). Several studies use tourism climate index (TCI) (Mieczkowski, 1985; Nicholls & Amelung, 2008; Amelung & Viner, 2006) or beach climate index (Morgan et al., 2000; Moreno & Amelung 2009) with main difference between them in the rating and weighting schemes (table 8). While Mieczkowski (1985) based his schemes on expert judgment, Morgan et al. (2000) based the climate index on the stated preferences of actual 1,354 north European beach users on their holidays in Wales, Malta, and Turkey in 1994 and 1995 (Moreno & Amelung, 2009; Eugenio-Martín & Campos-Soria, 2010). The study of Moreno and Amelung (2009, see figure 5) was based on monthly climate normals that did not allowed to identify possible increases in the frequency and/or intensity of extreme weather events, such as heat-waves and floods.

Indicators and indexes have been developed to compare different places and to describe tourist individual preferences with regard to comfortable climate as prediction to the choice of tourism destination (de Freitas, 2005; Perch-Nielsen, 2010; de Freitas et al., 2008; Amelung & Viner, 2006). TCI is used to evaluate how climate change under various scenarios will affect climatic appropriateness for tourism in particular place (Amelung et al., 2007). PET (physiologically equivalent temperature) (Mayer & Höppe, 1987; Matzarakis et al., 1999; Agarin et al., 2010) is a climate indicator recommended to use by tourism and meteorological sectors, e.g. in Australia (Shiue & Matzarakis, 2011). PET describes the effect of the thermal surroundings on the human body based on the energy exchange between humans and the thermal environment on humans (Matzarakis, 2010). PET is an indicator of thermal stress and/or comfort where such meteorological parameters as air temperature, air humidity, wind speed and short- and long-wave radiation, influencing the human energy balance are represented by PET values (Shiue & Matzarakis, 2011). PET values have been used for creating bioclimatic mapping that are prepared for the use in wellness tourism (Matzarakis, 2010). Modified Climate Index for Tourism (MCIT) measures climate as a tourism resource by combining several tourism-related climate elements that are relevant for the industry. The index incorporates hourly observations rather than simple daily averages thus giving an attention to weather extremes (Yu et al., 2009).
Table 8: Weightings (in % of total maximum score) for the different climate components (Moreno & Amelung, 2009).

<table>
<thead>
<tr>
<th>Climate components</th>
<th>Climate index for beach users (Morgan et al., 2000)</th>
<th>Tourism Climate Index (Mieczkowski, 1985)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal sensation</td>
<td>18&lt;sup&gt;a&lt;/sup&gt;</td>
<td>50&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Precipitation</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Wind</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>Sunshine</td>
<td>27</td>
<td>20</td>
</tr>
</tbody>
</table>

<sup>a</sup>: Skin temperature; <sup>b</sup>: Effective temperature (40% of the weight corresponds to Daytime Thermal Comfort Index and 10% to Daily Thermal Comfort Index).

Figure 5: Beach tourism climate index during summer in the 2060’s (a) according to the HadCM3-A1FI and (b) according to the CSIRO2-A1FI (Moreno & Amelung, 2009).

Critics note that neither the temperature, nor simplified indexes based on standard monthly and simple climatological elements provide a full account of individual preferences with regard to the choice of destination (Agarin et al., 2010). There is a need to study tourists’ potential reactions to both the perceived and actual impacts of climate change (Amelung et al., 2007). Interviewed tourists often respond to past weather and memories of recent weather extremes (Taylor & Ortiz, 2009). Regional tourism climate indexes might be useful if they not only relate to generally subjective and context-specific tourist weather perceptions and acceptances, but also might include customised tourism climate indexes attuned to regional visitors, including area-specific weather preferences, dislikes and acceptances, connecting to the commonly extensive range of visitor motives and activities (Førland et al., 2013). Contexts other than snow-based vacationing and sun and beach-oriented holidaymaking are rarely studied (Aaheim et al., 2012). Previous studies on weather and tourism have been mainly expert-based and rarely founded on tourists’ actual in situ attitudial studies (Denstadli et al., 2011) and rarely have been tested to observations of tourist behaviour (Tol, 2011; Coombes & Jones, 2010.). For instance, video of beach occupancy to test meteorological indices has been used (Moreno et al., 2008; Ibarra, 2011). Research from Northern Scandinavia shows that most tourists considered weather conditions in summer as fairly good and satisfactory or acceptable and that weather aspects have relatively small behavioural impacts in comparison with overall traveller motives and intentions in addition to aspects such as comfort or wellbeing (Denstadli et al., 2011). An empirical study on
German tourist preferences indicate that bad weather can influence particularly the choice regarding shorter trips in local surroundings than long-distance trips as the choice of the destination is not determined by the weather image alone (Lohmann & Kaim, 1999). It is combined with other beliefs about natural environment, natural attractions, scenery and beliefs about the built environment, culture and host communities (Nadeau et al., 2008; Dwyer & Kim, 2003; Echtner & Ritchie, 1993). Tourist perception, decision-making and behaviour depend on the climate and weather at the destination as well as at the trip origin, but also on the weather forecast and conditions anticipated by traveller (Perry, 1972, cited in Dewar, 2005).

3.2 Climatic impacts on tourist flows

Studies on tourist flows and their geographical and temporal redistribution and their potential shifts in visitation patterns are built on studies which seek to identify ideal climate or ‘comfortable’ conditions for tourists, e.g. expressed as climate indices (Becken, 2013) (see above). The question of tourist weather perceptions and sensitivities are thus having been actualized since climatic assets among tourism regions are likely to be redistributed with changing climates (Denstadli et al., 2011; Smith, 1990) by changing existing tourist flows. Amelung and Moreno (2012) argue that in Western countries due to high initial values for the number of bed nights and revenues, the positive results are likely to be an overestimation; as climate change no longer induces a growth in overall tourism volumes, but leads to a redistribution of visitation. The issue of possible climate change impacts on tourist flows also has raised interest for governmental and financial organizations. Finland’s national adaptation strategy states that predictions on where the tourism will be directed are prone to several uncertainties, but there is a possibility that northern areas may benefit from increased tourism (Marttila et al., 2005).

Based on argument that climate is among the most dominant factors affecting tourist destination choice (Scott et al., 2008d) and consequently global tourist flows (Scott & Lemieux, 2010; McCarthy et al., 2001; Wall & Badke, 1994), studies predicted changes in travel flows and the regional structure of tourism and patterns of seasonal attractions (Hall & Higham, 2005). In modern times “warmer” climates generally constitute preferred environments for recreation and leisure, and that facilitate tourism flow from the northern Europe to the Mediterranean region. Climate change impacts will simultaneously change the attractiveness of all potential holiday destinations, both international and domestic (Hamilton & Tol, 2007; Becken & Hay, 2007). Climate change raised concerns that tourist flows will change the advantage or disadvantage of destinations in comparison with other destinations (Gössling & Hall, 2006). Current models predicting future climate conditions for tourism (figure 6) and consequent generation of tourist flows are based on two quadratic relationships: 1) cool destinations become more attractive as they get warmer, and warm destinations become less attractive; 2) cool countries generate less international tourists as they get warmer, and warm countries generate more (Bigano et al., 2008). The argument that colder countries will benefit and can expand their tourism sector is generally accepted due to its positive message in spite of critical remarks. Present
predominant tourist flows from north to south (from northwest Europe to the Mediterranean in summer) and their timing might be changed; tourists in the future might prefer colder countries and places - higher latitudes (Simpson et al., 2008; Schott et al., 2010; Hamilton et al., 2005a, Hamilton et al., 2005b; Hamilton, 2003; Coombes et al., 2009) and altitudes (Bigano et al., 2008). Existing major tourist flows to the Mediterranean in summer might be weakened if heat waves increase, particularly in the southern countries (Nicholls, 2006; Amelung & Viner, 2006).

Current models suggest that warmer regions will experience a decrease in tourism ranging from -8% to -20%, whereas regions of higher latitude will expect an increase ranging from 1.3% to 8% (Berrittela et al., 2006). Favourable conditions are suggested not only for the BSR but also for the North Sea and the northern Atlantic coast of Spain and the Canary Islands (Heymann & Ehmer, 2009). Particularly senior tourists and nature tourists might prefer northern Europe (McCarthy et al., 2001) and it is predicted that the proportion of overnight stays taken by foreign tourists will increase (Ehmer & Heymann, 2008). The OECD and UNEP report (2011) criticise a postulate that climate change will lead to larger tourist flows to the Baltic and the Northern countries as a result of heat stress in the Mediterranean region. The report stresses that tourist flows is not affected only by temperature but many other factors, e.g. culture and nature resources and tourism services. It is highly uncertain that tourists currently preferring the Mediterranean region will move to other more northern destinations, e.g. the BSR (OECD & UNEP, 2011). Changes in tourist flows attributable to global warming are smaller than those resulting from population and economic growth at the same period (Becken & Hay, 2007).

The models suggest that total number of tourists is also reduced due to climate change, because international tourism that is dominated by the Germans and the British would prefer short-haul destinations in neighbouring countries. Tourists will stay closer to home and thus importance of domestic destinations will increase (Bigano et al., 2008; Becken & Hay, 2007). Domestic tourists have a greater consistency regarding destination preferences and a greater loyalty, at the same time regions with poorer climate show higher flexibility in terms of destination choice; and there is less variability in the probability of travelling domestically than abroad (Eugenio-Martin & Campos-Soria, 2010). For Germans and Scandinavians their own countries are is still their favourite holiday destinations. It is possible that these tourists will stay in their home country in larger numbers than they do now (Heymann & Ehmer, 2009). No changes in the number of tourists are predicted for city tourism and for treatment at health resorts in the BSR due to climate change impacts (Heymann & Ehmer, 2009). Currently longer-haul tourists (mainly from the USA) play a minor role for the BSR tourism industry. It is suggested that Northern American tourists will travel more to Northern Europe (Mather et al., 2005). At the same time an expected increase in travel prices will affect longer-haul holiday destinations more than closer ones (Heymann & Ehmer, 2009).
Several studies note the weaknesses of current models in predicting travel flows. Current models are not covering all global tourism flows, and mainly focusing on particular nationalities, e.g. German or British tourists; climate is mainly perceived as ‘pull’ factor for tourist motivation; ‘push’ factors that make tourism source areas unpleasant (hot, wet and cold weather) and the possibility of substitution between destinations are neglected. Several limitations of modelling have been admitted by authors (Berrittella et al., 2006). The coarse spatial disaggregation does not permit to observe differences within European tourism destinations. Mainly direct climate impacts on tourism destinations are considered, while crucial indirect effects, e.g. sea level rise or erosion, changes in water resources or spread of diseases, are neglected. Only the effects of tourism expenditure in the destination country are estimated, not the effects of tourism travel Uncertainties (Gössling & Hall, 2005 and 2006; Goh, 2012; OECD & UNEP, 2011) of current models are due to very few empirical studies, validity of databases, not adequate time-space resolution in climate data, largely unknown role of weather extremes and other weather parameters influencing thermal and perceived comfort, unclear role of information in decision-making and non-climatic parameters (cultural resources, costs of transport, personal disposable income (economic budget) and availability of leisure time (time budget) in the future, the existence of fuzzy-variables, e.g. terrorism, war, epidemics, natural disasters). Other weaknesses are following: often estimates used in models are based on results of different, and possibly inconsistent, climate scenarios; only average temperature and precipitation are included, neglecting other relevant climate variables and the required time-space resolution in climate data; and thus the geographical resolution of the models are not adequate for adaptation policies (Ciscar, 2009). Models perceive climate change as event with effects occurring suddenly in a given reference year,
while in reality, climate change is phenomenon, which evolves over time, and thus there is time to adapt behaviour of tourists and tourism industry (Berrittella et al., 2006).

### 3.3 Climatic impacts on tourism destinations

Coastal tourism can be defined as a set of diverse tourism activities located in costal zone or using coastal resources. Which different tourism activities can be pursued there depends from a geographical zone and the characteristics of the coast (Hall et al., 2009). Coastal areas, islands and archipelagos located in commuting distance from large and medium cities and large are important areas for domestic tourism and recreation (EEA, 2012a). Coastal tourism enterprises cover accommodation and restaurant sector, second home development and costal infrastructure developments facilitating recreation and tourism, as well as a number of recreational activities: swimming, boating, recreational angling and marine based ecotourism (Hall et al., 2009; Bramwell, 2003). Marine tourism is closely related to the concept of coastal tourism, but includes activities outside coastal zone, e.g. cruising tourism (Hall et al., 2009; Orams, 1999). Four main coastal tourism categories have been distinguished (Hall, 2001): urban, resort, nature and marine (nautical). For each type of coastal tourism destinations or activities there are specific climate change impacts. Competitive relationships between destinations and therefore the profitability of tourism enterprises will be affected by the changes in the length and quality of climate-dependent tourism seasons (Simpson et al., 2008). Indoor or weather independent facilities will not be able to compensate fully for a low attractiveness of the outdoor weather. The impact of climate change depends greatly on the flexibility of tourism enterprises, destinations, institutions and tourists to react to changing climate and weather conditions, climate variability and extremes (Perry, 2006). Flexibility to respond to climate variability and change varies between the subsectors of the tourist industry. Tourist resorts and regions that are the most vulnerable to climate change are a function of (i) the likely magnitude and extent of the climate impact, (ii) the importance of tourism to the local economy and (iii) the capacity to adapt (Agnew & Viner, 2001). Suppliers of tourism services and local managers have the least flexibility; and tourists, particularly short-haul, weekend and day tourists, have the greatest flexibility (Agnew & Palutikof, 2001). Tourism destinations depend on tourist operators and businesses at the venues. Tourist operators are less affected by climate change impacts as they are often with greater geographical mobility and flexible to change destinations, venues or activities depending on the tourism demands and risks at the destination. Venue-based businesses are place and activity fixed; they tend to have climate change impacts at high priority, regardless of the area of operation (Brouder & Lundmark, 2011). Venue-based businesses have over time invested more money in operations and has long-term payback period; they are more aware on place-based future prognosis. Urban tourism can be considered as less climate-sensitive, as it can rely on indoor activities, developed urban infrastructure and skilled-personnel; cities due to diversified activities are often less dependent on tourism-related businesses. Although cities are major gateways for international tourists (Hunt & Watkiss, 2011); and thus they play a role for tourism development at regional scale. Urban tourism can have higher risks
from weather related hazards due to the fact that larger number of tourists, residents, construction and other human-made values might be affected. The economic losses due to sea-level rise will be the highest in the urban areas, e.g. Tallinn, where roads, houses and other constructions are often very close to the present shoreline (Kont et al., 2003), similar situation can be found in other large coastal cities in the BSR that attract large numbers of tourists every year. British researchers find out as a result of the inquiry that smaller size English coastal towns are vulnerable to climate change and they share common, unsettling characteristics: physical isolation (poor road networks and public transport provision); high deprivation levels; inward migration of older people; outward migration of younger people; high levels of transience (short-term residency); poor-quality housing; and fragile, isolated coastal economies (Nicholson-Cole & O'Riordan, 2009). Resilience to climate change impacts in urban areas are greatly depends on green infrastructure, flood protection and spatial planning (EEA, 2012b). Green infrastructure is an interconnected network of natural and green man-made features, e.g. forests, extensive grasslands, wetlands, waterfronts, canals, storm-water ponds, lakes, rivers, seashores, parks, public and private gardens, cemeteries, trees at streets, vegetated road-sides, green walls and roofs, playing fields and other open spaces. Elements of green infrastructure can play an important role for urban tourism and recreation, at the same time it enables ecosystem services such as flood protection, regulating temperature, provides shadow, improving air quality and preserving biodiversity.

3.4 Climatic impacts on tourism activities

3.4.1 Outdoor activities and nature-based tourism

Outdoor recreation and nature-based tourism are particularly dependent from climate, weather and natural landscapes and thus directly affected by changes in climate (Saarinen & Tervo, 2006; Coombes & Jones, 2010; Coombes et al., 2009; Braun et al., 1999; Fredman et al., 2012; Scott et al., 2008a; Bell et al., 2007). During outdoor recreation people undertake activities out of doors in places where they can access nature or green areas as a part of daily or weekend routines; while nature tourism refers to holidays which focus on engagement with nature and usually includes an overnight stay (Bell et al., 2007; Silvennoinen & Tyrväinen, 2001); however commonly accepted definition or classifications are missing (Lundmark & Müller 2010). Lundmark and Müller (2010) are grouping commercial nature-based tourism in Sweden in based on a survey of web pages presented by the regional tourism organizations: (1) bath & boat (boat and canoe renting, boat trips, yachting, diving, windsurfing etc.); (2) hunting & fishing (hunting, fishing trips, guided tours, adventure etc.) and (3) nature experiences (nature, riding, guided tours, skiing, hiking etc.). Researchers excluded tourism products offering only accommodation, fishing licences and bicycle rentals since these are present almost everywhere in Sweden. The survey of commercial nature-based tourism identified 4862 tourism products registered in Sweden; from which 43% were related to land-based nature experiences. Water-based activities and hunting & fishing accounted to 34% and 21% respectively,
Climate Change Impacts on Coastal Tourism in the Baltic Sea Region

while2% represent Sámi tourism activities in the two northernmost counties in Sweden (Lundmark & Müller 2010). There is large diversity in participation rates in outdoor activities in different countries (Bell et al., 2007; table 9); although comparative studies at the BSR level are missing. Despite of the locational disadvantage in relation to tourism supply markets at large urban centres, peripheral areas have promoted nature-based tourism as a tool for development and thus tend to profile stronger in nature-based tourism (Lundmark & Müller 2010). Nature-based tourism activities and dependent communities are seen as being particularly sensitive to forecasted climate change impacts (Kaján & Saarinen, 2013). Climate change may affect outdoor recreation through overall comfort and enjoyment of recreation activities; the quality of the recreation experience, altering the ecological systems of an area and longer summer seasons and shorter winter seasons that will change the availability of certain recreation opportunities (Mendelsohn & Markowski, 1999; Richardson & Loomis, 2005: Moen & Fredman, 2007). These changes will produce both winners and losers of recreation activities, where skiing is being widely acknowledged as a potential loser (Moen & Fredman, 2007). The conditions that will affect nature-based winter tourism in northern Finland such as predicted changes in precipitation, shorter and warmer winters, and substantial decreases in snow and ice cover are easier to predict, then to evaluate the effects on nature-based summer tourism (Forsius et al., 2013). The results of studies indicated that impacts of climate change could be contradictory to nature-based tourism. Substantial benefits to beach recreation, fishing and boating as well as reservoir, beach, golf, and stream recreation are expected, which offset losses to downhill and cross-country skiing, camping, wildlife viewing, as well as to smaller decline of benefits in forest-based recreation (Richardson & Loomis, 2005). Interactions of positive and negative aspects for nature-based tourism in summer and winter seasons make it difficult to assess the accumulative impact from climate change (Forsius et al., 2013); and such combination of attributes is provided by many tourism destinations in the BSR, except southern coastal resorts. Decreasing of extreme cold days during the winter season can improve the utilisation rates of outdoor winter tourism facilities, which partially could compensate the shortening of the overall winter season (Forsius et al., 2013; Heikkinen et al., 2011).

**Table 9: Participation rates in recreation activities in Denmark and Finland (Bell et al., 2007).**

<table>
<thead>
<tr>
<th>Participation rate in %</th>
<th>Denmark</th>
<th>Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>63</td>
<td>68</td>
</tr>
<tr>
<td>Hiking</td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>Bicycling</td>
<td></td>
<td>55</td>
</tr>
<tr>
<td>Jogging, running</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Camping</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>Picnicking</td>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td>Hunting</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Picking berries and other ‘forest fruits’</td>
<td>2</td>
<td>57</td>
</tr>
<tr>
<td>Picking wild mushrooms</td>
<td>3</td>
<td>41</td>
</tr>
<tr>
<td>Cross-country horseback riding</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Studying and enjoying nature</td>
<td>56</td>
<td>51</td>
</tr>
<tr>
<td>Cross-country skiing</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>
Changes of forests due to natural hazards and global warming affect also its recreational value (Johnston & Williamson, 2007; Blennow et al., 2010), e.g. coastal pine forests are traditionally popular for walking, mushroom or berry picking and cross-country skiing. The study on climate change impacts, adaptive capacity, and vulnerability of European forest ecosystems (Lindner et al., 2010) covered direct and indirect impacts on the capacity of forests to provide economic, social and ecological services, including wood production, any non-wood forest products (e.g. berries, mushrooms), carbon sequestration, biodiversity, recreation, and protective functions. Overgrowth of forests due to climate change will reduce access for recreationists to favoured areas for activities, and also make some areas lesser suited for traditional outdoor activities (Fyhri et al., 2009). The future of forest-based tourism attractions and destinations, e.g., national parks, does not only depend on climate impacts but also on tourists’ perceptions of landscape change (Hall et al., 2011).

For cool weather destinations such as the northern part of the BSR, days with rain are a potential downside of climate change for tourism and recreation (table 10). Rain can be an obstacle to landscape sightseeing, nature-based attractions and various types of outdoor recreation, both due to individuals’ perceived discomfort of getting wet and feelings of reduced safety (e.g. hiking and trekking in slippery terrain) (Førland et al., 2013). Most of the climate impact studies focus on the tourism industry, however behaviour of tourists and recreationists differs in relation to adaptation to climate change - tourists would change the location, timing and activities of their holidays while recreationists would adapt only timing and activities (Smith, 1990). Heat stress and poor urban air quality in summer may push urban residents out from cities to rural and coastal tourism destinations, and outdoor recreation is likely to increase (McCarthy et al., 2001). Statistics regarding levels of participation in outdoor recreation in Europe tend to be collected at the national level and thus create a barrier to prepare comparative studies (Nicholls, 2006). Climate impacts on coastal tourism infrastructure might have implications for outdoor and nature-based tourism that not only depend on open access to countryside and sea coastline, but also highly values both nature and facilities (Fredman et al., 2012). Nature-based tourism operators in Finland are currently not aware (of about half of interviewed) of climate impacts; and few have considered adaptation options (Saarinen & Tervo, 2006). Increasing temperatures mean that destinations outside large urban areas will become more attractive, there will be greater demand for small-scale, rural, and nature-related tourism, e.g. Baltic States (Agarin et al., 2010). It is expected that with a future warmer climate destinations in northern Scandinavia might be more attractive for tourism, particularly recreational sea fishing, hiking, and outdoor recreation (Denstadli et al., 2011). Destinations that rely heavily upon climate as a touristic resource will be challenged to contend with changing perceptions of ideal times to visit, the altered composition of natural resources, changing tourism and recreation opportunities, altered access to and seasonal availability of outdoor pursuits and compromised levels of comfort and enjoyment (Higham & Hall, 2005).
Vulnerability to climate change has been assessed for World Heritage Sites (e.g. biodiversity, unique ecological or geologic processes) as the probability that attributes be negatively impacted given a particular climate scenario. In this study the vulnerability is expressed by several indices in an ensemble (size, edges, patch size and their variation, percentage of area fully surrounded by water, average elevation, and aggressive land use) (Perry, 2011). In this study Sweden and Finland High Coast and Kvarken Archipelago are analysed in relation to climate change impacts and defined as very vulnerable, patchy, edge laden, low elevation, subject to sea level rise. There are also study of tourism development in the cross-border World Heritage Site - the Curonian spit, Lithuania/Russia (Armaitiene et al., 2007) that identifies conflicts caused by human impact: recreation, diffuse water pollution and conflicts caused by natural agents: ice drift, wave activity, and outgoing currents. The study proposes to abolish any restrictions for visitors to enter drifting dune areas on the Curonian spit, even to encourage active dune tourism, as many tourists already ignore currently existing prohibitions. Scientists believe that this option is important in the interests of both, maintaining dune dynamism and responsible tourism promotion.

Table 10: Ideal climate–related requirements for summer water-based and dry-terrain recreation activities (after Hall & Higham, 2005; More, 1988).

<table>
<thead>
<tr>
<th>Recreation activity</th>
<th>Air temperature (°C)</th>
<th>Wind (km/h)</th>
<th>Water temperature (°C)</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor boating</td>
<td>15–35</td>
<td>&lt;50</td>
<td>2–20</td>
<td>Nil</td>
</tr>
<tr>
<td>Water skiing</td>
<td>18–35</td>
<td>&lt;15</td>
<td>10–20</td>
<td>Nil</td>
</tr>
<tr>
<td>Sailing</td>
<td>10–35</td>
<td>15–50</td>
<td>10–18</td>
<td>Nil</td>
</tr>
<tr>
<td>Fishing</td>
<td>15–30</td>
<td>&lt;15</td>
<td>&lt;18</td>
<td>Nil</td>
</tr>
<tr>
<td>Swimming/sunbathing</td>
<td>15–30</td>
<td>&lt;15</td>
<td>15–20</td>
<td>Nil</td>
</tr>
<tr>
<td>Camping</td>
<td>&gt;10</td>
<td>&lt;10</td>
<td>-</td>
<td>Nil to light</td>
</tr>
<tr>
<td>Picnicking</td>
<td>10–25</td>
<td>&lt;20</td>
<td>-</td>
<td>Nil</td>
</tr>
<tr>
<td>Golf</td>
<td>15–30</td>
<td>&lt;20</td>
<td>-</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Weather and climate can determine the planning, implementation, financial success, visitor experience and quality of special events such as fairs, concerts, theatre, other art or sport related events that take place in outdoor venues (Scott & Lemieux, 2010). Climate can determine the event planning, its implementation, financial success and quality of visitor experience (Jones et al., 2006; Scott & Lemieux, 2010). Outdoor events are often held at certain times of the year in order to take advantage of certain climatic conditions or reduce climate risk (Scott & Lemieux, 2010). Festivals or outdoor activities related to particular phonological phenomena such as flower blooming or autumn forest changes or harvesting, are more vulnerable to climate changes (Scott et al., 2005; Scott & Lemieux, 2010).

Also for golf industry the weather is a principal determinant of the length and quality of the season, the irrigation needs and pest management, which represent major operating costs (Scott & Lemieux, 2010). In Canada the climate change impact assessment indicated that golf participation would increase even under the most conservative climate change scenario (Scott & Jones, 2007 and
Longer golf seasons in the northern countries could alter international and regional competition among major golf destinations (Scott & Jones, 2007). Scotland sees the growth in golf tourism due to Spain’s overdevelopment of golf courses that might lead to water shortages and closure of many courses and due to an influx of Scandinavian golfers in winter time, early spring and late autumn as the weather in Scandinavia gets too cold or snow-covered for golfers to play at home; at the same time there is a concern that if Scandinavia’s climate will become milder, golfers will be able to play at home during these seasons (Yeoman & McMahon-Beattie, 2006). The increase of precipitation can cause negative effects to golf as to others outdoor activities. The golfing areas might have negative impact from water shortages in summer and at the same time weather extreme events such as increased erosion; flooding and other surge damage can damage golf courses (Yeoman & McMahon-Beattie, 2006).

3.4.2 Nautical tourism and water-based coastal tourism activities

Nautical tourism destinations (ports and marinas) in higher latitudes are often seen as a potential winning segment of climate change. At the same time seaports are located in vulnerable areas to climate change impacts: on coasts susceptible to sea-level rise and storms or at mouths of rivers susceptible to flooding (Becker et al., 2012). Ports also differ in types and volumes and thus in adaptive capacity, and their involvement in passenger transport terminals, cruise tourism, yachting or recreational fishing. With warming up it is expected that coastal sea, river and lagoon-based water sports might grow in the BSR, although it is reported that the limits exist due to aging population (ECORYS, 2012a). Although contradictory climate change impacts are observed: the rise of water temperatures could lengthen the water activity season, but if water quality declines, this could result in, for example, prohibitions of swimming. The availability and the quality of marine and fresh water resources are important for nautical and coastal tourism (Orams, 1998; Garrod & Wilson, 2003). Nautical and coastal tourism includes beach-based recreation and tourism (e.g. sun bathing, swimming, and surfing), non-beach related tourism in the coastal area (all other tourism and recreation activities that take place in the coastal area for which the proximity of the sea is a condition), nautical boating (including marinas and yachting) and cruise tourism (ECORYS, 2012a).

Boating and water sports activities cover large diversity with different requirements for climate and weather conditions. In the UK for the purposes of recreational boating activity survey (Arkenfords, 2012) twelve core boating activities are distinguished: small sail boat racing, other small sail boat activities, yacht racing, yacht cruising, power boating, general motor boating, canal boating, canoeing, rowing, windsurfing, water skiing and using personal watercraft. The same survey groups watersports activities as follows: surfboarding, body boarding, paddle boarding, rafting, kitesurfing, angling, cliff climbing activities, coastal walking activities, spending general leisure time at the beach, outdoor swimming, leisure sub-aqua diving (open water from the shore or boat) and coasteering. Filies and Schumacher (2013) refer that climate change adaptation option in the BSR need to consider the differences in the region’s coastal tourism development. Authors argue that in the Nordic countries
boat tourism, harbour attractions, accommodation with marine flair and fishing including the important sector of second home tourism, whereas bathing tourism and increasingly boat tourism represent the main subsectors of the southern BSR. Coastal tourism is based on a unique resource combination at the interface of land and sea (coastal waters and costal zone) offering amenities such as water, beaches, scenic beauty, rich terrestrial and marine biodiversity, diversified cultural and historic heritage, healthy food, good tourism infrastructure (hotels, resorts, hotels, resorts, second homes, catering) and support infrastructure (ports, marinas, fishing and diving shops, and other facilities) at destination and accessibility to major tourism markets (UNEP, 2009). Coastal tourism is strongly dependent upon natural (climate, landscape, ecosystems), cultural (historic and cultural heritage, arts and crafts, traditions), social (skills and knowledge of host community and employees in tourism, health and security conditions, political factors) and economical (availability and maintenance of infrastructure and services) resources. Several coastal tourism activities can only be carried out in particular areas and in specific conditions (e.g. swimming, wind-surfing, ice-fishing, ice-yachting) thus certain areas are considered to be particularly suited to specific types of tourism activities, for which they became known on a global, European or regional scale (UNEP, 2009).

A study on Northern Europe stresses that no negative effects of climate change are expected for seaside holidays on Germany's North Sea and Baltic coasts - on the contrary - there could be positive effects resulting from the longer summer season, as better conditions for seaside holidays (higher temperatures, less precipitation in summer) will compensate the risks of climate change (extreme weather events (e.g. storm surges) or coastal erosion) (Ehmer & Heymann, 2008; Heymann & Ehmer, 2009). Authors argue that Baltic States could attract more seaside tourists and that the Polish and Russian coasts could also benefit to some extent. Heymann and Ehmer (2009) conclude that “increasing summer temperatures will result in a positive effect for northern regions like the Baltic”. Nautical tourism destinations (ports and marinas) in higher latitudes are often seen as a potential winning segment of climate change. Regional climate models, such as WETTREG and REMO, indicate warmer and longer bathing seasons and less precipitation in summer for the Baltic Coast.

The Baltic Sea's potential profitability of nautical tourism in a future climate is, however, expected to be second to that of the Mediterranean and Atlantic Seas (ECORYS, 2012a). The current density of tourism capacity is generally greater in the southern coastal regions of the EU (Collet, 2010), and climate conditions are an important explanation for this pattern. Nautical tourism is a very profitable and expanding business, although still not enough evaluated (ECORYS, 2012a). The Baltic Sea is becoming increasingly competitive in some niches such as aquatic sports and marinas, by promoting coherent strategies aimed at improving public services, infrastructures and adapting to the emerging climate conditions (ECORYS, 2012a). Warming of both the atmosphere and the ocean will increase the length and quality of water sport season in the BSR (ECORYS, 2012a). There are negative impacts related to water quality, sea-level rise, the erosion of beaches and threats to coastal infrastructure. Swimming, sailing, kayaking, canoeing, diving or fishing can be negatively affected by declining water quality, and there can be health risks in addition (Heggie, 2010; Semenza & Menne,
Consequences of Climate Change on Coastal Tourism

2009). Yachting, motor-boating, short distance coastal boating, canoeing, kayaking, sailing, rafting, surfing, kiting, and diving have specific requirements to wind and have low tolerance to precipitation, fog or storms, conditions which may change in a future climate. Boating is as leisure and tourism activity is strongly embedded in Nordic culture (Hall et al., 2009). There are 5.6 million recreational boats owned in Europe, from which 2.0 million are used in Scandinavia and Baltic States and 0.8 million boats in Germany (BMF, 2004, cited in Waterways for Growth, 2011); while equipment and involvement in boating differ among boaters (Hall et al., 2009). In Finland from 750 000 privately owned boats, only 2 percent are sailing boats; and approximately 35% are small boats without motor (Salmensaari, et al., 2010). Local authorities have been establishing guest harbours all along the Nordic coastlines, however, natural harbours complete the total supply and thus, accurate statistics of boat tourism are difficult to accomplish (Hall et al., 2009).

In Europe the yachting industry has grown of the 228% from 1998 till 2008 (ECORYS, 2012a). Yachting is expected to grow in the future with approximately 2–3% and this will also affect the development of marinas, particularly smaller in size, in the Baltic and North Seas, although the trend is also evident in the Mediterranean Sea (ECORYS, 2012a). Longer yachting season can contribute to marinas development in the Baltic Sea. If properly design new marina infrastructure can contribute positively to coastal protection against erosion. Two types of marinas have to be distinguished in relation to local development that need to be considered in climate change adaptation aspects, – established locations with developed services and integration with local community and new sites where investments for infrastructure and services are needed to utilize great potentials (ECORYS, 2012a). The report to the EU (ECORYS, 2012a) notes that in the future unsustainable trend might develop in the absence of proper regulation and effective intervention of public institutions over marinas development. Well served and weather-sensitive marinas are crucial for safer yachting and other water-based activities. Boating, particularly motorized boating is not a singularly focused experience; it usually occurs in association with other water-related activities, e.g. self-contained underwater breathing apparatuses, scuba diving, and fishing (Jennings, 2007). Small sailing vessels (sailing dinghies, sailboards, motorless small yachts) cause little or no environmental impact, while larger sailing vessels with auxiliary engines, or motorboats with outboard or inboard motors are cause for several types of environmental degradation (Davenport & Davenport, 2006). Ice-yachting activities might be affected negative by climate change. More studies are needed to analyse climate change impacts on water-based recreational and sport activities the BSR.

Diving is considered to be highly affected by climate change (Marshall et al., 2011). When making a decision on a destination, divers expect water of high transparency; high ecological and species diversity; and variety of underwater landscapes (e.g. shipwreck). Global warming might favour diving activities in the Baltic Sea that at the present are at lower scale in comparison with other European destinations, although with a tendency to grow (ECORYS, 2012a). There are about 3,500,000 scuba divers in Europe; 70% of them choose the Mediterranean region (ECORYS, 2012a). SCUBA diving and snorkelling in coastal and marine waters generate value for the local businesses
that support these activities. When making a decision on a destination, divers expect clarity of water; high ecological and species diversity; and variety of underwater landscapes (e.g. shipwreck). Several European countries have taken advantage of their natural and cultural wealth setting up underwater archaeological parks, including Finland (ECORYS, 2012a). At the same time, climate change is expected to decrease water transparency in the Baltic Sea as a result of eutrophication that affects particularly the coastal waters (von Storch et al., 2008). This can have negative impacts on diving.

**Surfing** was originally a largely warm-water activity, but with improved technology of wet suits, the activity is now pursued in temperate areas (Davenport & Davenport, 2006). 10 million people in the world travel each year to surfing destinations and the trend is growing. 500 thousand more people every year practice this sport, as along with the growth of other type’s adventure tourism. Surfers are of average purchasing power and are people who usually have time to travel, that are healthier and younger (ECORYS, 2012a). It is expected that with higher temperatures and longer swimming season, the Baltic Sea beaches might attract more surfing, kiting activists and related **wind-dependent** beach-based sport activities. Increased storminess might facilitate this trend.

Studies on climate change impact on the Baltic Sea’s *recreational fishing* (including both angling and river fishing) are scarce. The term recreational fishing covers various segments, while recreational angling (rod and line fishing) is the biggest of these segments measured in numbers of participants and/or economic benefits and jobs. There are 8-10 million recreational sea anglers and the sector has the annual socio-economic value estimated € 8-10 billion; tens of thousands jobs depend on anglers’ expenditure in Europe (ECORYS, 2012a). Studies from Norway prove that recreational fishing has a positive role to diversify coastal communities’ economy, while keeping their local identity (Hovelsrud et al., 2010). Traditional local fish species might be suffering from climate change and invasion of alien species may increase (Peltonen et al., 2012). Higher temperatures, reduction in sea ice cover, ice depth and ice coverage and increased storminess can reduce ice-fishing activities, but increase involvement in recreational fishing in ice-free waters.

**Destinations of the BSR largely rely on the potential of natural beaches.** In the German Baltic coast the beach is the main reason for 70% of all tourists that have overnight stays (33 million) in 2009 (Haller et al., 2011). Prospective favourable weather conditions in summer might further increase the number of beach tourists. Research had identified that at present coastal communities concerns are on losses of sand caused by erosion and storm surges, and accumulations of beach wrack (Haller et al., 2011; Donges et al., 2013; Mossbauer et al., 2013). Weather and climate are dominant imperative to travel motivation for beach-based activities (Morgan et al., 2000; Denstadli et al., 2011). Seeking and enjoying the sun is one of the main reasons why many tourists go away on holiday (Gomez-Martin, 2005; see also table 11). Beach tourist destinations thoroughly depend on favourable weather and climate conditions, e.g. sunshine, no precipitation, no wind, pleasant temperatures, clear waters and low health risks (Scott et al., 2008b; Moscardo et al., 2001; de Freitas, 1990). Beach tourism is a major factor for tourists travelling from Northern Europe to the Mediterranean. It is argued that temperature is the most influential component of climate change for beach tourism while modifications
due to changes of precipitation and sea level rise will not have such impact (Coombes et al., 2009). Research proves that reductions in beach width appear to have little influence on visitor numbers and thus geologically soft and low-lying coastlines which are vulnerable to sea level rise may experience similar levels of growth in tourism to rocky coastlines (Coombes et al., 2009).

Recent developments with man-made beaches, which are created in urban waterfronts, prove this. With climate change the distribution of visitors along the coastline and across the year might be transformed, the polarisation of the utilisation of coastal resources might increase; and the length of the peak tourist season at the beach tourism destinations might be extended. Improvements of the relative conditions in the shoulder seasons will not change conditions for beach tourism at large scale in Europe (Moreno & Amelung, 2009). It is expected that excellent weather conditions for beach recreation and tourism in the summer may also be found in the southern part of the Baltic and Atlantic sea regions, while still the Mediterranean Sea will be dominating in European beach tourism as the adverse climate condition will limit beach tourism season to be extended beyond summer in other European regions (ECORYS, 2012a). Beach tourism that has highly seasonal character is closely related to mass tourism development and thus with the provision of accommodations.

Table 11: Main reasons for going on holidays in 2012 (TNS Political & Social & European Commission, 2013).

<table>
<thead>
<tr>
<th>Countries</th>
<th>Sun/beach</th>
<th>Visiting friends/relatives</th>
<th>Nature</th>
<th>Culture</th>
<th>City trips</th>
<th>Wellness / spa/health treatment</th>
<th>Sport-related activities</th>
<th>Specific events/festivals</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU 27</td>
<td>40</td>
<td>36</td>
<td>26</td>
<td>22</td>
<td>20</td>
<td>12</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Denmark</td>
<td>39</td>
<td>28</td>
<td>30</td>
<td>29</td>
<td>18</td>
<td>3</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Germany</td>
<td>35</td>
<td>34</td>
<td>33</td>
<td>27</td>
<td>21</td>
<td>16</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Estonia</td>
<td>31</td>
<td>47</td>
<td>24</td>
<td>26</td>
<td>16</td>
<td>7</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Latvia</td>
<td>15</td>
<td>55</td>
<td>23</td>
<td>17</td>
<td>25</td>
<td>37</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Lithuania</td>
<td>37</td>
<td>42</td>
<td>34</td>
<td>16</td>
<td>19</td>
<td>12</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Poland</td>
<td>29</td>
<td>39</td>
<td>29</td>
<td>12</td>
<td>26</td>
<td>8</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Finland</td>
<td>29</td>
<td>37</td>
<td>25</td>
<td>24</td>
<td>27</td>
<td>14</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Sweden</td>
<td>42</td>
<td>42</td>
<td>21</td>
<td>22</td>
<td>19</td>
<td>20</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Norway</td>
<td>44</td>
<td>33</td>
<td>16</td>
<td>24</td>
<td>20</td>
<td>16</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>

Beach tourism involves sun bathing, swimming, surfing, kiting, beach volleyball and football, running, walking, cycling, street gymnastics and other sports and activities in children playgrounds. Any increase in beach tourism will mean that new tourism infrastructure, such as upgraded transportation networks, the expanded provision of accommodation, catering and safety, is required to provide capacity for an increase of visitors in the region (Coombes et al., 2009). Several BSR coastal resorts use natural resources, e.g. mud and mineral water. Studies on possible climate change impact on natural resources relevant for spa development are missing.

Countries around the Baltic Sea have a long history of coastal tourism, wellness and spa tourism that started in the first half of the 19th century while the origins of a seaside resort comes from the 1700s when the upper classes perceived beach resorts as a restricted place ‘for medicine, rather than pleasure’ (Gormsen, 1997; Bacon, 1997; Worthington, 2003; Thorsteinsdottir, 2005; Hall et al.,
2009: Kask & Raagmaa, 2010; Onofri & Nunes, 2013). In Europe coastal destination have been distinguished based on their different development pathes and thus adaptive capacity to climate change (1) destinations where tourism has developed around existing small or medium-sized structures, e.g. fishing villages, agricultural towns or villages and administrative centres, which eventually developed into conurbations where tourism is the main activity; and (2) seaside resorts built on the sea front, that is run like a town and organised around a single socioeconomic activity based on making the most of its human and natural resources (the sea, climate, spas) (EC, 2000). The planned tourism economy has left challenges in the eastern BSR that have consequences on coastal tourism development (Filies & Schumacher, 2013). The German Baltic Coast was divided in Eastern and Western tourism markets – the demand for coastal tourism was equal, but tourism was ‘monitored and controlled’ differently, thus tourism supply differed (Filies & Schumacher, 2013). After German unification new touristic infrastructure were built based upon recent touristic demands. Almost all shoreline of the Baltic Sea, except military and industrial sites, particularly in Russia, was open for tourist and locals’ access. Currently coastal resorts in the post-socialist countries of the BSR are not fully utilising their capacity. Studies on climate change impacts and adaptation capacities are missing, that would consider differences due to historical experience of the socialist period characterised with over-militarization of the BSR’ coastline.

The Baltic Sea is one of the fastest growing cruise markets in the world; it is the second largest area for cruise tourism in Europe, after the Mediterranean. The Baltic Sea with 95.3 million maritime passengers had 24.1 % of all passengers in the EU in 2010 (Eurostat, 2012). Despite that ferries principal function is transportation, ferrying is important tourism and leisure activity in the BSR (see table 14; figure 7). Trips with ferries are made not only to move from one place to another, but also as leisure activity in its own right, and many ferries offer services for tourists (Hall et al., 2009); however climate impact studies is missing on ferries and their services provided to tourists.

Over the past 10 years, the demand for cruising worldwide roughly doubled (ECORYS, 2012b) however cruising remains a small segment in the overall global tourism industry and a fraction of all international tourists, accounting for only about 0.6% of the all the hotel beds worldwide and a fraction of all international tourists (Clancy, 2008). In the long run however, the cruise tourism market is expected to stabilize or even to decline (ECORYS, 2012b). A warmer climate and a decrease in sea ice extent might have a positive impact on the cruise and ferry industries. The warmer winter temperature will extend the cruise season, first of all in the Mediterranean (ECORYS, 2012b). Increased inter-annual variability in sea-ice extent might be a barrier for extending the cruise tourism season in the BSR. Depth of the waters in ports of call set limits to the size of ships (ECORYS, 2012b) and thus sea-level rise might provide a positive impacts if ports are adapted to new conditions (Krämer et al., 2012).

A cruise according to the Cruise Europe's definition is a voyage of at least 60 hours by a seagoing vessel, mainly for pleasure; it must include at least two visiting ports apart from the starting and ending port; cargo/rolling stock can not be transported but only passengers with tickets that
should include accommodation and all meals (Cruise Baltic, 2013). Weather is ranked as a last satisfaction element by cruise passengers after valuating cities, tours on land, arrival in ports and the quality of services in the Baltic Sea (Cruise Baltic Passenger Survey, 2011). Cruise tourism has developed as a relatively luxurious form of travel, however, with the building of more and larger ships; cruising is becoming affordable to more consumers, including families with children and senior tourists. The ship has become a destination in itself with amenities and attractions located on the ship, passengers need not venture ashore unless desired, and often time is limited to brief excursions (Hritz & Cecil, 2008; Jaakson, 2004). With more active consumers, cruise lines are expanded their shore excursion choices to including outdoor activities of adventure-type choices (Gulliksen, 2008). Low-cost cruises are the largest-growing sector in the cruise industry (Berger, 2004). Researchers reveal that more sustainable and nature-based shore excursions are more expensive and time-consuming and thus are rarely provided by cruise operators (Johnson, 2006). While tourist operators gradually introducing more environmental considerations, it still relevant that cruise tourists as consumers and destinations with lower capacities have until now largely failed to exert the fundamental pressure necessary to ensure real environmental and social improvements in the cruise industry (Johnson, 2006 and 2002). As voluntary approaches for greater environmental responsibility of the cruise sector in the past have been found ineffective, there is proposal to motivate sector through pressure from nongovernmental organisations, the consumer demand of threat of stricter government legislation (Klein, 2010).

The total number of passengers starting or ending a cruise in the Baltic ports in 2009 was 1.07 million cruise passengers (see table 12 and 13). The share of the Baltic Sea was 10.2 % of the EU (ECORYS; 2012a). Cruise tourism in the countries around the Baltic Sea gives an annual turnover of around € 443 mln and approximately 5500–11500 jobs are created (Helcom, 2010). Worldwide there are 55 cruise lines and 20 million people took cruise in 2011, around 260 ships were in 2008 and 167 new ships were built from 2000-2013 (CLIA, 2013). The BSR receives more than 350 cruise ships with over 2100 port calls each year. The size of cruise ships vary between 3,600 passengers to less than 100, while in the Baltic the largest ships and the niche cruise ships are not frequent visitors. The largest cruise sea ports are Copenhagen, Stockholm, St. Petersburg, Kiel, Tallinn, Helsinki and Riga (ECORYS, 2012a; Eurostat, 2012). In total there were 924,000 cruise passengers in the Baltic Sea basin in 2010 (Eurostat, 2012). Germany with 375,000 cruise passengers in 2011 is the forth largest market in Europe after Italy Spain, and the UK. Denmark had 220,000, Sweden had 40,00, and Finland had 20,00 cruise passengers measured by country of embarkation (European Cruise Council, 2012). It is characteristic for the Baltic and the rest of the world is the market dominance of a limited number of cruise lines (ECORYS, 2012b) while cruise ports are competing among each other with some emerging efforts to cooperate through regional associations and the EU financed transnational development projects.
### Table 12: Leading cruise ports in 2011 (x 1,000 passengers) (European Cruise Council; 2012 cit. ECORYS, 2012a).

<table>
<thead>
<tr>
<th>Ports</th>
<th>Embarking</th>
<th>Disembarking</th>
<th>Port Call</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copenhagen</td>
<td>220</td>
<td>219</td>
<td>380</td>
<td>819</td>
</tr>
<tr>
<td>St. Petersburg</td>
<td>0</td>
<td>0</td>
<td>455</td>
<td>455</td>
</tr>
<tr>
<td>Stockholm</td>
<td>40</td>
<td>40</td>
<td>372</td>
<td>452</td>
</tr>
</tbody>
</table>

### Table 13: Cruise ports of the Baltic Sea in 2012, segments by calls or ship entering in a port (Cruise Baltic, 2013).

<table>
<thead>
<tr>
<th>Segments</th>
<th>Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-Large (200+ calls)</td>
<td>Copenhagen (372), St. Petersburg (307), Tallinn (294), Stockholm (274), Helsinki (265)</td>
</tr>
<tr>
<td>Large (50-199 calls)</td>
<td>Rostock (181), Oslo (166), Kiel (137), Riga (92), Gdynia (69), Gothenburg (69), Visby (62), Kristiansand (51)</td>
</tr>
<tr>
<td>Medium (25-49 calls)</td>
<td>Rønne (44), Klaipeda (43), Gdansk (29)</td>
</tr>
<tr>
<td>Small (0-24 calls)</td>
<td>Mariehamn (20), Aarhus (20), Sassnitz (7), Aalborg (7), Helsingborg (5), Turku (4), Arendal (3), Kalmar (3), Saaremaa (3), Elsinore (2), Karlskrona (2), Kotka (1), Malmö (0)</td>
</tr>
</tbody>
</table>

Cruise tourism in the Baltic focus mainly on attractive cities with cultural heritage (offshore excursions), with little attention to the region’s beaches or natural landscapes (ECORYS, 2012b). The price of fuel and climate change mitigation policies might have large impact on cruise industry (Adams, 2010). Besides implementing more fuel efficient technologies, another strategy to save fuel is limiting the distances between ports during a voyage. Regions where destination ports are located close to each other, e.g. the southern and central part of the Baltic could experience a future growth in cruising while peripheries might have fewer cruises (ECORYS, 2012b).

Cruise ships can be perceived as effectively mobile villages or towns (the largest vessels carry <5000 passengers and crew) that consume energy, water and produce substantial quantities of solid waste and wastewater; and tourist ferry traffic environmental effects are comparable with cruise ships (Davenport & Davenport, 2006). Cruise tourism impact on marine and coastal environment and local communities has been studied in the South (mainly Caribbean) and the Arctic destinations; however there is a lack of research with focus on the Baltic Sea. Cruise tourism in the Baltic focuss mainly on attractive cities with cultural heritage (offshore excursions), with little attention to the regions beaches or natural landscapes. The cruise industry segment that concerns the trips focused on natural scenery and wildlife is not developed in the Baltic Sea. Such trips that are developed in as example in Norway, and Scotland provide a good niche market comprised cruise operators at the higher end of price (ECORYS, 2012b). It is expected that in the future a variety of specific cruises will increase. Global trends indicate that cruise tourist interest in new experiences will lead to the emergence of new destinations as well as special theme cruises for every target group is being developed including ecotourism, golf, deep sea fishing or wellness. Consumer concerns about sustainable development increases causing pressure for greening ships (e.g. use of solar panels, wind turbines) and for more sustainable tourist services (e.g. eco-excursions) (ECORYS, 2012b).

Rapidly growing cruise industry is not vulnerable to sea-level rise, unlike coastal resorts (Nicholls et al., 2007; Nicholls & Kebede, 2012). Due to the growth of cruise industry, the size of ships...
and the climate impacts - port infrastructure becomes more and more a constraint for the growth. Operational consistency between cruise ports is one of the main problems as highlighted by the European Cruise Council - unlike airports – where many of the check-in, security and boarding procedures are standardised internationally – at ports nothing is standardised (ECORYS, 2012b). In the Arctic increased interannual variability in sea-ice hazards request for the availability of short-term and long-range sea-ice forecasts to aid in safe vessel transits, route planning, and long-term planning (Weber, 2012; Stewart et al., 2007) and such increased inter-annual variability in sea-ice might be relevant also for the Baltic. It is expected that the warmer winter temperature will extend the cruise season, first of all in the Mediterranean (ECORYS, 2012b). The current cruise season in the Baltic sea'ports is from May to September, as case study on Riga port shows (ECORYS, 2012b), however the studies on climate and weather variability on cruising in the Baltic is missing.

Table 14: Passenger numbers in Baltic ports in 2012 (Cruise Baltic, 2013).

<table>
<thead>
<tr>
<th>Ports</th>
<th>2000</th>
<th>2006</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arendal</td>
<td>-</td>
<td>-</td>
<td>496</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>166,000</td>
<td>458,000</td>
<td>840,00</td>
</tr>
<tr>
<td>Elsinore</td>
<td>400</td>
<td>3,322</td>
<td>2,560</td>
</tr>
<tr>
<td>Gdansk</td>
<td>3,643</td>
<td>9,703</td>
<td>8,294</td>
</tr>
<tr>
<td>Gdynia</td>
<td>57,610</td>
<td>94,135</td>
<td>108,628</td>
</tr>
<tr>
<td>Gothenburg</td>
<td>3,400</td>
<td>11,272</td>
<td>83,000</td>
</tr>
<tr>
<td>Helsingborg</td>
<td>6,266</td>
<td>8,311</td>
<td>11,300</td>
</tr>
<tr>
<td>Helsinki</td>
<td>140,000</td>
<td>270,000</td>
<td>368,000</td>
</tr>
<tr>
<td>Kalmar</td>
<td>4,100</td>
<td>2,717</td>
<td>1,235</td>
</tr>
<tr>
<td>Kalskrona</td>
<td>-</td>
<td>2,460</td>
<td>850</td>
</tr>
<tr>
<td>Kemi</td>
<td>600</td>
<td>2,000</td>
<td>3,145</td>
</tr>
<tr>
<td>Kiel</td>
<td>48,033</td>
<td>154,250</td>
<td>348,180</td>
</tr>
<tr>
<td>Klaipeda</td>
<td>4,613</td>
<td>24,914</td>
<td>26,769</td>
</tr>
<tr>
<td>Kotka</td>
<td>-</td>
<td>-</td>
<td>542</td>
</tr>
<tr>
<td>Kristiansand</td>
<td>14,000</td>
<td>38,000</td>
<td>70,00</td>
</tr>
<tr>
<td>Malmö</td>
<td>-</td>
<td>1,350</td>
<td>-</td>
</tr>
<tr>
<td>Mariehamn</td>
<td>1,678</td>
<td>3,366</td>
<td>6,742</td>
</tr>
<tr>
<td>Oslo</td>
<td>108,813</td>
<td>206,234</td>
<td>303,486</td>
</tr>
<tr>
<td>Riga</td>
<td>-</td>
<td>40,843</td>
<td>83,000</td>
</tr>
<tr>
<td>Rostock</td>
<td>52,622</td>
<td>173,500</td>
<td>385,800</td>
</tr>
<tr>
<td>Rønne</td>
<td>12,000</td>
<td>16,311</td>
<td>31,717</td>
</tr>
<tr>
<td>Saaremaa</td>
<td>-</td>
<td>4,909</td>
<td>1,120</td>
</tr>
<tr>
<td>Sassnitz</td>
<td>3,047</td>
<td>19,099</td>
<td>3,814</td>
</tr>
<tr>
<td>St. Petersburg</td>
<td>149,252</td>
<td>305,835</td>
<td>452,000</td>
</tr>
<tr>
<td>Stockholm</td>
<td>157,000</td>
<td>287,000</td>
<td>470,000</td>
</tr>
<tr>
<td>Tallinn</td>
<td>109,511</td>
<td>305,026</td>
<td>440,504</td>
</tr>
<tr>
<td>Turku</td>
<td>5,654</td>
<td>3,273</td>
<td>2,600</td>
</tr>
<tr>
<td>Visby</td>
<td>48,339</td>
<td>77,578</td>
<td>54,158</td>
</tr>
<tr>
<td>Aalborg</td>
<td>400</td>
<td>2,550</td>
<td>6,451</td>
</tr>
<tr>
<td>Århus</td>
<td>12,868</td>
<td>26,317</td>
<td>39,436</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,109,849</td>
<td>2,552,275</td>
<td>4,349,592</td>
</tr>
</tbody>
</table>
3.4.3 Snow- and ice-based tourism activities

Snow-based tourism activities (downhill or Alpine, cross-country or Nordic skiing, snowboarding, snowmobiling, outdoor skating, dog-sledging, ice-fishing) and related businesses are being identified by numerous studies as tourism activities that are affected by climate change already or will be in near future (Landauer et al., 2012; Polovitz Nickerson et al., 2011; OECD, 2007; Cramer et al., 2001; Becken, 2013; Dawson & Scott, 2013; Fredman et al., 2012; Brouder & Lundmark, 2011; Davoudi et al., 2012). The winter sports industry in Europe is the largest globally and attracts millions of tourists each year, generating nearly EUR 50 billion in annual turnover (EEA, 2012a). For ski holidays weather and climate are essential to travel motivation (Jacobsen et al., 2009; Denstadli et al., 2011). Winter sports depend directly on climatic resources: without snow or low temperatures for the artificial production of snow, the development of winter tourism will not be possible (Gomez-Martín, 2005; table 15). Snow conditions are a key variable for skiers’ decisions on destination choice; however other factors are also important such as skiing terrain, vertical drop and climatic conditions (temperature, precipitation and wind) (Moen & Fredman, 2007). Ski areas will have reduced snow and winter
seasons will likely vary greatly. This will make business planning extremely difficult (Reynolds, 2010). Snow- and ice-based outdoor activities are facing the prospect of higher temperatures, less natural snowfall, more thaw periods and shorter, more variable winter tourism seasons in the future (UNWTO & UNEP, 2008).

However according to regional climate models Scandinavia will have more precipitation and therefore snow amounts will increase in the winter season and thus snow reliability will remain higher than in other regions; thus its market share in Alpine and Nordic ski sports will increase (Ehmer & Heymann, 2008). In Sweden significant changes in snow conditions are not expect until the 2020s; and this situation can contribute to winter tourism international competitiveness, although certain winter tourism locations in the southern areas may experience problems (Swedish Government, 2007). There are studies from Sweden (Moen & Fredman, 2007; Brouder & Lundmark, 2011; Baynes & Koivisto, 2012) and Finland (Tervo, 2008; Saarinen & Tervo, 2006; Landauer et al., 2009; Landauer et al., 2012; Sievänen et al., 2005) that predict crucial negative impact on the economic viability of ski resorts and tourist operators acting in ski tourism. For the BSR countries skiing, skating, ice fishing and snowmobiling are favourite outdoor recreation activities with long long history and tradition that since 1920s have developed as nature-based winter tourism industry (Hall et al., 2009), and thus winter tourism is important for the regional identity, the quality of life and well-being of its inhabitants. The Nordic countries in addition to winter activities related to Christmas traditions and Santa Claus that was launched by Finnish tourist authorities in 1980s; a variety of new products and attractions have been developed, that are dependent from ice and snow, e.g. IceHotel (Sweden), Snow Castle and ice breaker trips with ice dips in Kemi (Finland), dining on ice in Luleå (Sweden) (Hall et al., 2009), in Russia and the Baltic States ice water swimming is a recreational tradition that attracts tourists as well.

In southern Finland and Sweden, opportunities for snow-related activities are expected to decline; whereas the northern parts of Finland and Sweden could have a competitive advantage compared to winter tourism destinations in central Europe (Saarinen & Tervo, 2006; Neuvonen et al., 2005; Swedish Government, 2007). In Finland there is a projection that due to climate change cross-country skiing will reduce (Pouta et al., 2009; Neuvonen et al., 2005). In Baltic States regional differences observed, e.g. a considerable drop in snow-cover duration will take place on islands and in the coastal region of west Estonia (Jaagus, 1997), while upland areas can still attract winter sport tourism. Winter thawing events lead to wetter snow which creates problems to skiing, snowmobiling and travel by sled (sled tours) (Keskitalo, 2010). Climate change impacts will make skiers more flexible in time and space (Dawson & Scott, 2010). Snow conditions are a key variable for skiers’ decisions on destination choice; however other factors are also important such as skiing terrain, vertical drop and climatic conditions (temperature, precipitation and wind) are also important (Moen & Fredman, 2007). The potential impact of climate change on winter tourism can be examined by the length of ski, snow-making and snowmobiling season (McBoyle et al., 2007), and the probability of being operational during the economically critical Christmas–New Year's holiday period (Scott et al.,
Climate Change Impacts on Coastal Tourism in the Baltic Sea Region

2008c; Tervo-Kankare et al., 2013). Today the winter season in the Nordic winter tourism has been expanded to the ‘first snow season’ in October–November and the Christmas season in November–early January (Hall et al., 2009). In the northeast of the BSR Christmas–New Year’s – Orthodox Christmas period of winter holiday making cover slightly longer period of time. For instance, there is the 100-day rule formulated by Abegg (1996) and developed for Alps (Steiger & Mayer, 2008) that state that ski resorts can be considered as snow-reliable ‘if, in 7 out of 10 winters, a sufficient snow covering of at least 30–50 cm is available for ski sport on at least 100 days between December 1 and April 15’. There is also a formula to calculate the required number of snowmaking days per month, with potential snowmelt is included for utilizing snowmaking facilities (Steiger & Mayer, 2008). Similar study was undertaken in the North America, that found that ski areas can operate when the snow depth is more than 30 cm, when the temperature does not exceed 10°C for more than two consecutive days accompanied by rain, or when it does not rain for two days and over 20mm (Scott et al., 2006).

For the Baltic Sea climate requirements for cross-country skiing and ice-fishing, e.g. period and the depth of ice and ice-coverage of shallow coastal waters, coastal rivers and lagoons, might be as important as snowmobiling. High wind occurrence was found the most common reason for ski field closure in Finland, while snowmobiling and cross-country skiing was disturbed most by frosty conditions (Tervo, 2008).

<table>
<thead>
<tr>
<th>Environmental condition</th>
<th>Nordic skiing</th>
<th>Alpine skiing</th>
<th>Snow shoeing</th>
<th>Snowmobiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snow depth (cm)</td>
<td>20–30</td>
<td>20–30</td>
<td>20–30</td>
<td>30</td>
</tr>
<tr>
<td>– Minimum</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>– Optimun</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Snow density (g/cm³)</td>
<td>&lt;0.6</td>
<td>&lt;0.6</td>
<td>0.2–0.6</td>
<td>0.4–0.1</td>
</tr>
<tr>
<td>Air temperature (°C)</td>
<td>–2 to –15</td>
<td>5 to –20</td>
<td>10 to –40</td>
<td>10 to –30</td>
</tr>
<tr>
<td>Snow making (°C)</td>
<td>–3 to –15</td>
<td>–3 to –15</td>
<td>Not applicable</td>
<td>–3 to –15</td>
</tr>
<tr>
<td>Wind (km/h)</td>
<td>&lt;20</td>
<td>&lt;15</td>
<td>&lt;45</td>
<td>&lt;45</td>
</tr>
<tr>
<td>Wind chill (watts/m²)</td>
<td>700</td>
<td>700</td>
<td>1600</td>
<td>1400</td>
</tr>
</tbody>
</table>

The winter season can have twice as little tourism as in the summer (ESPON-IRPUD, 2011); and thus the changes in the winter tourism flows can have less impact on the total annual number of tourists and the flows between countries and regions. In Finland skiing is the main purpose for about 10% of tourist trips made to participate in outdoor and nature activities, and cross-country skiing is not only a popular way to spend active holidays, but also an everyday sport and leisure activity in close proximity to residences (Landauer et al., 2009). With regards to climate change, the following research questions have been studied: the extent to which individuals change their participation habits by substituting skiing for another activity (activity substitution), participating less or more during a shortened ski season (temporal substitution), or travelling to other ski areas with better snow conditions (spatial substitution) (Dawson et al., 2011a). Climate change can have an impact on tourism destination marketing and branding activities if the place image (the set of expectations and perceptions) relies on snow and ice (Landauer et al., 2012). Snow is not only a medium for winter
Consequences of Climate Change on Coastal Tourism

Sports but also a base for an important economic sector because of the links to tourism, winter cabins, producers of equipment, and local businesses (O’Brien, 2009).

Climate change impacts in ski areas will likely vary greatly; low-lying ski areas are most sensitive and this will lead to a concentration of ski tourism on higher altitudes (EEA, 2012a; OECD & UNEP, 2011). Not the entire ski sector is at risk to climate change but rather certain individual ski areas that collectively make up a particular ski marketplace; the competition is likely to decline as individual operators of skiing become unable to afford the cost of adapting to future climatic conditions and this may actually advantage the ski areas that are able to remain operational (Dawson et al., 2011a). Poorly adapted to climate change other ski resorts likely to close; skiers will travel to other remaining resorts (Dawson et al., 2011a; Reynolds, 2010; Scott & McBoyle, 2007). The competition is likely to decline as individual operators of skiing become unable to afford the cost of adapting to future climatic conditions and this may actually advantage the ski areas that are able to remain operational. If demand for skiing decreases in parallel with supply-side capacity associated with the closure of individual ski areas, there would be an equal loss of supply and demand in the ski tourism marketplace. However, if demand remains stable or diminishes proportionally less than the decrease in supply, there would be a net transfer of demand favouring ski areas that remain operational (Dawson et al., 2011a). Scott (2003) argues that large-scale ski tourism corporations are less vulnerable to climate change as they are more diversified business operations, regionally diversified and better capitalised.

Compared to alpine skiing, cross-country skiing is more vulnerable to climate change; it is predicted that air temperatures of winter days will rise; the snow depth will decrease as well as the number of days with snow cover, and thus will have direct negative influences on cross-country skiing, especially in southern Finland, where the majority of the Finnish population live (Landauer et al., 2009). Snow supplemented by snowmaking can increase snow cover and extend the season (Reynolds, 2010). Artificial snow-making will increase costs and energy use and can have negative environmental impacts (increased water and energy demand, pollution, etc), and there will be fewer days with suitable snow-making conditions (Boden, 2007; Brouder & Lundmark, 2011; Koponen & Pesonen, 2012; Scott et al., 2008c). Finnish cross-country skiers expect the society to provide support for skiing activities and are not in general willing to pay for opportunities to ski (Landauer et al., 2009; Neuvonen et al., 2005; Landauer et al., 2012). Coastal tourism businesses in the northern Sweden have different perceptions on climate change than those in the inland – at the coast more variation than previously known is observed, and entrepreneurs are far more willing to accept one poor-snow winter as evidence of climate change and thus aware to begin to adapt new conditions (Brouder & Lundmark, 2011). In Finland ski tourism destinations are smaller-scale and with less-diversified tourism product and thus their capability might be lower to adapt new conditions (Landauer et al., 2012). There are similar observations in Sweden where Kungsberget Ski Resort faces not only decreasing snow cover, but also high maintenance costs, lack of summer activities and lack of marketing, while as opportunities are considered opening-up for summer activities and international
markets (Baynes & Koivisto, 2012). The shortening of the winter season is perceived as a threat to well-being of employees in tourism (Heikkinen et al., 2011). Winter safaris in Finland have a major role attracting foreign visitors; due to their need for large amounts of snow, making artificial snow is not considered as realistic adaptation mechanism (Kaján & Saarinen, 2013; Tervo, 2008). Instead diversification and alternative products are suggested as an option. This option will make former winter safaris destinations less competitive, due to the fact that branching out into summer tourism and focusing on summer activities (i.e. rafting, mountain-biking or hiking) means that former niche of snow-dependent tourism (unique and attractive at European scale) is lost and a new position in the market of summer tourism should gain in competition with many other places in Europe having similar products (Kaján & Saarinen, 2013). In Finland there is a projection that due to climate change cross-country skiing will reduce, particularly among women, the lower classes, and urban dwellers (Pouta et al., 2009). Finnish researchers note that there are differences among skiers in their sensibility to climate change impacts, depending on their demographic and socioeconomic status (Pouta et al., 2009); fewer young people will learn basic skiing skills compared with previous generations due to the lack of skiing opportunities close to home (Neuvonen et al., 2005). Cross-country skiers have been divided in three groups depending on their motives and behaviour toward skiing that are relevant for climate change adaptation: social type skiers value skiing traditions, outdoor type skiers stressed important qualities of the skiing environment, while technical type skiers that consider skiing a way of keeping fit and developing skills (Pouta & Sievänen, 2001). Studies on tourist perceptions and attitudes towards climate change and the change of behaviour are particularly important for winter tourism destinations (Gössling et al., 2012; Jacobsen et al., 2009). Studies are missing on development of downhill and cross-country skiing tracks, outdoor skating rings, bobsleigh, luge, and skeleton tracks with opportunities to use artificial snow and ice making in the BSR, for instance exploring upland areas or urban artificial terrain and artificial lighting.
4 Adaptation Measures

Coastal tourism in the BSR is a spatially diverse, segmented, constantly changing and sensitive to climate-related risks, thus is requiring the need for complex adaptation measures (Filies & Schumacher, 2013). Coastal areas have received a particular attention from climate change research and policy community as these areas accommodate a number of challenges to be addressed (Nicholson-Cole & O’Riordan, 2009): shifting risks and uncertainty and policy context; many stakeholders and different interests; lack of cross-sectorial coordination, mismatched expectations and understandings; the sensitive of culture of coastal settlements, local economies and social justice questions; and complex, and innovative management arrangements to be implemented. At the same time the tourism industry has long experience in coping with climate variability and the ability to adjust to timing, places and activities, in order to respond changing demographic and economic conditions as well as to new demands and technologies (Perry, 2006). With relevance to the tourism sector, climate change adaptation is defined as a set of measures to deal with consequences caused by risk factors for tourism such as negative impact to such aspects as sustainability of tourism destination and facilities, to the appeal of destination, tourism satisfaction and safety, transport to and within the destination, natural and human resource base of the destination (Becken & Hay, 2012). Adaptation includes all these actions or activities that people undertake, individually or collectively, to accommodate, cope with, or benefit from, the effects of climate change, including changes in climate variability and extremes (Becken & Hay, 2007). The objective of adaptation is to reduce vulnerability to climatic changes and their negative impact, and thus adaptation process attempts to identify steps that can be taken to reduce the negative impacts of climate change and to take advantage of the benefits of climate change (Wall, 1998). Adaptation is a practical way of get accustomed to current climate variability and extreme events, as be informed and prepared for long-term climate change (Peric et al., 2013). Short-run and long-run adaptations are distinguished on the basis of flexibility of adaptation options. In short term adjustments, the response to climate change is constrained by fixed factors (such as physical infrastructure), thus the possibilities are limited these certain factors. Major investments in infrastructure are long-term and thus require to consider climate and weather in the future (Peric et al., 2013). Climate change requires to incorporate adaptation aspects into mainstream tourism planning, policies, information distribution and activity performance. Adaptation strategies need to cover three sides to adaptation: (1) minimizing sensitivity or exposure to risk, (2) developing a capacity to cope after damages have been experienced and (3) acquiring the means to exploit new opportunities that arise (McCarthy et al., 2001). Lessons how to adapt to climate change based on integrated coastal management experiences suggest (Tobey et al., 2010) that adaptation should be seen as an inclusive, participatory, and on-going process, that uses best available knowledge, strategically defines priorities, goals, and objectives, and builds linkages among the possible adaptation entry points (sectoral institutions, top-down national policy, and place-based actions).
Close cooperation of governments and relevant communities are needed to re-use existing tourism infrastructure and resources in affected places according to changed climate conditions. Governmental aid is needed particularly for tourism destinations, resorts and venues due to immobility of tourism-related fixed capital and infrastructure (table 16). While tourists and lesser degree, tour operators may respond immediately to unfavourable weather events; venue-based tourism business are less flexible to react to changing climate conditions, variability and extremes (Hall & Higham, 2005; Perry, 2006; UNWTO & UNEP; 2008). Tourists are considered to have large adaptive capacity; however, their actual adaptive capacity and acceptable limits to change remains largely unexplored (Gössling et al., 2012; Scott et al. 2008b; Scott et al., 2012). Tol (2011) points that ‘people are more likely to change the composition rather than the level of their time and money spent on recreation’. For instance, activities in boating, golfing and beach recreation are increasing at the expense of skiing (Shaw & Loomis, 2008). It is believed that the fact that tourist operators, who are well adapted to weather events in various geographical settings, can help tourists and destinations to adapt to climate change (Becken, 2005).

Table 16: Sectors in which climate change should already be taken into account during phases of planning, investments, design and construction of new infrastructure (Hallegatte, 2009).

<table>
<thead>
<tr>
<th>Sector</th>
<th>Time scale (years of operation) of new infrastructure if built today</th>
<th>Exposure to climate change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water infrastructures (e.g., dams, reservoirs)</td>
<td>30–200</td>
<td>+++</td>
</tr>
<tr>
<td>Land-use planning (e.g., in flood plain or coastal areas)</td>
<td>&gt;100</td>
<td>+++</td>
</tr>
<tr>
<td>Coasline and flood defences (e.g., dikes, sea walls)</td>
<td>&gt;50</td>
<td>+++</td>
</tr>
<tr>
<td>Building and housing (e.g., insulation, windows)</td>
<td>30–150</td>
<td>++</td>
</tr>
<tr>
<td>Transportation infrastructure (e.g., port, bridges)</td>
<td>30–200</td>
<td>+</td>
</tr>
<tr>
<td>Urbanism (e.g., urban density, parks)</td>
<td>&gt;100</td>
<td>+</td>
</tr>
<tr>
<td>Energy production (e.g., nuclear plant cooling system)</td>
<td>20–70</td>
<td>+</td>
</tr>
</tbody>
</table>

Studies that cover aspects of human adaptive capacity to various climates and weather events can be relevant for understanding tourist behaviour and adaptation needs. Traditionally, human response to weather and climate has consisted in physiological adaptation to wide ranges of weather and climate, adjustment to variations of weather and climate (e.g. clothing, home insulation, storm-proof structures) and movement to another place or region (Sewell et al., 1968). Auliciems (2009) notes that adaptations adopted in the past have been more or less successful, but with climate change humans are faced to new situation; in which 'not the well adapted that can expect to thrive best, but the most adaptable'. Integrated adaptive model (Auliciems, 2009) is based on adaptation in three levels where all of them might be affected by climate change. First order adaptation is the initial reduction of hazard impacts, based on human defence mechanisms that consist of integrated biological and behavioural adaptive processes as augmented by second order technological mechanisms. The second order adaptations are technocultural responses ranging from routine maintenance of infrastructures to emergency activation of resources and technologies. Third level contains socioeconomic systems that cope with functions of security, health, education, environmental, amenity and resource availability.
Adaptation Measures

The on-site tourist behaviour to react on uncomfortable weather conditions are categorised by five stages (de Freitas, 2003):

1. Avoid areas of unfavourable weather- or climate determined conditions (e.g., move from sun to shade);
2. Change activity to suit weather conditions (e.g. walk, swim or ski more or less);
3. Use structural or mechanical aids (e.g. umbrellas or wind breaks);
4. Adjust thermal insulation of body (clothing);
5. Adopt passive acceptance.

Besides delivering adaptation actions and investing in physical infrastructure, society can increase adaptation to climate change through building adaptive capacity (Stern, 2006). Adaptive capacity refers to the ‘property of a system to adjust its characteristics or behaviour, in order to expand its coping range under existing climate variability, or future climate conditions’ (Brooks & Adger, 2005). It is the ability of a unit and their networks (e.g. tourism operator, tourism destination or a community) to learn and accumulate knowledge and experience, innovations and creative flexibility in risk evaluation, decision-making and problem-solving (Smith & Wandel, 2006, cited in Kaján & Saarinen, 2013). Determinants of adaptive capacity were identified (Tol et al., 2008; McCarthy et al., 2001; Mimura, 2010):

- Available technological options: ability to utilize the appropriate technologies and have access to the necessary information on them.
- Financial resources and their distribution: amounts of available capital and other economic resources and the access of the neediest to required economic resources, affordability to couple with problem.
- Human resources/capital: human capacities, such as skill, experience, and educational level adequate to grasp future climate challenges and its potential consequences and to implement adaptation strategies.
- Social capital/community: the trust, norms, and networks of the society to facilitate collective action on adaptation to climate change in the social community.
- The structure of critical institution: system of how natural resources are allocated - by markets, by law, or by custom.
- Social institutions /decision making authorities: capability of social systems for ensuring access to information and supporting decision making; capability of decision-making authorities to intervene or control unfavourable processes of tourism development.
- Risk management/spreading; framework and capacity for sharing and distributing risks (losses carried by individuals) throughout a larger population.
- Information management and the credibility of information supplied by decision makers: personal and collective access to information and ability to understand and process information on impacts and adaptation.
Knowledge and awareness: fundamental knowledge for understanding environmental changes and their effects and implications, and the public’s perceptions of risks and exposure of the climate change.

Tourism as activity has continuously adapted to various risks and changes related with geographical, temporal or technological settings or cultural, life style or ideological preferences; and adapting to climate change means building on this traditional tourism sector adaptive capacity (Becken & Hay, 2007). The three groups of tourism market chain - tourists, travel businesses and the destinations – have very different climate change adaptation capacities (Filies & Schumacher, 2013). Tourists which are mobile and often represent healthier and wealthiest segments of the society are considered to have higher adaptive capacity, then tour operators, transport providers or travel agents. Tourists can easily adapt their behaviour in response to climate variability and poor weather conditions, extreme weather events, resort or venue closures or inability to participate in selected tourism activities (Dawson & Scott, 2013; Scott & McBoyle, 2007; Gössling et al., 2012). Tourists as individuals can adapt to changes by choosing an alternative time to travel or destinations to go; while tour operators can have a chance to respond these changes of tourist demand by reorganizing their range of products (Filies & Schumacher, 2013). Tourism destinations and venue-based and local tourism enterprises will experience more adaptation challenges due to difficulties and expenses involved in structural and management-based adaptations. As they are place fixed, mobility as adaptation option cannot be exploited; other options to deal with climate change impacts has to be find, such as by organizational and financial tools (Filies & Schumacher, 2013).

The lowest adaptive capacity to climate change are to venue based tourism businesses, e.g. hotels, resorts, attractions, as well as local operators, guides and host communities (UNWTO & UNEP, 2008). Adaptive capacity for tourism destinations, enterprises and venues can be enhanced by creating the information and conditions (regulatory, institutional and managerial) that are required to support adaptation through public awareness, education, training, research, monitoring, and pilot and demonstration projects (Stern, 2006). It includes the capacity to learn from past experience in order to cope with current or future events, both known and unknown (Brooks & Adger 2005). Adaptive capacity can be measured by social, educational, institutional, place-specific and other factors.

<table>
<thead>
<tr>
<th>Countries</th>
<th>Travel &amp; Tourism investment of total investment, %</th>
<th>Travel &amp; Tourism investment of total investment in national currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>2.8</td>
<td>RUB 311.7 bn</td>
</tr>
<tr>
<td>Sweden</td>
<td>2.8</td>
<td>SEK 17.9 bn</td>
</tr>
<tr>
<td>Poland</td>
<td>3.4</td>
<td>PLN 10.3 bn</td>
</tr>
<tr>
<td>Lithuania</td>
<td>3.1</td>
<td>LTL 576.3 mn</td>
</tr>
<tr>
<td>Latvia</td>
<td>4.7</td>
<td>LVL 123.7 mn</td>
</tr>
<tr>
<td>Germany</td>
<td>4.1</td>
<td>EUR 19.2 bn</td>
</tr>
<tr>
<td>Finland</td>
<td>2.6</td>
<td>EUR 1.0 bn</td>
</tr>
<tr>
<td>Estonia</td>
<td>6.5</td>
<td>EUR 0.2 bn</td>
</tr>
<tr>
<td>Denmark</td>
<td>4.5</td>
<td>DKK 13.9 bn</td>
</tr>
</tbody>
</table>

Table 17: Travel and tourism investment in 2011 (BASTIS, 2013, data from World Travel & Tourism Council - Travel & Tourism Economic Impact 2012).
Adaptation Measures

The BSR coastal tourism adaptive capacity is characterised by large spatial and industrial polarisation (figure 8, table 17 and 18). Germany’s coastal regions have medium overall capacity to adapt to climate change, the Baltic States have low capacity and Poland coastal regions are judged to have the lowest adaptive capacity in the EU. On the other hand Finland, Sweden and Denmark were assessed as having highest and high overall adaptive capacity to adapt to climate change in comparison with other regions in the EU (ESPON-IRPUD, 2011). Adaptive capacity was calculated as weighted combination of economic capacity (weight 0.21), infrastructural capacity (0.16), technological capacity (0.23), knowledge and awareness (0.23) and institutional capacity (0.17); weights were based on a Delphi survey of the ESPON Monitoring Committee (ESPON & IRPUD, 2011). Large diversity of adaptive capacity is due to socio-economic disparities in the BSR. Eastern and northern coastal regions are characterized by demographic sparsity, poor connectivity, difficulties in access and lack of critical mass of human, material and financial capital (GEOSPECS, 2012). Even climate change adaptation has become a concern in the Nordic countries and regional responses has been considred as crucial, a study illustrates that currently Nordic regions have high capacity but there are also significant differences between and within countries (Juhola et al., 2012). Thus countries that are wealthier and which have longer experiences in tourism industry might have larger adaptive capacities in the tourism sector. Coastal cities and resort towns have larger capacity to cope with climate variability and possible changes then peripheries, e.g. countryside, former fishermen villages and nature areas. Shrinking coastal cities and resorts on decline probably still have structures and knowledge, human, social and material capital preserved from tourism boom periods that can contribute to adaptive capacity. The same applies for communities and structures that were connected or developed due to with high militarization of coastal area during cold war. There is already experience that former coastal protection structures built for military defence or during war operations are used for civil protection purposes. Micro and small and medium tourism enterprises may not have adequate human, social, technical and financial resources to cope with climate challenges, while it is expected that large companies, like tour operators, hotel chains, and cruise and airline companies have larger adaptive capacity.
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Figure 8: Degree of urbanisation and sparsely populated and poorly connected LAU2 (GEOSPECS, 2012).

A proposal has been elaborated on indicators to be used for adaptive capacity assessment of tourism sector (Perch-Nielsen, 2010):

- Economic resources available to tourism to adapt (GDP per capita); (see table 18)
- Innovation potential of tourism entrepreneurs;
- Technologies available to tourism to adapt (Internet users, % of population);
- Knowledge within the tourism sector on climate change and its potential impacts (total gross enrolment; % of population of respective age group);
- Existence and effectiveness of institutions relevant for the tourism sector (regulatory quality; GDP generated by the travel and tourism industry, % of GDP).


<table>
<thead>
<tr>
<th>Country</th>
<th>GDP per capita, current US$</th>
<th>International tourism real receipts per capita, current US$</th>
<th>Foreign direct investment net inflows per capita, current US$</th>
<th>CO² emissions per capita (metric tons)</th>
<th>Tourism direct contribution to GDP, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>36,389</td>
<td>773</td>
<td>975</td>
<td>10.07</td>
<td>2.47</td>
</tr>
<tr>
<td>Estonia</td>
<td>7962</td>
<td>491</td>
<td>670</td>
<td>12.81</td>
<td>3.01</td>
</tr>
<tr>
<td>Finland</td>
<td>29,206</td>
<td>440</td>
<td>649</td>
<td>11.12</td>
<td>2.54</td>
</tr>
<tr>
<td>Germany</td>
<td>28,227</td>
<td>307</td>
<td>367</td>
<td>10.48</td>
<td>1.89</td>
</tr>
<tr>
<td>Latvia</td>
<td>4788</td>
<td>125</td>
<td>245</td>
<td>3.50</td>
<td>1.47</td>
</tr>
<tr>
<td>Lithuania</td>
<td>5072</td>
<td>140</td>
<td>202</td>
<td>4.30</td>
<td>2.08</td>
</tr>
<tr>
<td>Poland</td>
<td>5283</td>
<td>156</td>
<td>178</td>
<td>8.81</td>
<td>2.41</td>
</tr>
<tr>
<td>Sweden</td>
<td>32,715</td>
<td>636</td>
<td>1536</td>
<td>6.04</td>
<td>1.64</td>
</tr>
</tbody>
</table>
Various types of **barriers** have been identified that prevent climate change adaptation in the tourism sector (Schott et al., 2010; Moser & Ekstrom, 2010). The widespread denial of climate change by the tourism industry is explained by ‘a lack of resources to implement long-term responses, uncertainty surrounding the manifestations of climate change, and the ineffectiveness of short-term responses to climate change’ (Higham & Hall 2005; Hall & Higham, 2005). Fragmentation of the sector, the dependence on other sectors and the dominance of micro and small and medium enterprises are crucial barriers for voluntary adaptation actions to be taken by the sector itself. Various types of barriers have been identified that prevent climate change adaptation in tourism sector (Schott et al., 2010): (1) **Psychophysiological barriers** are due to the fact that the physical “signals” of changes in temperature due to climate change are weak in value if compared with variation in temperature due to daily, seasonal, and regional variations. Knowledge distribution and public awareness can contribute to better understanding that if the current physical signals of climate change are overall below the common perceptual thresholds of discernability do not mean that is different from other environmental problems. (2) **Temporal barriers** are in the fact that there is a great temporal delay between human actions and their perceptible influence on environmental systems. Temporal barrier also refers to individuals’ temporal orientations, and a conflict between short-term and long-term interests. (3) **Judgmental barriers** are based in judgments about uncertain outcomes, e.g. natural disasters caused by climate change are underestimated because of their low frequency of occurrence as well as because of their familiarity. (4) **Geographical barriers** are in the fact that people perceive environmental problems as more worrying when they take place at greater distances and problems that are at the global or regional level. (5) **Social barriers** are in differences between individual and public interests while using natural resources; and climate change involves both resource dilemmas and public good dilemmas.

Adaptation to climate change depends on various factors such as political, legal, economic, technological, social and cultural context, planning and management context, equity and awareness, information, education and skills level (Grothmann, 2010; Becken & Hay 2007). Adaptation should be placed in a wider **sustainable development** context, recognising that it is an ongoing process and occurs at different levels in particular, at the local level; the tourism sector should build on current adaptive experiences to cope with future climate variability and climate hazards and should also consider impacts and adaptations in other sectors (Simpson et al., 2008). Due to large ecological footprint of long-haul tourism, there is a challenge to integrate or at least coordinate climate change mitigation and adaptation measures with relevance to tourism. Win-win solutions are difficult to obtain as concerns for economy and environment appear to be diametrically opposed. “When finances, time, or resources for problem solving are limited, adaptation and mitigation appear almost as mutually exclusive options” (Patterson et al., 2006), such new concepts as ‘slow’ transport options (Higham & Hall, 2005) or slow tourism should be explored. Tourists of the present and even more in the future are becoming environmentally concern and looking for tourism destinations and operators taking account
sustainability principles. As climate change is interwoven with the issues of sustainability climate change mitigation and adaptation have to be at the centre of organizations involved in tourism business with long-term goals (Yeoman & McMahon-Beattie, 2006). The United Nations Development Programme (UNDP) guiding principles for climate change adaptation (after UNDP, 2005; Simpson et al., 2008) are making linkages with sustainable development principles:

a) Position adaptation in a wider sustainable development context and consider impacts and adaptations in other sectors.

b) Build on current adaptive experience to cope with future climate variability and climate hazards.

c) Recognise that adaptation occurs at different levels in particular, at the local level (local destination, business, venue or project level).

d) Recognise that adaptation is an ongoing process.

Glavovic (2008) suggests principles and operational imperatives for building sustainable, hazard-resilient communities that can help to guide efforts in adapting the tourism sector to climate change impacts: (1) put people first; (2) develop responsive and participatory processes; (3) prioritise empowerment; (4) prioritise ecological sustainability; and (5) adopt a proactive and strategic but precautionary approach by developing a long-term, visionary approach that is implemented in a risk averse manner. Operational imperatives to translate these principles into practice include (Glavovic, 2008):

1. Adopt an integrated, multi-level and holistic approach: The complex, multi-dimensional character of natural hazards necessitates the linking of natural, social and technological considerations across scales. Adopt common principles to guide the actions of diverse organisations involved in relief and recovery efforts, with clear lines of responsibility and accountability.

2. Vigorously manage mitigation and mainstream natural hazards planning into decision-making processes: Hazard risk avoidance and mitigation needs to be an integral part of policy- and decision-making processes.

3. Adapt to local circumstances, build and mobilise local capacity and foster local responsibility: Recognise and respect local cultures and capabilities, and develop empowering partnering arrangements through all stages of disaster response and recovery.

4. Identify, understand and address the needs of vulnerable communities and groups.

5. Focus on priority sectors and critical assets: Make sure that providers of essential services develop resilient systems and that key decision-makers are well-integrated into emergency planning and preparedness processes.

6. Strengthen information networks and proactively share information to inform, solicit feedback and raise public awareness.

7. Focus special attention on securing the buy-in and commitment of leaders from the State, private sector and civil society.
8. Capitalize on disaster: The media-spotlight can be a powerful ally in initiating or developing risk avoidance and mitigation measures that would otherwise not receive adequate attention.


10. Monitor, review and adapt planning and decision making processes, informed by initiatives that promote social learning.

Adaptation measures should cover the most vulnerable aspects of tourism industry with reference to sustainability, cost-benefit and social justice principles. As vulnerability to climate change is likely to be unequally distributed across different groups in society, nationally and internationally, scalar thinking, e.g. regional vulnerability analysis (Brouder & Lundmark, 2011; Filies & Schumacher, 2013; table 19) and policies are needed to provide resources (including capital, knowledge, technology and consent) that are not held by the adapting agents themselves (Berkhout, 2005). Adaptation should avoid situations when governments concentrate on their own residents during extreme weather events and are not able to communicate effectively with tourists who may be more vulnerable to natural hazards due to a lack of knowledge of the destination (OECD, 2012). Six dimensions are listed as important for the vulnerability assessment of coastal tourism with relevance to climate change (after Moreno & Becken, 2009; Fussel, 2007):

- the system of analysis, e.g. the tourism sector, a tourism destination;
- the attribute of concern, e.g. tourism infrastructures, beaches, the length of the tourism season, snow and ice availability, coastal ecosystems;
- the hazard or potential event that might damage or affect the system of analysis and the particular attribute of concern, e.g. sea-level rise, extreme weather events, erosion;
- the temporal reference, either the point of time or time period of interest (current vs. future vs. dynamic);
- the sphere, which distinguishes internal (i.e. from within the system of analysis), external (i.e. outside the system in question, but impacting upon the system) or cross-scale (both internal and external) vulnerability factors and;
- the knowledge domain, which includes socio-economic, biophysical or integrated factors.

*Table 19: Framework for the vulnerability of the tourism sector to climate change (after Perch-Nielsen, 2010)*

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Mean climate</th>
<th>Intensity of extreme events</th>
<th>Sea level rise</th>
<th>Biodiversity</th>
<th>Water availability</th>
<th>Snow</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure</td>
<td>Change in suitability of climate for the type of tourism present</td>
<td>Change in frequency and intensity of extreme events</td>
<td>Rise in sea level</td>
<td>Changes in composition of flora &amp; fauna</td>
<td>Changes in precipitation, water availability</td>
<td>Change in snow security</td>
<td>Policies to reduce greenhouse gas emissions</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Dependence on tourism that relies on current climate</td>
<td>Proximity of tourism infrastructure and resources to extreme events</td>
<td>Dependence and proximity of tourism infrastructure and resources to the maximum shoreline</td>
<td>Dependence on tourism relying on existing flora &amp; fauna</td>
<td>Dependence on water consumption</td>
<td>Dependence on tourism relying on snow</td>
<td>Dependence on long-haul tourists</td>
</tr>
</tbody>
</table>
Dubois and Ceron (2006) distinguish and propose three main responses to climate change relevant for tourism industry stakeholders:

(1) **Wait until knowledge increases**: This option assumes that short-term responses will be more financially efficient than long-term and precautionary measures. Research should point out the drawbacks of this approach and the problems with which stakeholders could be confronted.

(2) **Trust technology to cope with environmental change**. For example, artificial snowmaking or natural beaches, threatened by increased coastal erosion, can be replaced by artificial ones. Several questions arise from this approach: to what extent could tourism operators endorse this additional investment? Would profitability be maintained? Would customers accept these man-made environments? Would technology be efficient enough to create artificial tourism resources?

(3) **Adopt a precautionary attitude**. This option builds flexibility within the tourism sector and improves its ability to respond to environmental changes. The two major factors influencing the adaptability of the tourism sector are the reversibility of options and the diversity of the tourism supply. For example, developing off-ski activities (hiking trails, pathways, cultural events) in ski resorts may be more effective insurance for the future than investing in artificial snowmaking. In this perspective, climate change responses could be integrated into a broader risk management policy for the tourism sector: diversification also limits sensitivity to economic and other crises.

Widely used are five **types of adaptation measures** that are relevant to the tourism sector that are proposed by Scott, de Freitas, and Matzarakis (2008b) (see also table 20):

1. technical — changes made to physical infrastructure or provisions;
2. business management — changes made by the private sector in their businesses;
3. behavioural — behavioural changes made by tourists or communities;
4. policy — changes in government plans or strategies; and
5. research and education — initiatives to strengthen the understanding of adaptation, explore adaptation options, and educating communities.
Both *structural* as well as *non-structural* adaptation measures are important (Hay & Mimura, 2006). Another division is to divide measures into hard and soft climate adaptation paths (Sovacool, 2011). A *hard* adaptation path might rely on artificial human-built infrastructure, involve large-scale disturbances to local communities and/or ecosystems, be complex and capital-intensive, and use technologies and/or processes owned by foreign firms, and lack flexibility and adaptability to sudden changes in projections of climate change. Such hard adaptation schemes might be expensive, relatively rigid and dependent on large technological systems, although might fulfil the needs and priorities of the communities of the moment of the construction. There is a risk that such buildings and constructions that can last for hundreds years could ‘lock in’ patterns of initial building priorities (Sovacool, 2011; Hassler, 2009). As opposite, a *soft* adaptation path might rely on forms of natural infrastructure or natural capital, such as ecosystems and forests, together with low-impact technology, involve empowering local communities, and building institutional capacity and community assets, use simple and modular technologies, that are less expensive, relatively flexible, and would involve small-scale decentralized adaptation measures, use technologies and/or processes owned by local people and have the ability to respond to alterations in climate change projections. Ayers and Forsyth (2009) define such adaptation paths as ‘community based adaptation’ schemes that operate at the local level, rely on participatory processes of stakeholder inclusion and build on existing cultural norms and local knowledge to address local development concerns. In Kalundborg, Denmark, that is coastal area with important assets for tourism development, stakeholder identification and involvement through the Citizen summit have been implemented to design local adaptation strategy (Bedsted & Gram, 2013).

The European Commission suggests to **classify adaptation options** into three broad categories (EC, 2009) that can be used for coastal tourism industry: (a) a grey infrastructure approach: focusing on engineering techniques and infrastructures, aimed at providing physical protection against climate impacts such as floods and sea level rise, and preventing the adverse effects of climate variability, through heat-resilient road pavements, air conditioning, etc., (b) a green infrastructure approach: based on strengthening the resilience of ecosystems, using trees and green spaces to enhance cooling capacity and lessen flood impacts, and (c) a soft approach: based on the application of policies, procedures, information, communication, education, economic incentives and other price signals. Examples of adaptation measures that are utilised by tourism stakeholders are shown in table 4.
Table 20: A portfolio of climate change adaptations utilized by tourism stakeholders (modified Scott et al., 2008b; Scott et al., 2006; UNWTO & UNEP, 2008; Simpson et al., 2008; Wong et al., 2012; Peric et al., 2013; Dewar, 2005; Runhaar et al., 2012; Becken & Hay, 2007; Steemers, 2003).

<table>
<thead>
<tr>
<th>Type of Adaptation</th>
<th>Tourism Operators/ Businesses</th>
<th>Tourism Industry Associations</th>
<th>Governments and Communities</th>
<th>Financial Sector (investors/insurance)</th>
</tr>
</thead>
</table>
| Technical          | - Involvement in beach cleaning, coastal protection and the community infrastructure  
|                    | - Weather-based infrastructure design  
|                    | - Weather-proof (rain, wind, heat) buildings and transport  
|                    | - Green infrastructure  
|                    | - Utilising extreme weather (storms)  
|                    | - Free access to drinking water and shading  
|                    | - Real-time webcams of weather conditions  
|                    | - Enable access to early warning equipment to tourism operators  
|                    | - Develop websites with practical information on adaptation measures  
|                    | - Green infrastructure  
|                    | - Coastal protection  
|                    | - Ports, roads, and other transport infrastructure  
|                    | - Weather forecasting and early warning systems  
|                    | - Open public access to drinking water, bathing waters, shading  
|                    | - Green infrastructure  
|                    | - Water management  
|                    | - Drinking water supply  
|                    | - Increase sewer capacity/ enhance maintenance  
|                    | - Building design or material (fire resistant) standards for insurance  
|                    | - Financing the developmental infrastructure projects  
|                    | - Insurance from various natural disasters  
| Managerial         | - Contingency plans  
|                    | - Water conservation plans  
|                    | - Change of opening times / sales dates  
|                    | - Product and market diversification  
|                    | - Redirect clients  
|                    | - Weather sensitive marketing and branding  
|                    | - Selling the problem (e.g. storms)  
|                    | - Voluntary actions to preserve the environmental quality and nature resources  
|                    | - Staff adaptation and flexibility related to service quality and management  
|                    | - Communicate, and keep staff, customers and the media appraised  
|                    | - Short-term seasonal forecasts and weather condition reports for marketing  
|                    | - Cooperate with media to improve destination image  
|                    | - Training on climate change adaptation  
|                    | - Encourage environmental management and preservation of nature resources  
|                    | - Cooperation amongst local stakeholders to reopen the destination and cross-selling among local businesses in case of weather hazards  
|                    | - Water conservation initiatives  
|                    | - Impact management plans  
|                    | - Coastal zone management  
|                    | - Spatial planning  
|                    | - Natural disaster management planning  
|                    | - Business subsidies (insurance or energy)  
|                    | - Coordination of policy transfer / innovations in tourism  
|                    | - Coordinate improved destination branding  
|                    | - Ensuring the implementation of laws and policies  
|                    | - Replacement of vulnerable groups  
|                    | - Monitoring and inspections (food quality)  
|                    | - Marketing hazard recovery  
|                    | - Provide information to customers (on weather variability)  
|                    | - Adjust insurance premiums or do not renew insurance policies  
|                    | - Restrict lending to high risk business operations  
|                    | - Banning approvals for high-risk jobs  
| Policy             | - Natural hazards interruption guarantees by insurance and weather derivatives  
|                    | - Comply with regulation (e.g. building code)  
|                    | - Support innovations  
|                    | - Develop and have working emergency plan for severe weather events  
|                    | - Empower  
|                    | - Coordinated political lobbying for climate change adaptation mainstreaming  
|                    | - Seek funding to implement adaptation projects  
|                    | - Support science and innovations  
|                    | - Lobbying for weather-proof tourism  
|                    | - Mainstream adaptation in national and tourism planning and other policy areas  
|                    | - Boosting weather-proof tourism by providing economic incentives  
|                    | - Coastal management plans and set back policy, green infrastructure  
|                    | - Weather-proof  
|                    | - Consider climate change in credit risk and project finance assessments  
|                    | - Support investments to diversification of tourism activities and venues  
|                    | - Finance developmental models in tourism sector  

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Adaptation Measures

<table>
<thead>
<tr>
<th>Employees to make informed and realistic decisions</th>
<th>Building / Urban design standards and location - Support education, training, science and strategic planning, innovations in tourism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research - Site location - Green infrastructure - Water-proof design - Analysing tourism demand</td>
<td>- Assess awareness of businesses and tourists and knowledge gaps - Assess policies - Climate change impacts / adaptation - Informing on changes in ecosystems - Monitoring programs - Extreme event risk exposure (storms, floods, heat waves)</td>
</tr>
<tr>
<td>Education - Water conservation education for employees / guests - Training of staff on emergency procedures and information campaigns in case of extreme weather</td>
<td>- Water conservation campaigns - Campaign on mitigation and adaptation to climate change - Water conservation campaigns - Campaigns on risks of the UV radiation and extreme heat - Campaign on mitigation and adaptation to climate change - Educate and inform potential and existing customers</td>
</tr>
<tr>
<td>Behavioural - Tourists and tourism employees adjusting clothing and changing activities engaged in, timing, and places of visit</td>
<td>- Change of sector behaviour towards resource management and climate information and knowledge - Politicians and civil servants changing attitude and decisions toward tourism and climate change adaptation - Good practice in-house</td>
</tr>
</tbody>
</table>

**Transnational, national and sub-regional policies** have a particular role for tourism and climate change adaptation as a framework for top-down measures as well as supporting bottom-up initiatives with knowledge, organizational and financial instruments. Global tourism industry highlighted the climate change mitigation and the need for further adaptation efforts among tourist businesses and destinations by the Davos Declaration on Tourism and Climate Change (UNWTO, 2007). The knowledge gaps on weather and climate can be reduced by better collaboration of tourism authorities with the small and medium-sized enterprises, and strategic planning would be useful to reduce the tourism industry’s dependence on weather-sensitive (seasonal) activities (Rauken & Kelman, 2012). Better knowledge gained through strategic planning exercises can provide higher confidence, flexibility and minimize uncertainty for the tourism entrepreneurs when dealing with climate change and other global challenges and thus give a better position of the BSR as tourism destination in general. Coordinated marketing at the BSR or national, sub-regional, and cross-border level, as well as pooling resources and publicity through tourism authorities, could be advantageous.

Currently not all countries in the BSR have national legislation or strategies for tourism sector; and not all have national or regional climate change adaptation strategies. The predicted impacts of climate changes for tourism business are diverse. Strategies to adapt to climate change will therefore have to be multidimensional and should cover from small-scale behavioural adaptation of tourists themselves to infrastructural adaptation measures. Development of long-term, local adaptation strategies for tourism destinations and climate impact management plans with reference to local vulnerability and risk assessments is suggested for the tourism industry. It is important that climate change adaptation relevant for tourism is mainstreamed in other policy areas. Climate change
adaptation strategies for public health, food, transport, spatial planning, coastal and marine areas, biodiversity, forestry, construction and cultural heritage sector, if such are or will be adopted can have relevance for tourism and recreation.

**National strategies** of Germany and Finland cover tourism sector (Swart et al., 2009), as well as the report from the Swedish Commission on Climate and Vulnerability has detailed analysis of tourism sector aspects (Swedish Government, 2007). Each country focus on national particularities—Finland and Sweden address reindeer husbandry, Denmark focus on coastal management; Germany's national policy highlights longer summer seasons with positive effects for tourism (Swart et al., 2009). Positive aspects of climate change in terms of its potential for tourism and recreational use of the coasts are also noted by Finland's national adaptation strategy (Marttila et al., 2005), a study on the climate change impacts in the Helsinki metropolitan area (Järvinen et al., 2010), City of Stockholm's climate change adaptation strategy (Ekelund, 2007) and a report on climate change adaptation in Åland (Anonymous, 2011). The same findings are applicable to the rest of the Baltic Sea. Positive outcomes apply especially to summer time recreational opportunities that will improve due to a longer summer and ice-free season and due to increasing water temperature. In addition, Finland's national adaptation strategy anticipates that in the mid- and long-term climate conditions become unfavourable for tourism in Southern Europe. The report states that predictions on where the tourism will be directed are prone to several uncertainties, but there is a possibility that northern areas may benefit from increased tourism (Marttila et al., 2005). Swedish national report states that tourism is one of the vulnerable sectors dominated by small enterprises and thus should be offered proactive information campaigns, education and courses.

There are also several **European Territorial Cooperation and research projects** that have covered climate change and tourism aspects and provide analysis and/or recommendations relevant to tourism and climate change adaptation, e.g. ESPON Climate, BalticClimate ('Baltic Challenges and Chances for local and regional development generated by Climate Change'), AdaptAlp ('Adaptation in the Alpine Arc'), ClimAlpTour ('Climate Change and its impact on tourism in the Alpine Space'), CLISP ('Climate Change Adaptation by Spatial Planning in the Alpine Space'), BaltAdapt ('Adaptation in the Baltic Sea region'), ACCESS ('Arctic Climate Change, Economy and Society'), ClimATIC (Climate change—adapting to the impacts, by communities in northern peripheral regions), COOL Bricks ('Climate Change, Cultural Heritage & Energy Efficient Monuments'), and KeMMI (sustainable tourism in changing climate) (EEA, 2012a; Tervo-Kankare, 2011).

**Aspects suggested for climate change adaptation strategies** are important also for tourism sector (Easterling et al., 2004), e.g. awareness of climate vulnerability (vulnerability assessment and management), awareness of adaptation options (the need to integrate climate risk into innovation processes), uncertainty and motivation (supported by tailored information, incentives to adapt), provision of adaptation spill-over and removing (capital, knowledge, technology, consent, market or infrastructural) constraints on adaptation. Particular attention should be paid to both the innovative and the vulnerable ones in tourism, e.g. places, segments and stakeholders and for that
improvements of adaptive capacity play an important role (Easterling et al., 2004). It has to be checked whether tourism infrastructure, networks and services are robust with respect to current weather conditions, and for this, additional investment is needed. Linkages with other policy domains may yield opportunities for climate related measures in tourism sector, e.g. linking tourism development to spatial planning, stakeholder involvement and social learning (Albert et al., 2012; Jamal & Watt, 2011). By strategically prioritising and implementing low cost adaptation measures first, large investments may be saved in the future in case climate effects in the tourism sector turn out to be severe (Koetse & Rietveld, 2012; Mees et al., 2012). The tourism industry’s private sector relies on public investments and maintenance of public services and thus following public policy objectives related to climate change adaptation are relevant for it: to increase robustness of infrastructures; to inform the potentially vulnerable; to assist in the provision of early-warning and disaster relief; to facilitate, incentivize, guiding and enable adaptation and adaptive capacity; to regulate adaptation ‘spillovers’ and risk-shifting; increasing flexibility and adaptability of vulnerable managed systems; reversing trends that increase future vulnerability by spatial planning and regulating long-term and infrastructural assets and to improve awareness and preparedness, to regulate distributional consequences of adaptation, to provide information, knowledge and learning (Klein & Tol, 1997; Easterling et al., 2004; Berkhout, 2005; Nicholls & Klein, 2005; figure 9).

As a result of the stakeholder meetings a participatory tourism industry research list several issues relevant for climate change adaptation strategies (Turton et al., 2010): 1) adaptation measures that are “green and clean” and sustainable, including water- and energy-saving initiatives; 2) data and knowledge; 3) risk and disaster management, 4) brand recognition and marketing initiatives, 5) planning - the need for improved and better-informed planning of both built and natural environments; 6) community-themed adaptation strategies revolved around the idea of local identity, the need to produce food locally (and support it) and the need for strong community–government relationships, 7) adaptation strategies that focus on the management of resources, both built and natural, and the need for additional resources to support the implementation of adaptation strategies

![Figure 9: Conceptual framework of coastal adaptation to climate variability and change (Nicholls & Klein, 2005).](image-url)
Potential **evaluation criteria for adaptation options** are suggested for the tourism sector (UNWTO & UNEP, 2008): cost; effectiveness; ease of implementation; acceptability to local stakeholders; acceptability to financing agencies, ministries and/or donors; endorsement by experts; timeframe; institutional capacity; size of beneficiaries group; potential environmental or social impacts; and capacity to sustain over time. More detailed indicators relevant for coastal tourism industry are suggested within the preparation of the German Strategy on Adaptation to Climate (Schönthaler et al., 2010, see table 35). **Indicators** relevant for climate change mitigation and adaptation can also be included in eco-labelling certification schemes, e.g. Blue Flag certification, QualityCoast certification and in existing natural resources monitoring and management systems.

**Maladaptation** should be avoided (table 19 and table 21; figure 9), e.g. measures that potentially increase emissions of greenhouse gases (energy-intensive cooling), have high opportunity costs to alternatives, disproportionately burdens the most vulnerable, reduce incentive to adapt and avoid path dependency of infrastructural developments that are difficult to change in the future (Barnett & O’Neill, 2010). As tourism also affects biodiversity e.g. habitats and species, through its contribution to environmental and climate change, options to protect and enhance biodiversity through climate change mitigation and adaptation policies need to be explored in the tourism industry, particularly in close cooperation with the management of nature protection areas (Hall, 2010; Scott et al., 2007; Albert et al., 2012). Considering the fact that tourism and its infrastructure is a major influencing factor for the coastal landscape in the southern BSR there is a risk that adaptation measures are able to significantly change the appearance of the Baltic Sea coast (Gee et al., 2006; table 22).

Case studies suggest that climate change adaptation (and to a lesser extent mitigation, which might better be applied to the industry as a whole) must be incorporated as part of the on-going processes of “destination management” and (community/resource) “risk management” (Turton et al., 2010). Tourism agencies (state tourism organisations, state tourism industry councils, regional tourism organisations and local tourism organisations) need to be proactive in integrating measures relevant for climate change adaptation into tourism destination management and to regional and local government’s statutory planning processes. **Science/theory and practice linkages** in the field of tourism and climate change adaptation have to be developed and maintained.

**Table 21**: Integrating adaptation with mitigation (after Becken, 2005; Milne, 2004; Mills, 2003).

<table>
<thead>
<tr>
<th>Adaptation measure</th>
<th>Mitigation effects</th>
<th>Impact on environmental management</th>
<th>Economic aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather-proof tourist activities</td>
<td>Depends on the type of activities</td>
<td>Depends on the type of activities</td>
<td>High-yield alternative and income for local economy</td>
</tr>
<tr>
<td>Tourist education</td>
<td>Neutral</td>
<td>Increases awareness</td>
<td>Risk of deterring tourists</td>
</tr>
<tr>
<td>Green infrastructure</td>
<td>Reduces net carbon emissions through carbon sinks</td>
<td>Benefits water and flood management, biodiversity, reduces of fire vulnerability, health claims and deaths</td>
<td>Could be included in a carbon trading scheme</td>
</tr>
<tr>
<td>Water conservation</td>
<td>Reduces costs</td>
<td>Positive</td>
<td>Saves costs</td>
</tr>
<tr>
<td>Diversifying markets</td>
<td>Positive if new markets are more eco-efficient</td>
<td>Depends on the environmental impact</td>
<td>Positive if new markets are high yield</td>
</tr>
<tr>
<td>Adaptive response category</td>
<td>Measures of climate change adaptation relevant for tourism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Emphasising Nature         | - Relocate and prevent development: relocation could cause problems to communities; prevention more easily applied when land is in low-density areas
|                            | - Designate additional park protected land: government must take on an additional role in managing. Land that is important for environmental reasons can be protected from development but not adverse climate change effects
|                            | - Create setback buffers: land is set aside through re-zoning or overlays; environmental benefits but can potentially cause socio-economic detriment to communities; potentially the same thing as preventing development
|                            | - Prevent unsustainable land use: through re-zoning and overlays; would need to work on capacity-building and community involvement; vulnerable environments would benefit
|                            | - Create wetland buffers and revegatate vulnerable areas: more natural; lower costs with little upkeep; sympathetic to environment but not development
|                            | - Develop new ski terrain and paths in climatically advantaged locations (north facing slopes, higher elevations) |
| Emphasising Development    | - Private insurance for vulnerable properties: accepting the risks and compensating private property owners but not the environment
|                            | - Let developers accept full risk: land is being abandoned to private market forces; government or research could advise developers on risks but public safety is an issue
|                            | - Elevate buildings and change building codes: re-zoning and changes in building plan requirements must be coordinated locally; costs could be high to community or private property owners but not to environment; in high-density areas without other options could be beneficial
|                            | - Build hard structures (such as dykes and levees): high costs but interfere with natural processes; community impact—amenity losses; must continue protection long term
|                            | - Diversify tourism product and market. In ski resorts provide alternate activities for non-skiing visitors (e.g., snowmobiling, skating, dog sled-rides, indoor pools, health and wellness spas, fitness centres, squash and tennis, games rooms, restaurants, retail stores).  
|                            | - Become ‘four season resorts’, offering non-winter activities such as golf, boating and white-water rafting, mountain biking, paragliding, horseback riding and other business lines (spas, conference facilities) |
| Managed Nature             | - Beach nourishment (or nourishment): soft engineering solutions good for amenity beaches; high cost and upkeep over time; more natural but still do not interfere with development
|                            | - *Ex situ* conservation |

Tourism sector climate change adaptation dominate reactive than proactive measures. That can be explained by a lack of long-term view in tourism industry itself. Low interest to strategic planning, research and training if staff is caused by the high complexity of tourism and recreation, the dependence from other sectors as transport, nature and culture heritage management, catering and
retail, safety and public health provision and the fragmentation of the tourism sector itself (Hjalager, 2010). The dominance of micro- and small- and medium- enterprises limits innovation processes. Limited human, social and financial resources and a lack of skilled staff and training possibilities are disincentives for innovation, as well as knowledge sharing across the sector. Innovation research in tourism is a recent phenomenon. Challenges of diffusion of tourism innovations are in their increasingly global nature; thus diffusion channels are crucial, and so is a better enquiry into the spatial and social implications (Hjalager, 2010; table 23). Tourism industry has low innovation capacity, there is little research and knowledge in regard to innovation and tourism and particularly on the role of the government. Case study from Norway indicates that government's role may be too passive as much of tourism innovation is dependent on private sector initiatives (Mei et al., 2012). A report by ECORYS (2012a) is stating that skilled professionals are essential and currently mostly missing in tourism sector, particularly in poorest maritime regions where coastal tourism might have a greater impact for local economy. The exception is few large companies, although they have limited spill-over effects. Berkhout (2005) notes that not only the vulnerable' but also the innovative need to be protected and supported by adaptation measures that will draw on resources (including capital, knowledge, technology and consent) that are not held by the adapting agents themselves. There is need to support these actors that are innovative and provide adaptation spillovers in the sector and generate a rationale for policy and legal interventions (Berkhout, 2005). Adaptation measures are needed to motivate stakeholders and to communicate collective, broad-scale benefits from adaptation. There is a need to encourage policy and best practices transfer within the industry and beyond the tourism industry itself, e.g. hotel industry and airlines should work together, and tourism destination, marketing and management need to be coordinated in coastal destination to accommodate climate change challenges (ECORYS; 2012a). Disregarding small but successful niche market, growing sophistication and expectations of tourists mean that technology and expertise are indispensable for the creation/maintenance of competitive destinations (Butler, 2009). Tourists will expect destination brands that are trustworthy, ethical and sustainable, that take care of social and environmental issues (Butler, 2009), including climate change adaptation aspects.

<table>
<thead>
<tr>
<th>Table 23: Types of tourism innovations (modified Hjalager &amp; Flagestad, 2012; Mei et al., 2012; Hall, 2009; Hjalager, 2010; OECD &amp; Statistical Office of the European Communities, 2005; Ottenbacher &amp; Gnoth, 2005).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core product or service innovations</strong></td>
</tr>
<tr>
<td>Changes that are observed by the customer as new (e.g. wellness)</td>
</tr>
<tr>
<td>Product diversifications (e.g. expand the notion of well-being)</td>
</tr>
<tr>
<td><strong>Process innovations</strong></td>
</tr>
<tr>
<td>New or significantly improved methods from production or delivery which aim to escalating efficiency, productivity and flow</td>
</tr>
<tr>
<td><strong>Managerial or organizational innovations</strong></td>
</tr>
<tr>
<td>New or significantly improved ways of organising internal collaboration related a firm’s business practices, workplace organisation or external relations</td>
</tr>
<tr>
<td><strong>Technological innovations</strong></td>
</tr>
<tr>
<td>New technologies and methods to provide tourism services</td>
</tr>
<tr>
<td><strong>Marketing innovations</strong></td>
</tr>
<tr>
<td>New or significantly improved marketing methods including co-production of brands</td>
</tr>
<tr>
<td><strong>Institutional innovations</strong></td>
</tr>
<tr>
<td>New or embracing collaborative/ organisational structure and legal framework which redirects or enhances the business in fields of tourism</td>
</tr>
</tbody>
</table>
It is expected that tourism business with cooperation with other sectors will be more active in providing **innovative products** through utilization of basic and specialized climate information design for tourism needs (Scott & Lemieux, 2010). Innovative **weather derivatives and index insurance products** that are available from individual businesses to national governments have been developed on the basis of the historic climate data, although participation of the tourism sector in the weather derivatives market has remained rather limited and this has been seen as potential to develop innovative partnerships with the financial services sector to reduce weather-related revenue loss (Scott & Lemieux, 2010). If weather insurance covers firms against high risk, low probability events normally caused by severe weather such as floods, hurricanes, windstorms and hailstorms; then, by contrast, weather derivatives are designed to compensate firms for low risk high-probability events, such as dry or wet periods or cold or warm seasons in a region that affect the turnover of businesses (Pollard et al., 2008). Barrier to implement insurance products that are aware of actual risk levels and adjust premiums in tourism sector is a lack of access to affordable insurance and a lack of finance (Becken & Hay, 2007). Thus changes of insurance policy and use of innovative financial instruments, e.g. weather derivatives (Tang & Jang, 2012; Pollard et al., 2008) can be promoted in the BSR. It is necessary that climate-related information is taken into account when decisions on site selection and investments for development of new resorts, venues and accommodations are taken; observation show that climate information is utilised more extensively in engineering, construction planning, property design and maintenance (insurance, heating–cooling) (Scott & Lemieux, 2010).

Natural and institutional **seasonality** creates seasonal tourism flows, spaces of seasonal tourist concentration, seasonal tourism venues and activities, e.g. summer or winter tourism resorts. Traditionally seasonality in tourism was a regular and predictable cycle of tourist visitation across a year. With the climate change the seasonal patterns of visitation might be influenced, as effect of possible changing seasonality of tourism across Europe has been studied in larger extent (Berkhout, 2005). The consideration of the maximum and minimum value months is one of the approaches to understand the seasonal cycles (table 24). There are differences among the countries of the BSR that might be caused by the fact that in countries with more pronounced seasonality like Denmark and Sweden, tourists spend nights more in camping sites then in hotels, domestic tourists dominate and indoor and winter tourism activities are less developed. Destinations of the Baltic Sea islands and coastal resorts (Twining-Ward & Baum, 1998; Nyberg, 1995; Cooper, 1990) are highly affected by seasonality and have rather low diversification of tourism products, and thus they are sensitive to climate change impacts. Northern destinations in the EU suffer not only from short seasons, but also they are located in peripheries and their tourism infrastructure needs upgrading (ECORYS, 2012a). Climate change adaptation for tourism industry can occur in spatial terms (other destination) or in temporal terms (other season) or both, e.g. to reduce vulnerability to climate change tourism businesses and destinations can offer a diverse set of holiday activities - all-year tourism, less climate-dependent types of tourism, or technical measures (Amelung & Moreno, 2012). The European Commission is promoting measures to overcome seasonality challenges. It is expected that national...
Climate Change Impacts on Coastal Tourism in the Baltic Sea Region

and regional governments will assist more to tourism sector in this aspect, for instance fault marketing to focus only specific seasons is widely spread. The EU wide review on tourism sector notes that over-marked seasonality result in losses of efficiency (ECORYS, 2012a). There is an argument that adaptation options are available by harmonizing institutional seasonality to natural seasonality, relying more on tourism attractions that are climate-proof or creating ‘four seasons’ destinations or compensating shift in temporal seasonality with changes spatial patterns of tourism flows. National governments and the European Commission are advising tourism industry and destinations to minimize seasonality impact that is causing various negative aspects in cash flow, tourism employment, use of tourism infrastructure and transport, causing crowds, congestion and negative environmental impacts like under-utilization of resources (water treatment facilities) or over consumption (beaches, nature and culture heritage). The length of the operating season is sensitive to climate change and thus any changes in season length would critically implicate the short- and long-term viability of tourism and recreation enterprises. Working towards diminishing impacts of seasonality and opening destinations for all four seasons could make destinations not only weather proof, but also sustainable in economic, social and environmental aspects.

Seasonality is perceived as one of the largest challenges that face tourism industries in higher latitudes. At high-latitude destinations the natural seasonality is difficult to overcome as it depends not only from climate elements but also from the hours of daylight (Koenig-Lewis & Bischoff, 2005; Butler, 1994; Baron; 1975). Various forms of initiatives to counter seasonality have been promoted (1) off-season events and festivals; (2) market diversification; (3) product diversification; and (4) structural and environmental response (Baum & Hagen, 1999). The study on marine ecotourism proves that ecotourism tend not be so reliant upon the season in question, ecotourists being less concerned with climatic conditions in general than traditional seaside tourists (Garrod & Wilson (2004). As tourism industries and destinations in different countries (table 24 and table 25) have different approaches and successes to coupe with seasonality it might be useful to exchange the best practice in the context of changing climate.

Table 24: Seasonal variation in occupancy of collective tourist accommodation, monthly data, 2009, Eurostat (Demunter, 2010).

<table>
<thead>
<tr>
<th>Country</th>
<th>Tourism nights spent in the peak month ('000) and share of the tourism nights spent in the busiest month</th>
<th>Tourism nights spent in the bottom month ('000)</th>
<th>Ratio peak/ bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU-27</td>
<td>385 606</td>
<td>Aug 17%</td>
<td>100 438</td>
</tr>
<tr>
<td>Denmark</td>
<td>6 340</td>
<td>Jul 24%</td>
<td>684</td>
</tr>
<tr>
<td>Sweden</td>
<td>10 579</td>
<td>Jul 22%</td>
<td>2 210</td>
</tr>
<tr>
<td>Norway</td>
<td>5 427</td>
<td>Jul 19%</td>
<td>1 223</td>
</tr>
<tr>
<td>Lithuania</td>
<td>398</td>
<td>Jul 16%</td>
<td>126</td>
</tr>
<tr>
<td>Poland</td>
<td>8 689</td>
<td>Jul 16%</td>
<td>2 843</td>
</tr>
<tr>
<td>Estonia</td>
<td>642</td>
<td>Jul 16%</td>
<td>226</td>
</tr>
<tr>
<td>Germany</td>
<td>40 825</td>
<td>Aug 13%</td>
<td>15 217</td>
</tr>
<tr>
<td>Finland</td>
<td>2 851</td>
<td>Jul 15%</td>
<td>1 127</td>
</tr>
<tr>
<td>Latvia</td>
<td>350</td>
<td>Jul 14%</td>
<td>143</td>
</tr>
</tbody>
</table>
Table 25: National Strategy for tourism and measures to reduce the seasonality of demand; information from annual information on tourism in the EU member states 2008-2011 requested by a Draft Annual Tourism Reporting Template (EC, 2012; * information on Finland from Tervo-Kankare, 2011).

<table>
<thead>
<tr>
<th>Countries</th>
<th>National strategy for tourism</th>
<th>Measures to reduce the seasonality of tourism demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estonia</td>
<td>National Development Plan for Tourism 2007-2013</td>
<td>Support to regional destinations and SMEs to develop and market products and services for low seasons (well-being tourism, conference tourism)</td>
</tr>
<tr>
<td>Latvia</td>
<td>Latvian Tourism Marketing Strategy 2010-2015; Guidelines of Tourism Development Policy of Latvia</td>
<td>Domestic tourism promotion in off-season Promotion of tourist destination which provides a wide range of tourism products and services throughout the year</td>
</tr>
<tr>
<td>Lithuania</td>
<td>National Tourism Development Programme 2010-2013</td>
<td>Promotion of health tourism, business (conference) tourism; cultural events in resorts</td>
</tr>
<tr>
<td>Poland</td>
<td>Directions for Tourism Development until 2015 (adopted in 2008)</td>
<td>Support to innovative products which reduce the seasonality of demand; Participation in project European Senior Travellers</td>
</tr>
<tr>
<td>Sweden</td>
<td>No governmental national strategy for tourism National strategy for Swedish tourism sector 2010-2020, created by Swedish Travel and Tourist Industry Federation (RTS)</td>
<td>No action</td>
</tr>
<tr>
<td>Denmark</td>
<td>Danish Tourism towards 2015 (adopted in 2008) Action plan for sustainable development of Danish tourism with focus on climate and environmental issues</td>
<td>Participation in project “All-year tourism” 2006-2009 with the aim to attract more tourists off-season, focus on innovations and branding</td>
</tr>
<tr>
<td>Finland*</td>
<td>Finland’s Tourism Strategy to 2020 &amp; Action Plan for 2007-2013</td>
<td>Considering season lengths in the construction of tourist destinations and product development; development of supplementary products especially in Southern Finland; strengthening anticipation, provision and adaptation; increasing international cooperation</td>
</tr>
<tr>
<td>Germany</td>
<td>Tourism policy guidelines of the Federal Government, adopted in 2008 (Climate change impacts are mentioned)</td>
<td>Advocates staggering the school summer holidays in the Länders, in order to bring about a broader utilisation of available capacity in the hotel and restaurant sector</td>
</tr>
</tbody>
</table>

There is wide range of studies on adaptation strategies to winter tourism, for adaptation strategies to alpine skiing in Sweden (see Table 26). While skiing can rely on artificial snowmaking, there is no technical option for other outdoor winter activities that rely on snow and ice availability and their quality. This change in winter tourism destinations and proposed tourism products will shift tourist flows and businesses to other areas, can cause the decline of winter tourism resort and will require destinations restructuring. With further diminished natural snowfall, increased mid-winter melts and more variable ski season many ski resorts have made substantial investments to provide alternate activities for non-skiing visitors (e.g., snowmobiling, skating, dog sled-rides, indoor pools, health and wellness spas, fitness centres, squash and tennis, games rooms, restaurants, retail stores). Other former ‘ski resorts’ have further diversified their business operations to become ‘four season resorts’, offering non-winter activities such as golf, boating and white-water rafting, mountain biking, paragliding, horseback riding and other business lines (spas, conference facilities) (Simpson et al., 2009). Thus product and market diversification is becoming a common adaptation strategy for winter tourism. Adaptation practices that are identified as used among ski area operators are (1) technological (artificial snowmaking systems, landscaping, slope development and operational practices to change location (higher altitudes and north facing slopes), cloud seeding) and (2)
business practices or behavioural (ski conglomerates, revenue diversification, marketing, indoor ski areas, snow insurance, weather derivatives, improved climate forecasting, real-time web cameras, cooperation with media, government subsidies for snowmaking) (Scott & McBoyle, 2007; Agrawala & Fankhauser, 2008; Hoffmann et al., 2009). Gössling et al. (2012) warn that media has speculation tendency as regards weather and weather related events, thus in order to keep long-term reputation disinformation about destinations should be avoided. Ski conglomerate is an option to solve the problem that firms with ski resorts in a single region or independent small–medium size ski enterprises are at greater risk to poor climatic conditions. Although not intended as a climate adaptation, the ski conglomerate business model provides greater access to capital and marketing resources, thus enhancing adaptive capacity, but also reduces the vulnerability of the conglomerate to the effects of climate variability and future climatic change, through regional diversification in business operations (Scott & McBoyle, 2007). Product diversification for skiing resort might additionally include such measures as to develop hiking trails, offer theme hiking, organize summer-events (e.g. concerts), develop bike/downhill routes, offer adventure and fun sports (e.g. paragliding), develop gastronomy, build a summer toboggan-run, establish winter toboggan runs, snowshoeing trails and winter hiking trails (Hoffmann et al., 2009). New snow insurance products and particularly weather derivatives are suggested to use for affected skiing operators (Bank & Wiesner, 2011). Compensations for reduced snowfall by artificial snowmaking are already common practice for coping with year to-year snow pack variability (Schneider et al., 2007). When problem of not viable winter attractions are solved by developing all-year tourism activities; there is a positive social effect with job opportunities for local community (Moen & Fredman, 2007). There is an uncertainty of the ski industry responses to the impacts of climate change, as researchers noted that investment cycles of ski industry are typically less than 10 years and thus currently climate change does not perceived as urgency (Bicknell & McManus, 2006; Becken, 2013). Several issues of concern are identified in relation to climate change adaptation of Alpine tourism that can be reconsidered for the destinations in the BSR - representation and leadership, stakeholder relationships (socio-political barriers), data and statistics (lack of consistency in tourist-related data gathering and reporting), seasonality and weather variability (season-specific tourism offer, observed extremes and shifts in weather patterns and variability), natural disaster management (post-disaster recovery and access to support for re-building, as well as the media’s role in the recovery process), business capacity (skills shortage, employability and lack of adequate business skills), infrastructure and transport, exposure to external factors of macro-scale (fluctuations in economic indicators such national currency, interest rates, inflation, GDP growth and fuel price) (Roman et al., 2010).
### Table 26: Adaptation strategies to alpine skiing in Sweden (Moen & Fredman, 2007; after Elsasser & Bürki, 2002).

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Activity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Maintain ski tourism</td>
<td>Artificial snowmaking</td>
<td>Expensive and requiring sub-zero temperatures</td>
</tr>
<tr>
<td></td>
<td>Development of higher terrain</td>
<td>Generally not possible in Sweden</td>
</tr>
<tr>
<td></td>
<td>Cooperation/expansion into areas with more reliable snow</td>
<td>Will diversify income structure</td>
</tr>
<tr>
<td>2. Subsidies</td>
<td>Government subsidies</td>
<td>Only viable for short periods if politically possible</td>
</tr>
<tr>
<td>3. Alternatives to skiing</td>
<td>Non-snow related activities in winter</td>
<td>More choices may attract tourists even if snow is lacking</td>
</tr>
<tr>
<td></td>
<td>All-year tourism</td>
<td>Develop summer tourism</td>
</tr>
<tr>
<td>4. Fatalism</td>
<td>Business-as-usual</td>
<td>Do nothing and hope for the best</td>
</tr>
<tr>
<td></td>
<td>Cancel ski tourism</td>
<td>Give up</td>
</tr>
</tbody>
</table>

**Winter resorts** in the BSR might have to start looking for new innovations how to enable traditional winter sports and activities in the next few decades (Koponen & Pesonen, 2012). New technical adaptation measures are suggested: indoor skiing tunnels, styrofoam hills, or new materials introduced by nanotechnological solutions either in sport equipment or facilities. Another adaptation option with focus on management are proposed - create alternative non-winter activities, even year-round activities, thereby being prepared to less or even no snow (threat) for places that are specialised as winter resorts presently. How far society will accept technical adaptations to decreased snow cover are closely linked with preferences and values of tourists, are they will use such new technologies as indoor snow domes with artificial snow-making machines, artificially cooled cross-country ski tracks (O’Brien, 2009) or instead tourists will walk, run or bike in outdoors and will enjoy natural landscapes. Today artificial snowmaking that has been used since 1952 is an integral part of most winter resort operations (Scott & McBoyle, 2007). Snowmaking comes with environmental and financial costs (Moen & Fredman, 2007). The adaptation versus mitigation dilemma is to be found in winter tourism. If investment in snowmaking (by using renewable energy resources) allows ski areas nearer to major urban market centres to remain operational, this technological adaptation prevent thousands of ski tourists from travelling at larger distances (by car, buss or plane) (Scott, 2011). In Sweden ski resorts in the north are further from population centres; costly to travel and ski (Moen & Fredman, 2007). Snowmaking has become the most widespread climate adaptation used by the ski industry although there are environmental barriers to the increased used of snowmaking in Europe, e.g. high energy costs, challenges to securing adequate water supply, stress to local fauna and flora, and environmental pollution (e.g., chemical additives that allow snowmaking at temperatures near 0°C are banned in Germany) (Scott et al., 2008b).

In Finland **cross-country skiing** is not only a popular way to spend active holidays, but also an everyday sport and leisure activity, and it was traditional that at a distance of approximately 1.5 kilometres from the place of residence there is a suitable ski area with prepared ski tracks (Pouta & Sievänen, 2001; Landauer et al., 2009). Research on cross-country skiing notes (Landauer et al., 2009) that before any adaptation measure to be planned it is crucial to obtain correct information on tourists and their recreational behaviour that are involved in the affected activity. Skiers that are
focused on skiing as sport will not accept all-season activities, snow-independent activities and cultural activities as substitute options while these tourists that were skiing for the sake of socializing and nature experience are more likely to adapt alternative activities (Landauer et al., 2009). Short-term adaptation strategies for cross-country skiers have been suggested (Neuvonen et al., 2005) - when skiing conditions close to home are poor could include travelling to more distant locations, using artificial snow tracks, choosing snow-independent activities or investing in new types of recreation equipment using high-tech solutions. In the longer term, changes in winter recreation activity preferences and choices are to be expected (Landauer et al., 2009) as winter sport tourists prefer regions with reliable snow conditions. There are studies on skiers’ climate-induced behaviour change that are based the theory of “recreation substitution” (Iso-Ahola, 1986) that suggests that when individuals are no longer able to participate in an activity, they generally substitute that activity with another. In the relation with climate change the following research questions have been studied: the extent to which individuals change their participation habits by substituting skiing for another activity (activity substitution), participating less or more during a shortened ski season (temporal substitution), or travelling to other ski areas with better snow conditions (spatial substitution) (Dawson et al., 2011a). Winter tourist behavioural adaptation to climate change is complex; climate-induced substitution patterns are influenced by tourist commitment to skiing (individual’s level of experience) and by the extent to which involved skiers are committed to particular ski areas (i.e., loyalty) (Dawson et al., 2011a). Several studies noted that expert skiers are disproportionately more likely to continue skiing despite marginal snow conditions than to beginner level skiers (Dawson et al., 2011a). One third of surveyed skiers in Switzerland and Australia responded that they would ski less often at the same locations (temporal substitution) and another third would go elsewhere (spatial substitution) and only five percent of surveyed skiers would stop skiing entirely (Scott et al., 2008c). Finnish skiers expect society to provide support for skiing activities and are not in general willing to pay for opportunities to ski (Landauer et al., 2009). Finnish study indicates that cross-country skiers are not willing to pay for skiing in general; they expect some support from society for the provision of skiing services. For instance, ski cards have been proposed as a solution (Landauer et al., 2009). Today’s market is not accepting fees for cross-country skiing as this winter tourism and recreational activity has been a part of the ‘Right of Public Access’ and therefore free of charge (Neuvonen et al., 2005; Landauer et al., 2012).

Coastal tourism is highly sensitive to the characteristics and the quality of beaches and the environmental and scenic qualities of shoreline and hinterland and access to the beaches. Coastlines and beaches have been often viewed by tourism industry as stable permanent assets, in reality they tend to be dynamic, and this process will intensify with climate change (Phillips & Jones, 2006). Adaptation to coastal erosion and sea level rise starts depends from interdisciplinary knowledge that starts with scoping of a problem and relevant data and information collection and analysis. In 1992, the former Coastal Zone Management Subgroup of the IPCC published the Common
Methodology for Assessing the Vulnerability of Coastal Areas to Sea-Level Rise, where impact indicators were considered, as follows (IPCC CZMS, 1992):

1. People affected (the people living in the coastal floodplain that are affected by sea-level rise);
2. People at risk (the average annual number of people flooded by storm surge);
3. Capital value at loss (the market value of infrastructure which could be lost due to sea-level rise);
4. Land at loss (the area of land that would be lost due to sea-level rise);
5. Wetland at loss (the area of wetland that would be lost due to sea-level rise);
6. Potential adaptation costs, with an overwhelming emphasis on protection;
7. People at risk, assuming the adaptation considered in indicator 6.

For tourism and recreation sector it is important that these indicators are supplemented with people visiting affected area – recreants, tourists and seasonal (second home) residents and with affected coastal tourism infrastructure, beaches, lagoons and other landscapes used by tourists (Hinkel & Klein, 2009)

Adaptation to coastal erosion and sea level rise can include various types of adaptation measures, although most often used and studied are technical solutions, while change of destination brand images and thus the change of tourist and host communities perception and behaviour (Donges et al., 2013) might be less costly and more environmentally friendly option (table 27). For new long-life (decades or longer) coastal tourism infrastructure and buildings it is important that adaptation to sea-level rise is considered at the design stage. Retrofitting existing infrastructure is considerably more expensive than designing it to be more flexible or more robust in the first place, additional adaptation costs being negligible in terms of initial building costs (Tol et al., 2008) Anticipatory adaptation is implemented before impacts of climate change are observed, while reactive adaptation takes place in response to impacts. In natural systems adaptation is always reactive, whereas in human systems both reactive and anticipatory adaptations are observed. The goal of reactive adaptation is to minimise damage or maximise opportunities, as well as to prepare for a future similar event (Tol et al., 2008).

The changing coastline might become the tourism attraction itself, if adequate information and education and awareness rising are provided. Stories on the natural and man-made history of coastlines as well as local cultures and heritage of long-lasting coastal protection activities as experienced in the southern and eastern regions of the Baltic Sea can become tourism attraction itself. There are examples from other regions, particularly the North Sea where impressive coastal protection structures are a part of tourism product. Wide beaches with fine sand surrounded by natural landscape (coastal forests or meadows) are considered as one of the most important natural resources. At the same time beaches that are still naturally accumulating material and coast with other natural processes could become tourism attraction itself if tourism industry properly informed. For solutions available to protect beaches against rising sea levels and altered erosion processes see Baltadapt report #5 (Krämer et al., 2012).

There are numerous studies that argue that constructional measures – such as flood barriers, dunes, dikes, and groins are not attractive for tourists if not properly design. Until now coastal
protection has been considered as technical issues and with almost no participation by stakeholders, including those who represent tourism and recreation interests (Storbjörk & Hedrén, 2011). At the same time there are long-term experience with piers and coastal promenades built with the purpose as tourism attraction (Żaromskis, 2007). Various types of coastal protection structures have been built along 26% of the Polish coastline, including about 98 km that are protected by groynes and 41 km are protected by light and heavy revetments (Pruszak & Zawadzka, 2008). Dikes protect about 1100 km of the coastline and hard structures about 700 km of the Danish relatively long (7400 km) coastline. Besides that soft solutions, especially beach nourishment, are increasingly used (Fenger et al., 2008).

Research has found that in Denmark until recently direct planning for sea-level rise due to climate change “has been modest and purely qualitative. The same applies to most new and upgraded coastal infrastructure, where the approach has largely been a “wait and see” attitude” (Fenger et al., 2008). Danish coastal planning has more attention to the impacts on coastal ecosystems, especially saltmarshes and sand dunes, with unofficial or absent economical evaluations. Researchers believe that “the choice of action will depend on attitudes to and weighing of economic, sociological, and biological interests and options. The general strategy appears to be toward the preservation of a natural coastline, if necessary at the cost of land loss” (Fenger et al., 2008).

Three basic strategies are used to reduce coastal communities’ vulnerabilities towards sea-water level rise and coastal erosion (IPCC CZMS, 1992; Munasinghe & Swart, 2005; Tol et al., 2008; Agrawala & Fankhauser, 2008; Eichhorst et al., 2010; Mather et al., 2005; Schmidt-Thomé & Klein, 2011):

1. ‘Protect’ or to reduce the risk of the event by decreasing its probability of occurrence; this means to protect land from sea so that existing land uses can continue, can include hard (e.g. sea-walls, groynes) and soft (e.g. beach nourishment) measures, protection measures are often ‘external’ solutions.

2. ‘Retreat’ or to reduce the risk of the event by limiting its potential effects; this can include retreating from areas at high risk from climate hazard and in the extreme case abandon the endangered coastal area, but also avoiding development in these areas through planning. In modern times the most seldom applied concept. Pre- and post disaster retreat are distinguished. The first strategy is possible if reasonable understanding exist on the potential disaster the impact of a hazard might cause. The post-hazard retreat is used a protective measure that is implemented prior rebuilding after hazard.

3. ‘Accommodate’ or to increase society’s ability to cope with the effects of the event, that means continue to occupy the land but make some adjustments by adopting tourism system or infrastructure itself, and can include also both hard (e.g. improvements of structures and vehicles, the use of temporary homes or homes of pillars) and soft (e.g. tourism routes and schedules, growing flood or salt tolerant plants) measures.
**Table 27: Options for adaptation of coastal areas** (Klein & Tol, 1997; Nicholls & Klein, 2005; Nicholls et al., 2007; Mimura, 2010).

<table>
<thead>
<tr>
<th>Proactive adaptation</th>
<th>Coastal adaptation</th>
<th>Options</th>
</tr>
</thead>
</table>
| Increasing robustness | Protection         | Land use planning  
Hazard delineation  
Proactive planning to avoid harmful impacts  
Changes of land use and land use patterns  
Change water abstraction  
Protection of coastal ecosystems  
Strict regulations in disaster-prone areas  
Flood-proof buildings  
Creating green infrastructure by planting trees, bushes, grass or re-creating wetlands  
Disaster insurance |
|                     |                    | Hold and advance the existing coastline by protection through hard structural measures:  
• disaster-prevention: dikes, seawalls, floodgates, estuary closure, empoldering, land claim  
• anti-erosion measures: jetties, detached breakwaters  
Water resource management: weirs, walls against saltwater intrusion  
Protection through soft technologies:  
• anti-erosion measures: beach nourishment, protection of sand beaches  
• conservation of coastal ecosystems: protection of marshes, afforestation |
| Increasing flexibility | Accommodation | Land use planning  
Hazard delineation  
Proactive planning to avoid harmful impacts  
Changes of land use and land use patterns  
Change water abstraction  
Protection of coastal ecosystems  
Strict regulations in disaster-prone areas  
Flood-proof buildings  
Creating green infrastructure by planting trees, bushes, grass or re-creating wetlands  
Disaster insurance |
|                     |                    | Evacuation from highly vulnerable coastal areas  
Subsidies for relocation  
Retreat the line: managed realignment  
Building set backs  
Limited intervention (ad hoc seawall)  
No intervention (monitoring only) |
| Enhancing adaptability | Retreat            | Project appraisal methods  
Sustainable adaptation (wetland restoration) |
|                     |                    | Development regulations for disaster-prone coastal areas  
Land use and regional planning  
Community-focused adaptation  
Flood hazard mapping, flood warnings |
| Reversing maladaptive trends |                    |                     |
| Improving awareness and preparedness |                    |                     |

**Beach and dune management** has attracted enduring academic and policy interest (table 28, 29 and 30). The protection, vegetation and stabilisation of dunes, the maintenance of sediment supply and the provision of buffer zones, rolling easements or setbacks that allow the landward migration of the coastline are favourable for coastal resilience and ecological processes (Defeo et al., 2009), however can be implemented in coastal areas with lower anthropogenic impact, where built-up structures, resident and tourist densities are lower than urban. In areas with low population density flexible response options, such as partial set-back of dikes in areas, could offer more sustainable solutions to the aggravating problem of coastal squeeze (Sterr, 2008). There is an agreement across the Mediterranean basin (Sanò et al., 2011) that the coastal setback of 100 m in the context of coastal erosion and climate change is starting point for coastal zone policies. Studies indicate that coastal setback lines are delineated on the basis of a multiple of the annual erosion rate; or a distance from a prominent natural coastal feature, such as a foredune or vegetation line; or an arbitrary value (Nordstrom, 2000). Erosion control setback lines are designed with various purposes, e.g., to minimize loss of life and property; to reduce public costs; to protect public access and use of the beach; to protect natural features; to provide a natural buffer area for beach mobility; and to preserve visual
openness and aesthetic values (Nordstrom, 2000). The Mediterranean study highlights that “this provision should be considered as a reference value but it should be integrated with more deterministic approaches in the future, used to identify both the future high water mark position and setbacks, to (i) defend and adapt human settlements (ii) provide space for dynamic environmental processes (iii) protect sensitive coastal ecosystems and landscapes, both in sedimentary and rocky coasts and (iv) provide public use and accessibility to one of the last commons” (Sanò et al., 2011).

Roads, bridges and ferry landings that are potentially affected by sea level rise are being identified in Norway. It is believed that as preventative adaptation measure there is a need to take into account climate-change effects in the legislation already in place to regulate and guide coastal construction. Currently Norwegian regulations and guidelines estimate the required height to allow for rough weather conditions, such as strong winds and storm surges without sea-level rise impacts (Aunan & Romstad, 2008). Nordstrom (2000) lists main objectives of national programs that have impact on evolution of beaches and dunes:

- acquire sites in order to ensure their long-term conservation and meet projected needs,
- maintain the image of the coast and build up a heritage to be passed on to future generations;
- plan and manage sites to make them accessible to a public respectful of the natural environment;
- create protection easements to prevent or control type and density of construction close to the beach;
- shift the concept of coastal property to public uses that require no fixed installations;
- institute regulations for declaring accreting areas as public property;
- provide strict limits for locating concessions and installations on beach;
- prevent mining of beach materials and mining of materials on tributaries;
- provide for hazard mitigation and protection against natural disasters;
- protect existing beach and dune systems from human-induced erosion;
- regulate use of fill or disposal of incompatible materials;
- give priority to water dependent uses;
- avoid exploitation that threatens coastal resources;
- provide for environmental quality, recreation and property protection;
- carry out cost-effective strategies;
- develop a program to pay for the management strategy and obtain commitments for financing;
- provide a long-term (e.g., 20 to 50 year) strategy;
- use strategies that mimic natural processes when they are equal to alternatives in cost effectiveness;
- adopt proactive planning programs rather than case-by-case decisions on permit applications;
- give consideration to cumulative impacts.

In Australia the principles for an intergovernmental agreement on coastal planning and climate change have been developed (Norman, 2009) that combine the precautionary principle, evidence-
based risk assessment, natural resource management, urban and regional planning, and community engagement and seek to build the essential bridge between the social and physical sciences in responding to climate change. The following principles are proposed for ‘An intergovernmental agreement on coastal planning and climate change’ (Norman, 2009):

1. That a coastal climate change buffer zone be declared to underpin a precautionary approach to coastal development in proximity to the coastal foreshore;
2. That coastal dependent uses be the primary land use activity on coastal public lands;
3. That an ongoing evidence-based assessment of cumulative risk and impact of climate change impacts on the coastal environment be undertaken to advise government and industry policy responses;
4. That the importance of community engagement in place-based solutions be recognised as critical to achieving sustainable outcomes;
5. That ‘sustainable regional plans’ for managing urban growth and infrastructure be recognised as a key policy instrument in implementing integrated coastal management;
6. That the intrinsic value of natural and cultural heritage and indigenous interests in coastal planning be recognised in developing responses to climate change; and
7. That capacity building for local communities including tools for climate change adaptation is supported over the long term.

Table 28: Current status of adaptation to sea-level rise and climate change along Europe’s coasts for selected countries in the BSR (Tol et al., 2008).

<table>
<thead>
<tr>
<th>Country</th>
<th>Sensitivity</th>
<th>Awareness</th>
<th>Planned Adaptation</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estonia</td>
<td>Potentially large impacts on coastal ecosystems</td>
<td>Low</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Germany</td>
<td>Potentially large impacts on coastal zone, with limited consequences for people and economy</td>
<td>High</td>
<td>Current regulations under reconsideration</td>
<td>Monitoring of sea level, climate, and erosion; upgrading of new infrastructure</td>
</tr>
<tr>
<td>Finland</td>
<td>Large invulnerable</td>
<td>Very low</td>
<td>None</td>
<td>Monitoring of sea level and Climate</td>
</tr>
<tr>
<td>Lithuania</td>
<td>Potential increases in erosion and flooding; negative impacts on harbours</td>
<td>Low</td>
<td>None specifically related to sea-level rise</td>
<td>Unclear</td>
</tr>
<tr>
<td>Poland</td>
<td>Potentially large impacts in coastal zone, with little significance to country</td>
<td>Low</td>
<td>National coastal plan (including SLR) being developed</td>
<td>Monitoring of sea level, climate, and erosion</td>
</tr>
</tbody>
</table>

Natural scientists (Harff & Meyer, 2011) believe that for studies of coastline change the Baltic Sea serves as an excellent natural laboratory. They remind that „isostatic uplift in the North has caused continuous regression of the sea during the last 8000 years, whereas in the South climatically controlled sea level rise superimposed with subsidence of the earth’s crust is responsible for a transgression between the Belt Sea and the Curonian spit in the Southeast” (figure 10). Tourists can be interested in the fact that both transgression and regression of the sea and the consequences to coastal landscapes can be studied and explored at the same time in the Baltic Sea. Over the last
thousands of years the northern Baltic has been uplifted by more than 100 m, while on the contrary, in the southern Baltic the sea level rise and isostatic subsidence cause a permanent transgression of the sea (Harff & Meyer, 2011). Traditionally the coastal villages in Estonia and Latvia were located at a distance from the shoreline today. With current climate projections researchers assume that there are only a few areas in Estonia where ‘retreat would be the most reasonable adaptation option’ (Kont et al., 2003). While there are more such places in Latvia, as Eberhards (2004) points that “in long-term view most sensible would be gradual retreat inland”. The Latvian study indicates that this strategy is not popular among coastal land owners at the current situation; they try to rely on small-scale coastal protection measures (Apine, 2011). This study underlines that technical solutions alone can not resolve existing and future coastal protection problems. Improved coordination and coastal planning and management is needed; land use and land ownership issues among private, state and municipal stakeholders should be readjusted to changing conditions; treating out of dunes by unorganized flows of people and driving with quadricycles has to be restricted (Apine, 2011). Besides possible strategy to regulate and protect low-lying coastal areas by means of technical solutions that can result in regulated, stable dunes and probably a loss of saltmarsh area, an alternative strategy can be selected, which allow natural processes to continue. Such strategy needs the specific land use permits and coastal planning that can result in dynamic, living dune and saltmarsh ecosystems, but sometimes with severe restrictions of land use adjacent to the coast (Fenger et al., 2008). Both host and tourist attitudes toward nature conservation, will define which of the strategy may be favoured. Although if with sea-water rise the ecosystems would survive migrating inland, researchers note that their species richness would be expected to diminish, as many rare species are unlikely to survive the gradual migration into these initially unfavourable conditions (Kont et al., 2008), and this can threaten natural resources of wildlife tourism in the Matsalu Bay, Estonia, where are located the biggest and most important breeding grounds for birds in northern Europe (Kont et al., 2008; Kont et al., 2003). New challenges for heritage tourism are created by increased coastal erosion and storms that uncover ancient boats, as reported by Estonian case (Kont et al., 2011). The southern part of the BSR has long experience with struggle against coastal erosion and the movement of dunes, particularly by protecting dunes with coastal forest, osier or shrubs (Apine, 2011; Žaromskis, 2007; Gulbinskas et al., 2008) or permitting the natural process of saltmarshes moving inland (Fenger et al., 2008). Shore reinforcement works using logs and a wicker fence with soil filling started in the Middle Ages (Žaromskis, 2007), coastal protection and flood prevention (Dubra & Abromas, 2012; Küle et al., 2013) became a part of coastal community’s identity and today can be consumed as tourism product itself if adequate narrative and tourism attractions (exhibitions) are created. In the Curonian Spit the shore protection has the purpose not only to protect human settlements but also to provide the inland traffic along the coast. Nordstrom lists cases of historical experience to stabilize drift sands with vegetation plantings or afforestation in Europe – in Prussia and Denmark large-scale measures took place since eighteenth century and in Poland since nineteenth century (Nordstrom, 2000). Construction of foredunes and beach nourishment are more recent measures – the first European large-scale beach
nourishment project started in Germany in 1950ties, since 1970ties it was widely used in Poland and in the former Soviet Union (Nordstrom, 2000). Beach nourishment is increasingly favoured due to the decreasing real cost of sand (Nordstrom, 2000). There is an argument that despite the high cost, seawall construction is an option to prevent socio-economic damage and relocation of the population in the cities (Kont et al., 2003). In Latvia the length of shore fortifications is comparatively short, about 4 km in total that are “scattered” along all coastline (Lapinskis, 2012). No groins, detached or submerged structures have been constructed or no beach nourishment projects have been executed along Latvia coast. Most often coast protection is to accomplished with limited intervention through coastal forest and foredune management; to enhance aeolian accumulation in the foredunes the dune planting of osier and maran grasses has been practiced since 1960s (Lapinskis, 2012).

Several studies point out that coastal segments need to be prioritized according to the most appropriate coastal protection measures in according to coastal morphology and threats. The exchange of information among coastal communities, researchers, and tourism industry might bring better results for whole the BSR. There is a need for the assessment of existing coastal protection measures and their impact to both ecosystems and tourism preferences as well as for innovative, improved and effective systems of coastal protection. Studies on the eastern BSR indicate that coastal protection has been underinvested for many decades (Ryabchuk, et al., 2012) and thus need to only increased interest from research community, but also from local and national development institutions and funding providers. In the BSR the majority of spa industry has been traditionally based on regulated capitalism and used as infrastructure to promote collective welfare, with extensive role of local and national government in the development and investment issues, with high public ownership and regulation of medicine and training (Bacon, 1997) and thus there is a wide range of opportunities to be used for climate change adaptation. Policy transfer among individually competing coastal
resorts and venues need to be supported nationally or at the BSR level to facilitate the distribution of knowledges and best practices in relation to climate change adaptation. An empirical study (Onofri & Nunes, 2013) indicates that domestic and international tourists have different preferences for beaches. Domestic tourists are the “beach lovers” and prefer a destination for the beach characteristics, e.g. beach length. International tourists are “greens” who prefer the natural and environmental dimension of the coastal tourism, and have more time and money than domestic tourists to spend in beaches. Researchers invite more studies in this direction to find if international beach tourists are representing a modern, nouvelle élite of coastal tourists. If this is a trend adaptation measures by accommodating sea-level rise and erosion by increasing nature protected areas might be an option for the future (Onofri & Nunes, 2013). Information on the international elite green preferences in the domestic markets might influence tourism demand and thus increase sustainability in general.

There is a proposal for multi-level governance approach towards coastal areas in risk (Sterr, 2008). In Germany the vulnerability assessments for coastal areas is carried out on three levels of scale – macro-, meso- and micro- scale assessments. Where macro-scale assessment are used for national and international policy preparation, with no specific indicators relevant for coastal tourism, meso-scale assessment can provide socio-economic damage potential described in greater detail (e.g., including coastal tourism, and technical, tourist, and traffic infrastructure). The micro-scale assessment can provide such detailed information as local topography, the exact number of people in the risk areas, or touristic capacity of coastal communities (number of beds). The potential risk in economic terms increases when the resolution of the analyses is higher, and in order to describe the present and future exposure of coastal segments to flooding and erosion risks there are need for detail information on the prevailing adaptation to storm flood hazards, in particular on the existing dikes (Sterr, 2008).

Table 29: Selected measures for responding to sea-level rise: objective and environmental effects (Titus & Craghan, 2010: 164-165).

<table>
<thead>
<tr>
<th>Response Measure</th>
<th>Method for Protection or Retreat</th>
<th>Key Environmental effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoreline armouring that interferes with waves and currents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakwater</td>
<td>Reduce erosion</td>
<td>May attract marine life; downdrift erosion</td>
</tr>
<tr>
<td>Groin</td>
<td>Reduce erosion</td>
<td>May attract marine life; downdrift erosion</td>
</tr>
<tr>
<td>Shoreline armouring used to define a shoreline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seawall</td>
<td>Reduce erosion, protect against flood and wave overtopping</td>
<td>Elimination of beach; scour and deepening in front of wall; erosion exacerbated at terminus front of wall; erosion exacerbated at terminus</td>
</tr>
<tr>
<td>Bulkhead</td>
<td>Reduce erosion, protect new land fill</td>
<td>Prevents inland migration of wetlands and beaches. Wave reflection erodes bay bottom, preventing SAY. Prevents amphibious movement from water to land.</td>
</tr>
<tr>
<td>Revetment</td>
<td>Reduce erosion, protect land from storm waves, protect new land fill</td>
<td>Prevents inland migration of wetlands and beaches. Traps horseshoe crabs and prevents amphibious movement. May create habitat for oysters and refuge for some species</td>
</tr>
<tr>
<td>Shoreline armouring used protect against floods and/ or permanent inundation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dike</td>
<td>Prevents flooding and permanent inundation (when combined with a drainage system)</td>
<td>Prevents wetlands from migrating inland. Thwarts ecological benefits of floods (e.g., annual sedimentation, higher water tables, habitat during migrations, productivity</td>
</tr>
</tbody>
</table>
Adaptation Measures

<table>
<thead>
<tr>
<th>Adaptation Measures</th>
<th>Transfers</th>
<th>Natural Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tide gate</td>
<td>Reduces tidal range by draining water at low tide and closing at high tide.</td>
<td>Limits fish movement. Reduced tidal range reduces intertidal habitat. May convert saline habitat to freshwater habitat.</td>
</tr>
<tr>
<td>Storm surge barrier</td>
<td>Eliminates storm surge flooding; could protect against all floods if necessary.</td>
<td>Storm surge flooding in salt marshes is eliminated.</td>
</tr>
<tr>
<td>Elevating land</td>
<td>Protects inland areas from storm waves; provide a source of sand during storms to offset erosion.</td>
<td>Can provide habitat; can set up habitat for secondary dune colonization behind it.</td>
</tr>
<tr>
<td>Dune</td>
<td>Reverses shore erosion, and provide some protection from storm waves.</td>
<td>Short-term loss of shallow marine habitat; could provide beach and dune habitat.</td>
</tr>
<tr>
<td>Beachfill</td>
<td>Avoids flooding and inundation from sea-level rise by elevating everything as much as sea rises.</td>
<td>Deepening of estuary unless bay bottoms are elevated as well.</td>
</tr>
<tr>
<td>Elevate land and structures</td>
<td>Delay the need for shore protection by keeping development out of the most vulnerable lands.</td>
<td>Impacts of shore protection delayed until shore erodes up to the setback line. Impacts of development also reduced.</td>
</tr>
<tr>
<td>Setback</td>
<td>Prohibit shore protection structures.</td>
<td>Impacts of shore protection structures avoided.</td>
</tr>
<tr>
<td>Rolling easement</td>
<td>Reduce the benefits of shore protection and thereby make it less likely.</td>
<td>Depends on whether owners of large lots decide to protect shore. Impacts of intense development reduced.</td>
</tr>
<tr>
<td>Density or size restriction</td>
<td>Changes in length of growing season</td>
<td>Changes in ecosystem composition (species)</td>
</tr>
<tr>
<td></td>
<td>Changes in tourism marketing, planning and investments</td>
<td>Migration of plants</td>
</tr>
<tr>
<td></td>
<td>Changes in coastal tourism</td>
<td>Migration of habitats</td>
</tr>
<tr>
<td></td>
<td>Changes of tourism activities</td>
<td>Wetland accretion and migration</td>
</tr>
</tbody>
</table>

Table 30: Matrix showing the five types of adaptation prevalent to sea-level rise and climate change with examples relevant to coastal areas (after Mimura, 2010; Hanak & Moreno, 2012; Tol et al., 2008; Lewsey et al., 2004; Smit et al., 2001; Klein & Tol, 1997).
<table>
<thead>
<tr>
<th>Measures</th>
<th>Adaptation Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promote stakeholder awareness and education</td>
<td>Coastal armouring</td>
</tr>
<tr>
<td>Early-warning system</td>
<td>Beach nourishment</td>
</tr>
<tr>
<td>Change in building codes and design standards</td>
<td><em>Ex situ</em> conservation</td>
</tr>
<tr>
<td>Develop mechanisms for enforcing strict building codes</td>
<td>Planned retreat, relocation, and abandonment</td>
</tr>
<tr>
<td>Improve education/training of code enforcement officers</td>
<td></td>
</tr>
<tr>
<td>Promote education and public-awareness raising of need for</td>
<td></td>
</tr>
<tr>
<td>strengthened codes</td>
<td></td>
</tr>
<tr>
<td>Promote stakeholder dialogue and cooperation</td>
<td></td>
</tr>
<tr>
<td>Land use planning and regional planning</td>
<td></td>
</tr>
<tr>
<td>Develop coastal risk assessment studies for identifying and mapping</td>
<td></td>
</tr>
<tr>
<td>hazardous areas</td>
<td></td>
</tr>
<tr>
<td>Inventory of opportunities for coastal habitat migration</td>
<td></td>
</tr>
<tr>
<td>Incorporate the identified hazardous areas into land use and urban</td>
<td></td>
</tr>
<tr>
<td>development plans</td>
<td></td>
</tr>
<tr>
<td>“No further armouring” policy</td>
<td></td>
</tr>
<tr>
<td>Evolving standards on setbacks</td>
<td></td>
</tr>
<tr>
<td>Rolling easements</td>
<td></td>
</tr>
<tr>
<td>Retreat and conditioning land ownership plans for existing low-lying</td>
<td></td>
</tr>
<tr>
<td>coastal development</td>
<td></td>
</tr>
<tr>
<td>Determine the baseline for development in coastal areas</td>
<td></td>
</tr>
<tr>
<td>Determine the protection strategies</td>
<td></td>
</tr>
<tr>
<td>Incentives for retreat or relocation</td>
<td></td>
</tr>
<tr>
<td>Develop and implement integrated coastal management plan</td>
<td></td>
</tr>
<tr>
<td>Implement tax program based on tourist fee study for access to coastal</td>
<td></td>
</tr>
<tr>
<td>resources</td>
<td></td>
</tr>
<tr>
<td>Strengthen partnership with research institutions</td>
<td></td>
</tr>
<tr>
<td>Develop educational material for decision/policy makers</td>
<td></td>
</tr>
<tr>
<td>Guidelines on preventative investment strategies</td>
<td></td>
</tr>
<tr>
<td>Better information on climate impacts and vulnerabilities</td>
<td></td>
</tr>
<tr>
<td>Provide funding</td>
<td></td>
</tr>
<tr>
<td>Improving institutional adaptation capacities</td>
<td></td>
</tr>
<tr>
<td>Pilots on new adaptation techniques and alternatives</td>
<td></td>
</tr>
</tbody>
</table>

*Coastal tourism adaptation options with relevance to the BSR* have been prepared based on research publications (prepared by authors based on Jopp et al., 2013; Mossbauer et al., 2012; Albert et al., 2012; Swart et al., 2009; Wong et al., 2012; Hanak & Moreno, 2012; Heikkinen et al., 2011; Chen & Graham, 2010; Müller & Weber, 2008; Becken & Hay, 2007; Hay & Mimura, 2006;
Munasinghe & Swart; 2005; Mather et al., 2005; Burton & Lim, 2001). It is important to re-position the BSR destinations in order to capitalise the benefits of climate change by investigating climate change impacts on competing destinations and by utilising new opportunities for domestic and the BSR tourism markets due to prolonged tourism season and the development of new activities, new products and new target markets. Climate change impacts on tourism and recreation development and adaptation options need to be intagreted into all types of planning activities that are performed at the coast; tourism planning at various scales, long-term strategies, economic and social development plans, regional and spatial planning, maritime planning, management of coastal and marine nature protected areas, into the plans of integrated coastal zone management (ICZM), integrated flood risk management (Küle et al., 2013). Such planning activities need to be supported with climate impact management plans with integrated, multi-level, holistic approach and local vulnerability/risk assessments for coastal areas. Revising policies on the financing of national tourism offices can be considered taking account new responsibilities. Marine protected areas need to be established or/and supported to mitigate conflicts of interest rising due to increase in tourism and maritime shipping.

National and regional promotional activities, destination images, marketing and branding should be improved by incorporating benefits from climate change; off-seasons and the prolongation of summer season, e.g. promoting ‘shoulder’ seasons need to be emphasised. Alternative marketing strategies to cope with an expanding or a diminishing market, including stronger promotion of domestic tourism or all four season tourism should be developed. New marketing offers, e.g. ‘Experience the Wild Baltic Sea’, are suggested as response to the increase of extreme weather events (Filies & Schumacher, 2013). Strategies should encourage innovation and diversification of tourism products (particularly in tourism destinations dependent from snow and ice-based activities) and consider public investments and tourism business subsidies. New target tourism markets should be explored and developed in order to use benefits of climate change. New opportunities for local economy due to prolonged tourism season and new tourism activities need to be explored and supported. Year-round tourism activities and attractions should be supported. Measures are needed to adapt institutional (calendar) seasonality (events, holidays, opening times) to the shift of climate-dependent natural seasonality and changes in phenology of plants that are important for event tourism. New marketing and pricing strategies and changes to the school year in order to change peak holiday times are suggested. For instance, shifting events or technical measures to delay or prolong blooming (e.g. planting in shadow, keeping snow cover or irrigated flower beds during warm/early springs) are adaptation options to respond to changes in the phenology of plants. Change of opening times for tourism infrastructure needs to be reconsidered. Measures to control the rush towards beach tourism and the use of coastal infrastructure and transport at maximum capacity in the peak season should be proposed and implemented. Flexible regulation to outdoor activities and climate-proof tourism infrastructure and services should be promoted (table 6); and measures are needed to respond to increasing demands and attractiveness of outdoor activities, beach and bathing tourism, water sports and cruising. Options might include also climate proof expansion of accommodation,
entertainment and gastronomy. Weather-independent alternatives for tourists need to be introduced. **Indoor attractions** (e.g. with ventilation) need to be introduced to replace natural attractions if the appeal of the latter diminishes. Air conditioning, cooling and sophisticated isolation- and shading-systems have to be explored in order how to use not harming environmental and public health as well as cultural heritage and other tourism assets. To cope with heat events new sustainable technologies of weather-proof constructions and transport need to be supported. Improved information and knowledge distribution are needed on impacts and adaptation option to cope with increased humidity, higher microbial activity and the increased growth of fungus and mould and thus damage to buildings. Resistant construction materials and improved ventilation and weather proof constructions and materials need to be introduced.

The tourism industry perceives climate change as a less urgent challenge and potentially even as beneficial for its business (Martinez et al., 2011); and tourism operators have a low **awareness** of climate change and there is little evidence of long-term strategic planning taking truly account of climate change (Simpson et al., 2008). Place- or activity-relevant or situational dimension is important for communication, planning and implementing climate change adaptation measures (Heinrichs, 2010; Weber, 2010). Before information and public education campaigns and training programs it is important to assess the awareness of businesses and tourists and their knowledge gaps. Such information campaigns, participatory interactive mapping and social learning can cover aspects relevant to tourism and recreation due to changes in species, habits, hazards to public health and safety, e.g. UV radiation, increased exposition of allergen- and air-pollutants and hygiene problems of food and water supply. **Training programmes** for tourism industry on climate change adaptation, as well as public education and practical information campaigns on climate change risks and adaptation measures are needed for host communities and tourists. Strengthen **information network and research capacity** of tourism destinations, e.g. protected area, staff with regards to climate change adaptation. Although increased temperatures might lead to more favourable tourism conditions in the BSR stakeholders need to take into consideration potential negative effects of a warmer Baltic Sea by including **health risk analysis** and early warning mechanisms.

As the occurrence of extreme climate events will be exacerbated by climate change, there is a need to create a link between tourism and **disaster risk reduction and management** (Becken & Hughey, 2013). In order to be prepared for heat waves, storms and floods and other extreme weather events improvements in weather forecasting and early warning system, medical infrastructure and health services are needed to be sure that the specific needs of tourists will be considered. Measures should be planned and implemented against, e.g., the increase of mosquitoes and new threats to public health. Additional information and maps for tourists with safety provision during heat waves and storm and flood events (free access to shades/ wind screens/ shelters with emergency communication equipment, drinking water, changes of opening hours, and closed venues) can improve their capability to cope with extreme weather conditions. Emergency preparedness and increase of rescue service capacities (e.g. constructing of rescue centres, more harbours of refuge needed) are important and
Adaptation Measures

may be obtained through cooperation between tourism industry and host communities. Increase of the size of deposit of strategic commodities has to be reconsidered. Unreliable coastal sea-ice conditions will increase safety risks and concerns and thus measures are needed to inform and protect tourists involved in ice fishing and walking along the coast. Access problems due to unreliable ice conditions inability to use temporary ice roads can be solve by using ferries or building safer crossings, bridges over water bodies and wetlands. There might be an increased need for outdoor lightening to compensate the loss of natural light reflection by snow. As for long-term adaptation tourism routes should be built on dry land; new routes should be planned for year-round use and to be exploitable in conditions of limited snow cover. Safety problems with second-home areas and tourism infrastructure in flooded areas should be solved through spatial planning and flood risk management, e.g. flood proof settlements should be promoted. Use of temporary constructions, water-friendly buildings for tourism purposes can be considered (Knieling & Fellmer, 2013). If parking places, camping areas, second houses or allotment gardens are located in flood prone areas; safety aspects need to be reconsidered, e.g. the ways how to be rapidly evacuated and how non-local population to be informed on safety aspects. Construction and maintenance of flood-proofed access routes are needed. Improve local communities and tourist knowledge on how storms are strike by teaching the history of storms and floods. Information on the usefulness of preserving dunes and the maintenance or construction the embankments along the coast need to be provided to locals as well as tourism industry. Measures need to be considered to cope with situations when hinterland connections can break down after extreme weather events, flooding, storms or heavy snowfall. New concepts how to increase coastal resilience has to be developed,e.g. coastal realignment, vegetation and stabilisation of dunes, the combination of hard and soft measures. Efforts to integrate climate change adaptation into civil protection (Groven et al., 2012) need to be expanded to tourism sector.

Wildfire proof settlements, including camping sites, second homes and caravan parking areas should be promoted. Relocation of vulnerable inhabitants and tourists if their health or accommodations are affected by direct impact of wildfire or smoke is needed. Restricted access to forest and nature areas under wildfire risk; clean-up of littering in forests and meadows, reed and grass-cutting, natural grass management by herbivorous animals (e.g. cows, wild horses) are measures to be promoted. Maintenance of open green spaces and the promotion of green infrastructure and urban forestry in order to reduce urban heat and flood risks can also be utilised as tourism attractions, e.g. the path networks for cyclists and hikers and parking places can be adjusted to green areas. Recreational fishing community, outdoor recreants and nature tourists should be informed on changes in local species and biotopes and the risk of introduction and establishment of non-indigenous species. Protected areas and national parks need to be encouraged to participate in the dialog between climate change researchers and tourists, e.g. through long-term integrated monitoring sites and research activities on climate change impacts on nature tourism. Beach cleaning management and according facilities such as disposal areas and collection vehicles need to be intensified. Innovation in beach wrack management supported by the science-policy dialog and
participation of coastal communities are needed. Monitoring programs, e.g. on beach and water quality need to be strengthened. Beach users should be informed about beach wrack thus to improve their acceptance of realities of nature processes at the coast.

Adaptation of water policies is needed in cooperation with tourism industry, e.g. safeguarding water supply, water conservation campaigns organized jointly by governments, communities and tourism industry, improvement of rainwater management to solve overloaded sewage problem, e.g. rain and sewage reservoirs, sustainable urban drainage systems, new or diversified drinking water supply sources, e.g. to shift from individual water supply, based on shallow groundwater to public water supply (Arustienė et al., 2013); and provision of green infrastructure, e.g. lawn, green roofs, parks, golf areas, gardens, and changes in watering practices. Monitoring of salt water content in the free-surface groundwater in the coastal zone should be maintained or introduced (Petersell et al., 2013).

When larger-scale tourism infrastructure is constructed, impact assessment and project appraisal have to address also climate change impacts, uncertainties and possible adaptation aspects (Colombo & Byer, 2012). Greater public investment in infrastructure for new tourism developments (e.g. land preparation, coastal defences or supporting infrastructure investment) to meet climate change impacts can be considered. Improvements and expansion and of coastal traffic infrastructure and systems, including parking places, road and path networks for cyclists and hikers have to be considered. This should include the expansion of transport that connects coast to hinterland and construction of new port infrastructure and new marinas. Jointly with tourism industry specific ‘values’ at risk to climate change and sea level rise should be identified. Intensification of coastal protection; protection schemes (e.g. levees, seawalls, dikes, infrastructure elevation) could be installed, foundations be strengthened to adapt to sea-level rise. Stronger and higher bridges and piers need to be constructed. Also for tourism purposes temporary constructions, water-friendly buildings, floating breakwater pontoons and piers can be used. Technical measures to protect sandy beaches (beach replenishment, flood barriers, dunes, dikes, groins) might be considered jointly with tourism industry. Increase of nature protection (coastal forests and seaside landscapes), ex situ conservation, and restrictions and limitations for new infrastructure developments are options to be considered for coasts that are sensitive to erosion. The potential impact on land-degradation should be taken into account when making decisions on investments and expansions of recreation areas and beaches. The importance of beaches and recreational areas around the coastline is highlighted by the Swedish municipality of Ystad who estimates that the benefits of protecting and conserving the coastline are three times greater than the costs.
5 Knowledge and Research Gaps

Adaptation to climate change in the tourism sector has only been studied in recent years. Researchers focus on tourism and climate change issues can be found since mid 1980ties while early approaches to climate change adaptation can be found in studies on alpine skiing climate challenges back in mid 1990ties (Kaján & Saarinen, 2013; Becken, 2013). Today knowledge on climate change impacts and adaptation approaches is cumulating fast (table 31). A number of academic papers have highlighted the limitations of existing knowledge and themes that are emerging otherwise studies are few (Kaján & Saarinen 2013; Becken, 2013; Pang et al., 2013; Scott et al., 2012; Scott & Becken, 2010; Burns & Bibbings, 2009; Scott et al., 2005; Smith, 1990). In 2001 the Commission on Climate, Tourism and Recreation of the International Society of Biometeorology listed research needs of government and industry (Higham & Hall, 2005), e.g. climate as a resource and a limiting factor for tourism, the implications of climate variability and extreme weather events; methods for assessing relationships between climate and tourism; needs of the tourist and travel industries for climate and weather information; development of a Tourism Climate Index; advisory services for proper climatic adaptation of travellers; and contribution of tourism to climate change.

Table 31: Proposed tourism and climate change research categorisation (after Patterson et al., 2006).

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destination types</td>
<td>Urban; Rural, Biome; Protected Nature Areas; Community; Coastal; Cool-Weather; Uplands</td>
</tr>
<tr>
<td>Geographic regions</td>
<td>Transects; Regional Comparisons; Continental, Regional, National, Local</td>
</tr>
<tr>
<td>Tourism segments</td>
<td>Annual; Seasonal; Day-visitors; Domestic, Foreign, Different source markets, Short-haul; Long-haul, First-timers, Repeaters, Elderly and disable, Families with children</td>
</tr>
<tr>
<td>Environmental</td>
<td>Water; Landscapes; Wildlife, Vegetation, Extreme weather events, Hydro-cyclic and snow processes; Physical infrastructure; Historical assets</td>
</tr>
<tr>
<td>Issues of concern</td>
<td>Health; Vulnerable areas; Ethics – intra and inter-generational equity</td>
</tr>
<tr>
<td>Policy structures</td>
<td>Institutions, Organisational arrangements, Governance, Levies; Tradable permits; Voluntary agreements</td>
</tr>
<tr>
<td>Methodology</td>
<td>Theoretical; Empirical; Qualitative; Quantitative</td>
</tr>
<tr>
<td>Models</td>
<td>Descriptive (numeric); Prognostic (forecast); Planning (optimisation)</td>
</tr>
</tbody>
</table>

Most of the tourism climate change impact studies are performed for destinations (Hall & Higham, 2005). The geographic concentration of research on tourism and climate change with focus on Western countries has been criticised (Scott, 2011; Scott & Becken, 2010). BSR-wide studies on climate change impacts and adaptation for tourism with focus on marine and coastal tourism is missing. Little attention has been given to the islands, peninsulas (narrow spits) and low-lying coastal meadows, wetlands, lagoons and dune landscapes of the Baltic Sea. Common understanding and studies on coastal ecosystems and species relevant for recreation and tourism in the region (e.g. fish, game, wild berries, and mushrooms) as well as climate change impacts studies for them are missing. A review stresses that for recreational fishing there is no common understanding or definition among the BSR countries (Pawson et al., 2008); thus any comparative study on climate impacts would face challenges.
Diversification of geographical and disciplinary perspectives, including intensified place-based research conducted by researchers that are appropriately equipped to understand these place-specific factors are needed to understand local responses and options how to adapt local tourism activities to the impacts of climate change (Schott et al., 2010). High uncertainties exist in forecasting flows and defining a character of future tourism as this depends not only from several environmental and social-economic factors but also influenced by tourists and tourism industry preferences, values and market trends. Climate impacts and adaptation for tourism cannot be analysed in isolation from trends in information, transportation, construction and indoor climate technologies, the quality of life, change of life style, and public health issues.

Another limitation is related to climate and tourism data availability, accessibility and compatibility (ECORYS, 2012a; Scott & Becken, 2010; Turton et al., 2010; Scott & Lemieux, 2009). Standard meteorological data typically fails to capture the microclimatic characteristics of specific tourism destinations (e.g. coastal resorts) and recreational settings (e.g. littoral zones) (Higham & Hall, 2005). Knowledge about snow processes and ice conditions relevant for tourism and recreation is limited (Swedish Government, 2007). Understanding the climate information requirements of tourism stakeholders (tourism planners, government policy makers, tourism operators and tourists themselves) is an important first step in the direction of developing a tourism climate change science agenda (Higham & Hall, 2005). Improved communication and collaboration between researchers, planners, policy makers, tourism operators and the wider public, including hosts and guests, are need in order to address the complexity of tourism and climate change adaptation (Becken & Hay, 2007).

Taking account the cartierity of methods (table 32), standardised research methodologies and alternative approaches to tourism climate change research are necessary (Higham & Hall, 2005).

Table 32: Key themes and methods of research on tourism and climate change impacts and adaptation (Becken, 2013).

<table>
<thead>
<tr>
<th>Key themes</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter/snow tourism</td>
<td>Quantitative and qualitative vulnerability assessments</td>
</tr>
<tr>
<td>Coastal tourism</td>
<td>Climate impact modelling</td>
</tr>
<tr>
<td>Special interest tourism (e.g. golf)</td>
<td>Economic modelling</td>
</tr>
<tr>
<td>Protected areas and tourism</td>
<td>Quantitative and qualitative behaviour analysis (surveys, interview, and focus groups)</td>
</tr>
<tr>
<td>Last chance tourism</td>
<td>Delphi survey</td>
</tr>
<tr>
<td>Biometeorology</td>
<td>Tourism Climate Index</td>
</tr>
<tr>
<td>Tourist behaviour and flows</td>
<td>Stakeholder workshops</td>
</tr>
<tr>
<td>Disaster risk reduction</td>
<td>Indicator development</td>
</tr>
<tr>
<td>Specific adaptation options (e.g. derivatives)</td>
<td></td>
</tr>
</tbody>
</table>

Studies on how media represent climate change and respective travel decisions (Rutty & Scott, 2010), and how travel writers, guide books and other information for tourists describe existing and future climate information can explain tourist behaviour changes and opportunities of possible intervention. Participatory research and cooperation with editors of tourism information, e.g. guides, webpages, and advertisements can contribute to their contents with relevance to climate change adaptation. More studies on tourist literature and the media’s role regarding the change of perception and information
distribution about climate, weather, its variables and extremes both at tourism destinations and the points of departures of tourists, including ‘last chance tourism’ or ‘disappearing destinations’ phenomenon and its implication for ethical and sustainable tourism are needed (Scott et. al. 2008b; Gössling et al., 2012; Dawson et al., 2011b; Jones & Phillips, 2011). As leading news agencies have global and regional scope, possible media-related studies on climate knowledge distribution, including under various climate change scenarios, are not only national issue, but can be of the BSR relevance. Single weather event (e.g. rainy holiday, hot period) or other singular events of natural processes (e.g. large amount of jellyfish) can have dramatic role in the change of perception (Donges et al., 2013), it can abruptly change travel behaviour of tourists and management behaviour of tourism industry and destination towards more climate change adaptation with emphasis on preventive actions. Such extreme weather events can explain until now largely unexplored adaptive capacity of tourists and tourism industry, and transfer this knowledge in planned adaptation measures. Therefore such BSR-wide weather events (e.g. extreme heat, floods, storms) and the social response to them are valuable to use as case studies by transnational and interdisciplinary teams. Transnational studies on climate change aspects and the BSR and its sub-regions place identity, image, tourism marketing and branding. Transnational studies on historical evidences on tourism, resorts and recreation and climate aspects in the BSR.

To improve weather-related risk management in the tourism sector the strengthening of climate monitoring networks is needed (Scott & Lemieux, 2010). A climate advisory service might be useful to prepare and protect tourists at risks (Matzarakis, 2010). Climate data in general is under-utilised as widely as that could be possible for a variety of purposes (de Freitas, 2003): (i) operational decision-making on choosing destination or activity; (ii) risk assessment, involving timing and nature of severe weather events; (iii) marketing, such as promoting attractive or appealing climate conditions; times of year or times of day to encourage business; (iv) investment decisions, such as which regional climate type is likely to be most appealing to vacationers and thus more profitable (heat and air conditioning costs); (v) siting of accommodation, resorts and other tourism developments, (vi) resort design, landscape and planning, and (vii) finance and budgeting (seasonality or short-term weather extremes). There is a need for information on tourist climate preferences and tourist perceptions of environmental impacts of global climate change at destinations and the points of departures (Scott et. al., 2008d; Scott & Becken, 2010). Research on tourist comfort parameters and indices and their validity to predict behaviour are needed. There are substantial knowledge gaps with respect to tourism demand responses to changing climate, its elements and variability (Gössling et al., 2012; Goh, 2012; Dubois & Ceron, 2006) and tourists’ likely behavioural reactions to the projected climatic changes (Moreno & Amelung, 2009). Impact analysis of aviation (Becken, 2013), passenger shipping (cruises, ferries) and other long-haul travelling modes are needed with their impact on the BSR tourism challenged by the climate change. New impact assessment studies of tourist comfort are necessary to reflect environmental quality and the diversity in activities to complement the traditional formula of
Climate Change Impacts on Coastal Tourism in the Baltic Sea Region

‘sun, sea, and sand’ by covering also tourism segments requiring higher levels of physical activity (e.g., adventure tourism or outdoor recreation) (Moreno & Amelung, 2009; Denstadli et al., 2011). Research gaps include various aspects of tourist decision-making, a relationship between weather expectations and weather perceptions, and short- and long-term adaptive travel planning (Denstadli et al., 2011), e.g. how tourists react on weather during their trip, whether they would prolong the stay of leave area under non-favourable conditions, and how weather conditions might impact on their overall tourism experience and return intentions. Climatic dimensions under the aspect of comfort or well-being cannot be single aspect of research on climate/weather and its relation to tourist behaviour. The large variety of traveller interests and motives need to be taken into consideration, for sunbathing/beach escapes weather and climate are imperative to travel motivation and hence crucial to tourists’ evaluation, while in other cases weather/climate is only a framework condition that has to be taken into account (Denstadli et al., 2011). The visitor experience (active and passive) of actual weather conditions should be studied other than through the use of hypothetical weather scenarios and/or seasonal means (Higham & Hall, 2005). Support to trans-disciplinary research potentially can bring more social scientists into climate change research that focus on tourism sector. Interdisciplinary research can help to overcome the fragmentation of existing information. Development of tools for multi-disciplinary research and how to integrate climate knowledge in tourism studies and policy documents are required.

Studies on tourism behaviour change due to changed perceptions of climatic appeal and image of certain tourism destinations and activities can give better explanation of associated tourism flows (Hall & Higham, 2005) and provide knowledge how to improve the management of tourism destinations (Donges et al., 2013). Several knowledge gaps are identified in the studies showing how climate change would impact tourism flows (after Bigano et al., 2006): whether summer tourists would shift their holidays in time (to spring or autumn) rather than in space (up mountain or pole-ward); the relative importance of winter holidays and summer holidays; the relative importance of climate and climate-sensitive determinants of holiday destination choice; whether tourists would shift from one coastal area to another rather then to mountainous or northern areas; the effect of climate on business trips, conference tourism and visits to friends and relatives; the effect of climate on decisions on the location of holiday homes and retirement location; and whether the relationships between climate and tourist destination choice are constant over time.

Better understanding is needed regarding how climate change impacts and adaptation to them will interact with other long-term social and market trends influencing tourism demand and development, e.g. ageing population, increased travel safety and health concerns, environmental and cultural awareness, advances in information and transportation technology and shifts towards shorter and more frequent holidays (Scott & Becken, 2010). There is a need to validate existing tourism climate indices on fundamental knowledge of climate conditions (Scot & Lemieux, 2010) that relevant for the BSR and its tourism and recreation activities employed, more cooperation between tourism industry and research is needed (Gössling, et al., 2008). Tourism sector at all scales and segments,
Knowledge and Research Gaps

from intergovernmental organizations, national governments, sectoral organizations, destinations and enterprises, needs to be meaningfully engaged in climate change mitigation and adaptation in its all phases – starting from academic studies, vulnerability assessment, policy-making and implementation (Scott & Becken, 2010). Low tourism industry commitment has been criticized acknowledging that for the sector consider both mitigation and adaptation is a challenge (Scott, 2011; Weaver, 2011). The inability of the tourism industry reply to current climate change challenges with informed and strategic long-term responses are explained by the historical inability of the sector ‘to move beyond the short term, to medium- and long-term sustainability horizons’, and only ‘willing dialogue and collaboration between industry, government and social and environmental scientists’ can change the current unsustainable trend of tourism and recreation industries (Higham & Hall, 2005). Only a small number of tourism-oriented researchers have attempted to bridge the research gap by considering in their research how the effects of a changing climate may result in impacts on socio-economic systems (Reynolds, 2010); however studies on particular types of tourism activities and tourist segments are missing. There is a need to study and understand alternative, niche and disaster tourism (Miller, 2008), the types of tourism that can exploit climate conditions, natural hazards and extreme weather events that is not seen favourable for mass tourism.

There are strong social network of researchers and tight partnership of small number of academics involved in tourism and climate change research at global scale (Becken, 2013), at the same time such network or cooperation does not exist at the BSR level, particularly researchers and institutes of the eastern part of the region are outside such research community. Future studies on climate change impacts on tourism are suggested (after Dubois & Ceron, 2006; Swedish Government, 2007) that are also applicable to the BSR:

- **Comparative research**: linking tourism destinations with similar climate change impacts, exploring why some destinations are more sensitive to climate change than others (e.g., diversity of supply and demand factors, or the presence of built/cultural attractions), investigating what are the different methodologies used to assess the potential impact of climate change; and facilitating learning and policy transfer among the BSR tourism destinations.

- **Studies of the impacts** of extreme events and weather variability on tourism industry and human health and behaviour and capacity to cope with it, studies on vulnerability of particular tourism sites (resorts) and venues, and particular tourists’ segments, e.g. elderly, disabled, families with children, foreign tourists.

- **Trans-disciplinary research** that could facilitate networking and linking social, economic and climate change (natural sciences) researchers from different BSR countries.

- **Activity-oriented and participatory action research**, dealing with the impacts on activities and linking scientists and tourism entrepreneurs (including large tourism operator firms, cruise, ferry and other transport managers, and micro, small and medium size tourism entrepreneurs at destinations).
With relevance to the BSR research needs and topics relevant for climate change impacts and adaptation for tourism have been identified (Bruneniece, 2012; Kaján & Saarinen, 2013; Heikkinen et al., 2011; Turton et al., 2010; ESPON-IRPU, 2011; Førland et al., 2013; ECORYS, 2012a; Biesbroek et al., 2010; Schott et al., 2010; Swedish Government, 2007; Dubois & Ceron, 2006; Sheppard, 2005).

There is a need for better representation of the BSR in climate models and studies of climate variations and scenarios at the local level with relevance to tourist industry and tourists in different social segments. Assessments of current models uncertainties on local climate are neede. For designing adaptation policies more specific timeframes for climate change impacts are needed. Studies of environmental consequences of climate change should consider both regions at the destination and regions at origin of tourism flows. Social science, economics and organization studies on tourism climate change impacts and adaptation need to be supported in order to assess existing and future policies; including the costs of inaction, preventive and adaptive measures.

Available domestic and international data need to be collected to conduct a comprehensive research as basis for further climate adaptation policy developments. Better statistics on coastal tourism (activities and venues) and recreation (including second homes), improved indicators used and data availability in relation to climate and tourism can improve knowledge on climate change impacts and adaptation to tourism. As for the BSR seasonality will still continue to be a determinative factor affecting direction and motives of tourism related travel and tourism-dependent business activities, further research on seasonality changes, shifts of tourism flows and on vulnerability of various tourism activities to a changed climate are crucial for the tourism industry.

Systematic and interdisciplinary review process of climate change impacts and adaptation to tourism in the BSR should be supported by the networking of researchers representing all countries of the region; linkages between social and natural sciences and between tourism industry, spatial planning, architecture and construction, public health and climate change experts should be strengthen. Climate research communities could receive expert support on specific development issues of tourism destinations at the BSR by closer cooperation with the Committee on Spatial Planning and Development leading intergovernmental co-operation of 11 Baltic Sea Region countries known as the Vision and Strategies around the Baltic Sea or VASAB. This spatial planning network of the BSR has experience dealing with region-wide spatial issues including coastal areas since 1992 and recently has actively participating in marine planning. A more detailed and participatory review of tourism climate change impacts issues and adaptation measures that are relevant from the Baltic Sea perspective and sub-regions of the BSR and their cross-border cooperation can be proposed in the future. Comparative and and site-specific research on land-use/marine planning, building and other regulations to tackle both climate change mitigation and adaptation with relevance to tourism and recreation, particularly at coastal destinations need to be supported. Aspects how to link mitigation and adaptation measures by finding synergies, particularly in transport, tourism infrastructure, catering, accommodation and other tourism related activities in coastal areas have to be covered in suc research. Studies need to focus also on possible conflicts at coastal tourism destinations due to
rise of offshore energy production (offshore wind farms, oil and gas), aquaculture and shipping. Comparative institutional analyses of climate change adaptation processes and multi-level governance aspects in relation to tourism sector could support improved national and sectoral policies. Comparative studies on host communities’ (small and medium-sized enterprises and venue-based tourism businesses), large tourism industry actors (tour operators, cruise, air-travel, etc.), and luxury tourism (e.g. golf, yachting, Alpine skiing) versus budget and mass tourism (e.g. bathing, sunbathing, walking, cross-country skiing) adaptive capacity to respond to changing tourism demand and opportunities are helpful for proposing adaptive measures. Aspects of adaptive capacity and capability to respond to tourism demand flexibility have to be covered. Identification and analysis of needs, capacity, barriers, willingness and attitudes of tourism destinations and tourism industry to adapt changing climate can be helpful for future policy design. Transnational research on climate change and adaptation aspects integration into strategic and environmental impact assessment with relevance to tourism site selection and development has to be promoted. Tourism destinations, as well as regions from where the tourists come from should be analysed in climate change impact assessments. Knowledge gaps still exist in the sphere of climate impacts on public health, food, and visitors’ comfort and behaviour with relevance to the BSR. Analyses of behavioural changes due to climate change impacts and adaptation should embrace tourists, tourism entrepreneurs and host communities.

Applied and comparative research to review and analyse policy transfer options and best practises of climate change adaptation strategies and measures at regional, local and tourism enterprise level can improve learning processes in this field. Participatory action research and knowledge transfer at the EU, the BSR and its subregions levels with focus on climate change adaptation options targeted for tourism sector need to be supported. New instruments for knowledge and policies transfer, e.g. tackling public-private partnerships and governance aspects, can be developed. Transnational research on innovations and professional education and learning in tourism sector with reference to climate change adaptation should be supported in the BSR taking account that the region is known globally as one of the forerunner of tourism innovations. Science and tourism sector cooperation can improve the curriculum and textbooks for tourism academical and professional education with most relevant aspects of climate adaptation. Opportunities for “weather-proof” tourism product development and the diversification of tourism activities at the destination are suggested to be explored. Studies on ecological (climate change mitigation), cultural, social and economical impacts of switching outdoor activities to indoor places (e.g. indoor mountain skiing, skating, water sports, field sports, running) and switching for natural to artificially maintained settings (e.g. urban beaches, skiing on human made snow, hunting in game parks, fishing in managed water bodies, berry picking in agro-wetlands) are needed to ensure sustainable tourism development in changing climate conditions. Research on how to link mitigation and adaptation measures and to find synergies, particularly in transport, tourism infrastructure, accommodation and catering, and other tourism related activities in coastal areas are crucial in the context of global climate policy.
To utilise new opportunities, possible limitations and benefits for tourism in the BSR due to rising average temperature and prolonged summer tourism season studies on changing climate conditions, better regulation for bathing, water sports and marinas are needed. Studies are needed on future use, safety and environmental aspects of leisure boats and marinas in variable and changing climate conditions, including too calm periods for sailing that occur regularly during summer due to stable weather conditions and heat waves and their possible negative impact for the attractiveness of the Baltic Sea for sailors. Studies on introducing new water sport, e.g. wind surfing, kiting, diving and on recreational angling in summer need to be conducted to assess possible environmental consequences, opportunities and barriers to for further development and needs for new regulations. Comparative and site-specific studies on climate change impacts on ice and snow-dependent tourism venues and adaptation measures with relevance to the BSR should be conducted. Studies on climate impacts on ice-fishing and adaptation options need to be conducted. Studies of the extreme weather events and climate variability impacts on human health and tourist behaviour with relevance to the BSR are required. Trans-disciplinary studies on green infrastructure design, planning and utilisation as tourism asset should be performed. The benefits of heat wave refuges and green infrastructure need to be assessed. It is also suggested to develop methodology for assessment of economic damage/losses of climate change related extreme weather events, e.g. storms, floods, heat waves. Furthermore trans-disciplinary research on marine and coastal flora and fauna changes and their impacts for tourism and recreation in the BSR should be undertaken. Tourism, recreation and climate change relevant research for the BSR that covers aspects of public health, food, bioclimatology and urban and landscape change and design can contribute to better adaptation policies.

Information needs to be improved on depositional dynamic of floating algae accumulations along the Baltic coastlines; and socioeconomic analysis has to be performed whether biomass accumulations on beaches affect coastal attractiveness and local tourism revenue (Mossbauer et al., 2012). To cope with impacts due to the sea level rise and erosion, the improvement of coastal monitoring and methods is needed that is relevant for tourism industry. Transnational research might be supported to work out a common typology of the BSR coasts with relevance to coastal erosion and beach tourism and possible adaptation measures. Finding out tourists’, host communities and tourism entrepreneurs’ attitudes and perception and their marketing responses with relevance to the sea level rise, coastal erosion and potential protection measures might be useful for proposing future adaptation strategies (Donges et al., 2013). Aspects of how to develop and/or acquire adequate technologies for different types of coast (dynamics and morphology) and the degree of tourism development, as well as justice and environmental aspects of more restrictions to the access of the coastline have to be considered.

Progress in implementing climate change policies should be monitored, and the policies re-evaluated over time (Jopp et al., 2010; OECD & UNEP, 2011). Adaptation policies should be derived from climate impact assessments that consider the time horizons for different impacts, and their geographical scales, as well as complexities in tourist behaviour (OECD & UNEP, 2011). It is
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important to connect research to local, regional and national policy needs. Within the framework of preparing the German Strategy on Adaptation to Climate Change, indicators for actions targeted on the tourism industry have been proposed (Schönthaler et al., 2010) (table 33). These indices may also be used at a BSR-level. To assess sustainable tourism destinations in relation to climate change the following indicators have been suggested (adapted from Simpson & Ladle, 2007):

- National standards exist for the construction of new buildings to be set-back from the shoreline;
- A climate change risk assessment for tourism industry has been completed;
- An assessment of destination’s adaptive capacity to climate change has been completed;
- A system to measure and monitor carbon emissions in destination is being used
- Percentage of energy consumed in the destination from renewable sources;
- Percentage of beaches where erosion is monitored at least annually;
- Percentage of coastline with visible signs of erosion;
- Effective erosion protection measures in place in vulnerable areas (i.e. that do not have direct or indirect negative effects elsewhere).

**Table 33: Proposed themes for the establishment of indicators within the Action Field ‘Tourism Industry’ for the German Strategy on Adaptation to Climate Change (Schönthaler et al., 2010).**

<table>
<thead>
<tr>
<th>Indication Field</th>
<th>Sub-theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts (to be prioritised)</td>
<td></td>
</tr>
<tr>
<td>Tourism offer and tourism potential</td>
<td>Changes in the tourism on offer resulting from changes in the seasons</td>
</tr>
<tr>
<td></td>
<td>Changes in the tourism offer, as a result of a northward shift of opportunities for many forms of tourism</td>
</tr>
<tr>
<td></td>
<td>Changes in the tourism offer as a result of changes in tourist attractions (in particular landscape conditions and flora/fauna)</td>
</tr>
<tr>
<td></td>
<td>Impacts on bathing and boating owing to changes in water quality and quantity</td>
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<td></td>
<td>Impacts on regions renowned for their curative climate and on spas</td>
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<td></td>
<td>Impacts on winter sports areas</td>
</tr>
<tr>
<td></td>
<td>Impacts on tourist opportunities on offer as a result of a reduction in the availability of resources</td>
</tr>
<tr>
<td>Tourism infrastructure</td>
<td>Impacts on tourism infrastructures as a result of extreme weather events</td>
</tr>
<tr>
<td></td>
<td>Impacts on tourism infrastructures as a result of processes of long-term climate change</td>
</tr>
<tr>
<td>Tourism demand</td>
<td>Spatial shifts in demand on a global scale</td>
</tr>
<tr>
<td></td>
<td>Spatial shifts in demand at regional level</td>
</tr>
<tr>
<td></td>
<td>Changes in tourism seasonality</td>
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<tr>
<td></td>
<td>Changes in the demand for products</td>
</tr>
<tr>
<td>Tourists’ health</td>
<td>Interface - Action Field ‘Human Health’</td>
</tr>
<tr>
<td>Economic risks and opportunities</td>
<td>Changes in costs in the tourist industry</td>
</tr>
<tr>
<td></td>
<td>Changes in costs for holidaymakers</td>
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<tr>
<td></td>
<td>Financial insecurities</td>
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<tr>
<td></td>
<td>Improved prospects for economic success for coastal tourist destinations</td>
</tr>
<tr>
<td>Responses</td>
<td></td>
</tr>
<tr>
<td>Communication with / explanations to visitor target groups</td>
<td>Improvements in information provided and advice on appropriate behaviour</td>
</tr>
<tr>
<td>Adapting to the tourism infrastructure</td>
<td>Opening up new tourist destinations</td>
</tr>
<tr>
<td></td>
<td>Adapting the ski infrastructure</td>
</tr>
<tr>
<td></td>
<td>Restoration of tourist infrastructure</td>
</tr>
<tr>
<td></td>
<td>Interface - Action Field ‘Building Sector’</td>
</tr>
</tbody>
</table>
Climate Change Impacts on Coastal Tourism in the Baltic Sea Region

| Adaptation to site conditions | Technical and architectural measures for landscape conservation  
|                             | *Interface - Action Field 'Water':* technical and architectural measures for the conservation of coastal areas |

| Seasonal restructuring  | Changes in tourist seasons |

| Risk management, early-warning systems, handling natural hazards | Development, enhancement and operation of early-warning systems and information services  
|                                                                 | *Interface - Cross-sectional field 'Population Protection':* Preparing plans for extreme situations |

| Expanding tourism monitoring | Studies on resource-sensitive tourism  
|                             | Studies of the tourism offer  
|                             | Surveys of tourism demand  
|                             | *Interface - Cross-sectional field 'Spatial, Regional and Physical Development Planning':* supporting adaptation to climate change in a specific region |

| Adaptation to the tourism offer | Creation of weather-independent offers, diversification  
|                               | Creation of new tourism products  
|                               | Improving the service  
|                               | Improving the provision of information |

| Market development | Flexibility and diversification of offers in tourist regions  
|                   | Development of incentive and reward systems  
|                   | Development of the tourist insurance market and building up reserves |
6 Summary and Conclusions

Climate change impacts will have both positive and negative consequences on tourism industry in the BSR. Coastal and cold-climate-dependent tourism are exposed to many climate change-related risks, while warmer climate can also bring new weather-related opportunities to the region. Variables of climate change and their impacts are identified based on existing reports as well as on new analyses carried out as part of the Baltadapt project. This report reviews existing research on climate change impacts with relevance to tourism destinations and activities, tourist behaviour and flows in the BSR. Possible adaptation measures are reconsidered with relevance to coastal and cold-climate tourism destinations. Finally, the research and knowledge gaps in relation to climate change adaptation and tourism are listed and discussed with the aim to support research and cooperation between science and industry.

Coastal tourism industry is an important contributor to regional and national economies and employments; it is the largest single maritime economic activity in Europe; it employs more than 2 million Europeans (ECORYS, 2012a). Coastal destinations are the most popular destinations for domestic and foreign tourists. Coastal areas are also important for the leisure and recreation to the local communities, and they are a part of regional identity, place image and branding. The BSR has a tourism industry with longstanding traditions and innovative enterprises; although tourism adaptive capacities with relation to climate change vary depending if the settings are in urban, densely or scarcely populated coastal areas or in wealthier or lower income regions. Nevertheless all coastal tourism destinations around the Baltic Sea are linked through climate change impacts relevant for the region. To create, share and distribute existing knowledge on climate impacts and to find the best and available adaptation options, joint activities are needed for the BSR tourism industry and governments. Fragmentation, polarisation and low capacity to research, innovation activities and long-term strategic planning of the tourism industry request joined support and intervention from the national and local governments, as well as coordinating action by trans-national regional organisations.

The most valuable resources for coastal tourism in the BSR are beaches and the water itself, and consequently the quality of these resources is of great significance for the decisions by tourists to spend their holidays in this area. Snow and ice in cool weather destinations, e.g. the northern part of the BSR, are equally important tourism resources. While climate change will bring many new opportunities due to the rise of average air and water temperature it also will make significant negative impacts on the quality of water and beaches and the shrinking of winter tourism season. Sea level rise and increased wind-speed, increased precipitation in winter and decreased in summer will affect natural and built-up environments and structures that are today located in a thin belt along the coast. Through increased precipitation the runoff of nutrients from cultivated land could increase the already existing problem of eutrophication which may affect, e.g., beach tourism.
There are certain barriers to climate change adaptation strategies for tourism sector (Turton et al., 2010) that makes it difficult for the stakeholders to act appropriately to the already arising impacts of climate change to the BSR:
- The scale and uncertainty surrounding climate change projections.
- Communication within and between regional, national and local actors.
- Concerns regarding the capacity of venue-based small and medium enterprises to adapt, relative to governments and larger/global tourism operators.
- Institutional, legal, community and resource limitations that inhibit, or are at least perceived to inhibit, the timely implementation of adaptation strategies.

To overcome uncertainties on climate change and its possible impacts, new knowledge and information distribution are needed not only for responsible governments at various levels, but also for tourism industry and tourists. Changes of tourism impact on coastal environment (beach, dunes, high coast affected by erosion, forests, built-up areas, coastal sea waters, lagoons, rivers and wetlands) need to be studied. Such studies have to focus on tourists and tourism entrepreneurs (behavioural change, comfort and adaptation capacity, health and food impacts, impact on bathing, sunbathing, walking and other outdoor activities) and places (built-up and nature areas). Research on climate impacts and policy guidelines in different destinations should cover most vulnerable areas and structures with an importance for tourism and recreation, e.g. coastal infrastructure, accommodations (cooling, energy use, shading, etc.), public spaces (shading), nature and culture heritage and attractions (threats from temperature change and extreme weather events.), nature resources (changes and losses in species and habitats, damages from natural hazards). Concerning climate change adaptation in tourism sector several key issues are identified and require the following (after Prideaux, 2009; Turton et al., 2010; Eliasson, 2000):
- Confidence that climate is changing and this fact is recognized at wider society and acted upon.
- Common understanding that increased variability in climate is part of the climate change process.
- Overcoming communication problem among climate change experts, tourism industry and decision-makers.
- Comprehension that there are a number of drivers that underpin change and in the tourism context which are poorly understood.
- Recognition that climate change and adaptation is a moving target.
- To overcome uncertainty, the effective monitoring and evaluation of impacts and adaptation measures are needed that are relevant for tourism industry.
- Motivation from the tourism industry and destinations to avoid climate change risks or take up opportunities through adaptation actions.
- Resources from the government and private stakeholders.
- Innovation is a key strategy for tourism industry and destinations and that includes demonstration of new technologies and good practises.
- The tourism industry need to be self-organized on an industrial scale to ensure its voice is heard and concerns are accorded legitimacy; thus transitional support from the government at various levels is needed.
## Annex 1: Tourist arrivals and overnight stays in the BSR countries in 2011

Compiled by authors, data source: BASTIS, 2013

<table>
<thead>
<tr>
<th>Country</th>
<th>Tourist arrivals</th>
<th>Overnight stays</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total million</td>
<td>domestic %</td>
</tr>
<tr>
<td>Sweden</td>
<td>24.0</td>
<td>79</td>
</tr>
<tr>
<td>Poland</td>
<td>21.5</td>
<td>80</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1.6</td>
<td>40</td>
</tr>
<tr>
<td>Latvia</td>
<td>1.6</td>
<td>33</td>
</tr>
<tr>
<td>Germany</td>
<td>141.7</td>
<td>80</td>
</tr>
<tr>
<td>Finland</td>
<td>10.7</td>
<td>76</td>
</tr>
<tr>
<td>Country</td>
<td>3% France</td>
<td>10% France</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>Estonia</td>
<td>2.7</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>6.2</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Russia*</td>
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<td>No data</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belarus**</td>
<td>2.4</td>
<td>No data</td>
</tr>
</tbody>
</table>

* data from 2008
** Mecklenburg-Vorpommern 24.7 and Schleswig-Holstein 21.3 million overnight stays 2011
*** data from 2010
Non-BSR country: non-BSR country and long-haul market
Annex 2: Latvian case study

This case study is based on Latvian policy documents and literature review with relevance to coastal tourism and climate change adaptation efforts in Latvia.

National policy context

Latvia does not have adopted national climate change strategy; although in 2008 the Council of Ministers adopted the informative report „On adaptation to climate change” (CM, 2008). The national report contains a statement that the Latvian coastline of 5-10 km zone has more than 1 million inhabitants (highest coastal population concentration among BSR countries) and thus coastal areas has priority in proposed climate change adaptation strategy.

Integrated coastal zone management (ICZM) is not institutionalised practise in Latvia. The coordination of different interests at the coastal zone is performed through national level spatial policy. Several national level documents is creating a “framework policy” for coastal zone that is implemented through spatial planning, environmental and relevant sectorial policies at regional and local scales. Latvian National Environment policy guidelines 2009-2015 adopted by the Council of Ministers (CM, 2009a) recalls on high population concentration in coastal areas, increased threat of coastal erosion and the need for adequate coordination among spatial planning documents. The policy guidelines supports the policy initiative to declare coastal zone as Latvian national interest territory with specific legislation and designated public investments to coupe with increasing challenges including climate change.

Latvia Tourism Development Policy Guidelines 2009-2015 (CM, 2009b) that includes the analyses of global trends and challenges relevant for Latvian tourism industry, refers also challenges related to climate change, global warming and impacts to tourism industry. Changing climate and variability of weather in tourism destinations affect tourists comfort and decision making. Fluctuating tourism demand affect tourism flows and thus has impact also on other sectors like construction, agriculture and crafts. Warmer summers create risks for skiing resorts and thus tourism strategies, particularly in winter season need to be adapted to changing conditions (CM, 2009b). The policy document urges tourism enterprises to implement also mitigation measures (energy effectiveness, use of new technologies), that are equally important to adaptation measures. Latvia Tourism Marketing Strategy 2010-2015 (TAVA, 2010) points out that climate change as one of major global trends creates better opportunities for Baltic States. Mild climate and existence of four distinctive seasons is listed as advantage for the region. It is suggested that warmer climate will create better business opportunities in both in winter and summer seasons. It is also stated that Latvia have skiing tourism segment, however there is no reference on possible impacts on this tourism segment in future in case of negative climate impacts for snow-dependent tourism.
High variability of coastal areas

Latvia has coastline of about 496 km in length on the eastern Baltic Sea shore. 67% of the coastline is affected by coastal erosion (CM, 2009a; Eberhards, 2004). Apine (2011) notes that in “Latvia, compared with other countries, there are not many rather valuable objects and households that are actually endangered, because of the geopolitical conditions during the last 50 years in the previous century, when the housing and economic activities in the Baltic Sea coastal zone and in the Gulf of Riga Kurzeme coast starting from Engure was severely restricted or banned”. It is estimated that 10% of the sea coast is directly affected by port infrastructure, coastal defence structures and residential proximity (Eberhards, 2003). There is no specific legislation in Latvia that would provide assistance to owners of built-up structures in case of coastal erosion or losses of land (Apine, 2011).

The Baltic Sea open coastline is approximately 183 km; the Irbe Strait coastline 57 km; while the Gulf of Riga total seashore length is 256 km. According to the coastal typology adopted for the EUROSION project, coastal area of Latvia can be described as: 3b Wave-dominated sediment; Plains; Micro-tidal river delta and 2 Soft rock Coast. Within this major coastal types there are large diversity of coastal formations and habitats, including the river delta and sandy beaches with bar and vegetated sand dunes (Lapinskis, 2012).

Figure 1: Generalised distribution of the morphodynamically different types of the coast (Lapinskis, 2012)

Since 2011 there are 16 of 119 Latvia local municipalities that have sea coast boundary, in total coastal municipalities occupy 12.5% of Latvian territory. There are in total ten ports and urban areas
and 56 villages in rural areas. Four cities has designated as having national importance – Riga, Jūrmala, Liepāja and Ventspils – and three of them is also national importance ports – Riga, Liepāja and Ventspils, while Jūrmala is recently designated as national resort (similar status was given to Jūrmala during the Soviet Period). Three major ports (Riga, Ventspils and Liepāja) (ferries, cruise tourism, smaller tourist ships and yachting) and eight smaller ports (smaller tourist ships and yachting, recreational fishing and angling) are nodes of development on the coastline. 44% (986.4 thousand) of the Latvian population has their permanent living place in coastal municipalities. 90% of all population resides in urban areas (SRDA, 2010). However there are many seasonal settlements and vacation homes, and the number of population increased during summers and the share of urban population increases. Population shrinkage in total is observed in Latvia as well as in its coastal areas, particularly in Kurzeme – Rucava and Pāvilosta municipalities, except Carnikava and Saulkrasti municipalities - adjacent areas to Riga City –where has been observed a significant population increase (CM, 2011).

Coastal zone, land use and spatial planning in Latvia

There are various interpretations of coastal zone used in planning and normative documents in Latvia (SRDA, 2010). For the purpose of the coastal zone spatial development the potential coastal zone functional space (PCZFS) is defined as a zone of 5 km into Latvian territorial sea waters and 5 km into land measuring from the sea water boundary. Lakes, particularly protected nature areas and cities (except Riga City where 5 km zone is complied) are included in the PCZFS undivided. The PCZFS covers 4% of total Latvia territory (figure 2). The most observed land use type is forest lands that cover 60% of the PCZFS. Forests have not only recreational and nature value, but they also serve as dune protection. Agricultural lands cover 25 %, water bodies and courses – 5 %, wetlands – 4%, sandy beaches – 2%, meadows of forests – 1%, and only 3% are built up areas (MRDLG, 2010). In Riga City within 5 km coastal zone there is 23.5% of its total territory. In total Riga City have 24.4 % of its land under parks and nature areas and 15.6 % under inland water area. Its neighbourhoods’ population density varies from 9 to 15981 persons per km², where flood-prone and coastal areas have lower densities. In total 49% of the coastline and 34% of the PCZFS are nature protected areas and have Natura 2000 status. In total there are two national parks, 22 nature reserves and six nature parks (MRDLG, 2010). In the capital city 17% of the territory is covered by particularly protected nature areas and micro-reserves these are mainly in coastal and flood prone areas (Riga City Council, 2010). Thus coastal area spatial development is characterized with high fragmentation and polarization. Traditionally Latvian settlements are located in distance from the sea coast and thus flood prone areas are kept inbuilt due to public land ownership or the planning and building regulations. National policies has been recently prepared for coastal zone in order to react on the needs for climate change adaptation, external development forces and changes in economical and social regime, and the change of the utilization of the coastal zone potential, including the change of public perception, policies and implementation (Saeima, 2010; CM, 2011).
### Table 1: Disparities of coastal local municipalities in Latvia (SRDA, 2010).

<table>
<thead>
<tr>
<th>Planning region</th>
<th>Coastal local municipality</th>
<th>Population in thousands, on 01.01.2010</th>
<th>Population density pers./km²</th>
<th>Personal income tax revenues in the local government budget in 2009, LVL per capita</th>
<th>Total local government expenditures after transfers and real estate tax and other revenues, in 2009, LVL per capita</th>
<th>Local government expenditures for environmental protection, area management and housing in 2009, LVL per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riga Planning Region</td>
<td>Salacgrīvas novads</td>
<td>9.5</td>
<td>14.8</td>
<td>214</td>
<td>586</td>
<td>158</td>
</tr>
<tr>
<td></td>
<td>Limbažu novads</td>
<td>19.6</td>
<td>16.8</td>
<td>212</td>
<td>695</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Saulkrastu novads</td>
<td>6.2</td>
<td>129.8</td>
<td>288</td>
<td>530</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Carnikavas novads</td>
<td>6.4</td>
<td>80.6</td>
<td>336</td>
<td>1134</td>
<td>647</td>
</tr>
<tr>
<td></td>
<td>Riga City</td>
<td>709.1</td>
<td>2340.4</td>
<td>365</td>
<td>602</td>
<td>20</td>
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<td></td>
<td>Jūrmala City</td>
<td>56.1</td>
<td>517.6</td>
<td>331</td>
<td>656</td>
<td>45</td>
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<td></td>
<td>Engures novads</td>
<td>8.1</td>
<td>20.3</td>
<td>227</td>
<td>799</td>
<td>47</td>
</tr>
<tr>
<td>Kurzeme Planning Region</td>
<td>Rojas (incl. Mērsraga) novads</td>
<td>6.2</td>
<td>20.2</td>
<td>164</td>
<td>455</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Dundagas novads</td>
<td>4.8</td>
<td>7.1</td>
<td>152</td>
<td>574</td>
<td>82</td>
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<tr>
<td></td>
<td>Ventspils City</td>
<td>42.8</td>
<td>739.4</td>
<td>323</td>
<td>724</td>
<td>120</td>
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<td></td>
<td>Ventspils novads</td>
<td>13.6</td>
<td>5.5</td>
<td>196</td>
<td>714</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>Pāvilostas novads</td>
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<td>6.3</td>
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<td>430</td>
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<td></td>
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<td>Liepāja City</td>
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<td>210</td>
<td>495</td>
<td>20</td>
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<tr>
<td></td>
<td>Nīcas novads</td>
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<td>11.1</td>
<td>172</td>
<td>382</td>
<td>79</td>
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<tr>
<td></td>
<td>Rucavas novads</td>
<td>2.0</td>
<td>4.5</td>
<td>110</td>
<td>390</td>
<td>50</td>
</tr>
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</table>
In 2010 the National Spatial Development Perspective (NSDP) was adopted by the Parliament as a part of the Sustainable Development Strategy of Latvia (SDSL) (Saeima, 2010; figure 3). The NDSL emphasises the need to identify the spatial development policy directions and the use of the economic potential of all regions. It focuses on three main aspects – internal and external accessibility (of transport infrastructure and communications) and mobility, the settlement (development centres, their functional networks and urban-rural interaction) and the spaces of national interests (rural areas, the Baltic Sea coast, area of Riga metropolis, Eastern border, outstanding areas of nature, landscapes and cultural history) (figure 3) (Saeima, 2010: 80). The aims of the spatial development are (1) creating “equal life and work conditions for all inhabitants regardless of the place of residence by facilitating entrepreneurship in regions, developing transport and communication infrastructure and public services”; (2) strengthening international competitiveness of Latvia and its regions by increasing the role of Riga” and other largest cities; and (3) to preserve the particularity of Latvia – “the diverse natural and cultural heritage, typical and unique landscapes” (Saeima, 2010: 61). The NDSL lists the coast of the Baltic Sea as a type of national interest spaces (Saeima, 2010: 80) and highlights its outstanding value and the importance for sustainable development and the need for complex solutions and purposeful state policy to solve existing and potential conflicts. The SDSL notes that “natural values belonging to the society should be linked with transport networks and recreational infrastructure, forming an integrated chain of services” (Saeima, 2010: 60). Describing the development potential and problems of the Baltic Sea coast the NDSL stresses that climate change create “serious risk factor for the use of the seacoast in long-term” and that bank erosion and accumulation processes are already observed (Saeima, 2010: 83).
The NDSL also calls the state regional development policy to provide support to environment favourable projects at the seacoast areas that ensure economic activity and employment possibilities. These supporting measures needs to balance of „the traditional (fishery, fish processing, recreation, resort farm) and — new types of economic activities (international tourism, including yacht tourism, extraction of alternative renewable energy resources) with the interests of environmental protection” (Saeima, 2010: 84). Besides horizontal coordination better vertical coordination is needed. Co-operation between local governments, planning regions, state administrative institutions and the society both at national level as well internationally needs to be promoted. The NDSL points out that the sea spatial planning is a new practice that needs to be applied in Latvia. There are also mentioned the need for thematic planning in the field of risk prevention (flood, seacoast processes), seacoast tourism infrastructure, landscape preservation, the use of wind energy or other alternative energy resources (waves and thermal resources). For the planning purposes the need to forecasting of the seacoast processes in practical and usable form is underlined. The guidelines for spatial development of the seacoast should be developed and introduced into practice, and to be interlinked with the investments in infrastructure, particularly to support investments in the development of the infrastructure of the fishing and yacht ports (Saeima, 2010: 84).

Coastal Spatial Development Policy Guidelines 2011–2017

In 2010 Latvian Ministry of Regional Development and Local governments prepared the draft Coastal Spatial Development Policy Guidelines 2011-2017 that were adopted by the Council of Ministers in 2011. Strategic impact assessment report and organized public participation process from 29th April to 7th June, 2010 where government institutions, municipalities and non-governmental organizations responded. The draft guidelines were prepared on the basis of two reports on coastal problems and conflicts prepared by the Kurzeme and Riga planning regions (SRDA, 2010).
It was a long-term expectation and encouragement from Latvian planning and nature conservationist communities that the coastal zone needs to be addressed at national level policies, particular in spatial planning, regional development and nature conservation. The coast served as the Cold war line between the East and the West and obtained a particular political meaning. Such development regime was imposed for fifty years (1941-1991) and resulted in the loss of local population, the perishing of local livelihoods, place identities and cultures, and as the consequence the coastline nowadays is characterized with intermingling of places of re-naturalization, dereliction, pollution and the interchange of urban and suburban places of high population densities with highly naturalized rural places with extremely low population densities (figure 2). Tourism development on Latvia coast is also very fragmented – higher number of tourists in suburban and urban areas, resorts (Jūrmala) with very low level of development in remote rural areas.

Already in 1990, the Latvian government decided to keep the Soviet regulations of strict control of development on the seacoast and to establish a 600-metre-wide protection zone (300m of land, 300m offshore) to protect the natural and recreational resources. However the history of Latvian coastline protection goes back into more remote past and coastal fortification in urban places were constructed during early industrialization period. The idea of 1990ties was that the coastal protective zone has to be incorporated into land-use plans at the various levels - national, regional and local. The Protection Zone Law adopted in 1997 replaced government regulations. All types of protected zones have to be fixed in the municipal land use plans. The Baltic Sea coastal zone was formed to minimize the sea pollution impact from land, to prevent erosion, to preserve, protect and sustainable use coastal nature, recreation and tourism resources, particularly coastal forests and seaside landscapes and other nationally important territories. The coastal protection zone is divided into a coastal dune...
Annex 2

protective belt, a sea protective belt and a restricted economic activity belt. Depending on the width of the dune area, the coastal dune protective belt is established, but not less than 300 meters in land direction form the place where natural terrestrial vegetation begins. There are exceptions for coastal areas in towns and villages. The restricted economic activity belt is defined 5 kilometres in land. The Baltic Sea coast protective zone foresees the wide range of land use and building restrictions. In general outside the boundaries of towns and villages new construction is permitted only as reconstruction of existing structures or on the fundament of former constructions. Such policy kept the nature values of the Latvian coast, the price of coastal properties had raised and in general the original fishing community descendants sold their property to new wealthy class members the coastal residences became as vacation homes or second homes. Coastal rural communities did not gained from the transformation process as well as the Latvian economy; its tourism sector did not gain either.

The challenges of the climate change impacts, the transformation of fishing industry and agriculture due to the Latvia accession in to the EU in 2004, and the need to stimulate the Latvian economy by exploiting all its potentials, including coastline and the need to support regional development potentials outside the main urban centres were some of the factors that facilitated the preparation of the Guidelines for the Spatial Development of the Coastal Area and the active participation by the government institutions, municipalities, businesses, non-governmental organizations and civil society. In spite of low permanent coastal population densities many of Latvian inhabitants and from neighbouring countries perceive the Latvian coastline as a symbolic value, as a place where nature and human interests have been balanced in a good manner and thus any new development is perceived with cautious attitude.

The Guidelines for the Spatial Development of the Coastal Area (CM, 2011) identifies the main development problem - the insufficient utilization of the development potential of the seacoast, its resources and advantages. Latvian national policies do not have coordinated vision concerning coastal area and there is no specific support to the coastal areas. The guidelines defines that the value of coastal areas at national level are a joint nature and culture heritage, that includes environment created by long-term interactions between humans and places. The policy document also notes that the concentration of the joint nature and culture heritage is distributed unequally; also local small scale conflicts exist in certain areas. In order to use the joint nature and culture heritage for the coastal areas development and the added value creation, the access needs to be provided meaning both physical access and legislative access. In thus public infrastructure creation in coastal areas is defined as a priority (CM, 2011). The document calls for preserving the joint nature and culture heritage, enhancement of the quality of life of the population and the increase of the competitiveness and international awareness of Latvia. The sub-goals are to improve governance, to promote an active and responsible coastal area local community creation, to promote sustainable coastal areas management and to develop coastal areas as economically balanced, multifunctional space by promoting coast-specific business activities and industries (port activities, fishery, recreation and tourism) and by improving the public infrastructure. The document highlights the need for better
coastal monitoring and the problem that existing statistical data does not provide information on functional areas, including coastal areas. The policy guidelines envisage establishing a coastal cooperation and coordination council as a consultative body where representatives of state institutions, municipalities, non-governmental organizations can exchange their ideas and information and initiate and mobilize joint activities. Joint actions are particularly important as the coastal municipalities are unequal in the size and the level of economic development. The policy document notes that exchange of good examples are needed and as well as public awareness promotion activities. It also intends to prepare a national level spatial plan that will prioritize places in the coastal areas that need support, including financial support to infrastructure. Here the needs for climate change adaptation option can be incorporated. The policy document for coastal areas calls for the speedy-up development of the national climate change adaptation strategy that adoption since 2009 was postponed due to the current economical and financial crisis. There is an urgent need for knowledge of coastal climate change impacts and adaptation options addressed for local level decision-makers and wider public (CM, 2011). The policy guidelines list some of the known coastal climate change impacts, and indicate the urgent action needed. It request for a risk planning, landscape planning, and public infrastructure planning and specific building regulations for coastal areas and to prepare a proposal for a new financial instrument for coastal areas infrastructure upgrading and maintaining in the framework of the use the EU structural funds starting from 2014.

Concerning recreation there is only statement that all have rights to access the sea coastline and services. It is suggested that coastal services providers (hotels, shops, catering providers) have to consider also dark season by creating terraces with artificial light. It is suggested that new buildings have to be medium size, not higher that trees, and in locations that do not obstruct existing view on the sea. It is suggested that recreational pedestrians have to be guided on specially created coastal paths, footbridges and coordinated entrances (by decreasing their number while increasing utilities) to the sea coast that fragile coastal ecosystem will be preserved. It is suggested that public objects, active tourism zones have to be created in a distance from the coast, thus diminishing human impact on the coastline itself. For tourism signs, fences and other utilities of leisure natural building materials are suggested to be used (particularly pine tree or tree washed out from the sea, not planed timber). Final recommendation is to the coordination of all kinds of infrastructure on the coast. It is suggested that high intensity motorways need to be developed at the distance from the sea coast. It is suggested that any parking places close to the sea coast need to be equipped with leisure infrastructure and pedestrian access to the sea. There is a statement that coastal villages in majority have non-paved access roads that in high tourism season create congestion, tourists do not visit such places and such situation is considered as an obstacle for future development. It is suggested to create bicycle roads in the places of non-used rural roads or railway lines. It is suggested that velo roads have to be created inland from dune zone in cases if beach is not suitable for tourism, except in the cases when dunes are affected by coastal erosion. There is no suggestion on creating pedestrian roads as usually beach
National level studies on tourism and climate change adaptation in Latvia

There are no specific studies on climate change adaptation and tourism sector in Latvia. An argument exists that Latvia does not adequate data to account leisure related activities in relation to the use of second homes and thus the share of tourism and tourism related activities in GDP is lower (Karnīte & Karnītis, 2006). Latvian statistics does not provide information on second homes, summer cottages and allotment gardens and there is scarce research activity in this field. However local and regional governments are well informed that the highest concentration of the vacationers is close to the sea coast and other water bodies, often in flooded areas, and that urban planning and construction standards in the period of creation of these leisure areas were lower than in neighbouring urban and rural areas, and as result currently and particularly in future these second home and camping areas are particularly vulnerable to any weather extremes. The study on residents’ attitude towards possible adaptation measures to the sea coast erosion in Latvia revealed that many residents are actually residing on the coast only in summer periods, however this study does not analyse their attitudes separated from permanent coastal inhabitants (Apine, 2011).

Research on parking places on major Latvian motorways (Ekonomikas ministrija, 2004) has been conducted that indicates the need to improving existing and to construct new tourism infrastructure. Currently existing parking places are insufficient equipped: only 30% have WC, 31% catering facilities and 26% leisure utilities (furniture) (data on whole Latvia, Ekonomikas ministrija, 2004). Inadequately developed parking places on major roads are causing littering in nature areas. This study has analyzed most important parking places that are located on the sea coast. The results of the study reveals that situation differs – some of coastal parking places are in good condition, has nature trails and bird observation platforms (North Vidzeme Biosphere Reserve 100km from Riga), other coastal areas does not have developed parking places – near Ainazi town, entering into Ventspils and Liepaja cities, on road Liepaja-Lithuania border. Other minor coastal roads and parking places in this study are not analyzed.

The research report on the development of the Latvian section of Eurovelo network (Ekonomikas ministrija, 2007) highlights that Latvia has a large variety of tourism resources including coastal that potential is not used for the development. There is inadequate access to nature and culture resources or they are poorly equipped with tourism infrastructure. Currently Latvian roads are not well suited for bicycling tourism in all climate conditions, particularly in cold season. With climate change this aspect might be improving. Study analysis EuroVelo 10 “Baltic Sea Circle” segment in Latvia that has in 770 km, from which 483 km is paved. 24% from total distance in Latvia are municipal roads, the rest are state roads and thus supervised by the Transport Ministry. EuroVelo 10 “Baltic Sea Circle” main theme is Baltic Sea coastline and its nature and culture resources. In Latvia bicycle road
is located in coastal areas with low human impact (un-built and scarce local population). The route goes along many NATURA 2000 areas (Pape lake Nature Park, Ziemupe Nature Reserve, Slītere National Park, Talsi Upland Nature Park, Kemeri National Park, Randu Meadows Nature Reserve, North Vidzeme Biosphere Reserve, and others. The route includes such culture and history tourism objects as Liepaja Karaosta (marine port and settlement), castle of Ventspils, Irbe radio telescope, historical Kemeri resort (mineral water and mud), Riga historical centre and other sites. EuroVelo 10 in Latvia has 88 resting places, form which majority are located at water bodies (including seacoast). Majority of rest places are created in areas owned by the State Forestry Company, which is important stakeholder in the development of coastal tourism as well as nature tourism in general in Latvian national context. The research report is not providing any details on the section of EuroVelo 10 going directly along the coast, for instance the risk of erosion of road infrastructure or parking place. No information is given how close to the coastline are 98 accommodation places that are listed and described by the study. Majority of accommodation places are located close to the coast however the study underlines that along the road between Ventspils and Kolka there is not enough of accommodation providers. This is an obstacle why Latvia does not qualify for the EuroVelo criteria that request one accommodation place per each 25 km. The majority of accommodation places are specialized for large scale events (usually booked in advance in high season), not for individual tourists and small groups. There is not adequate coverage with catering services in coastal areas as they are located mainly in cities and towns. In rural areas food is available only in groceries. WC and public transport is not adequately developed in coastal areas. Public transport connects mainly large settlement centers, in rural areas it is slow and rare, and often it is not provided every day. Ports are not developed for tourists. The research report states that in summer season some sections of coastal roads can have congestion.

Latvia association for rural tourism (Lauku Ļotājs, 2011) within the LIFE+ project POLPROP-NATURA has developed the guidelines for building in the coastal areas. The guidelines have an emphasis on preservation of cultural heritage, vernacular building styles and land use patterns, fences, landscaping. There is no information provided in relation to climate or its change impacts on built up areas and individual buildings. Impacts and possible solutions are missing in relation to changing weather conditions in winter season and storm surges with high speed winds, strong waves and water level rise. There is information given that in coming 15 years 310 ha will be lost due to coastal erosion that will cover 258 km or 51.1% of Latvian coastline. However no reference to climate change or a need to adapt is mentioned. In relation to coastal erosion there is only a suggestion not to interfere into natural ecosystem or coastal geo-morphological processes and illustration how sand flows are affected by erecting piers. There is also recommendation that coastal protection zone have to be taken into account when new buildings are erected. It is suggested that developers have to think in advance what kind of coast is this- erosion type, accumulation type or dynamic balance type, where both accumulation and erosion is taken place. Recommendations suggest that preserving and developing natural vegetation (afforestation) is only way how to preserve coast line.
Within the national research programs on coastal areas and climate change, as well as with the support of the Baltadapt project several studies have been conducted to identify current and future coastal risks and possible adaptation measures. Latvia coastal areas are diverse and for analytical and management purposes are suggested to divide in zones (Figure 4; Lapinskis, 2012):

- **Gulf of Riga Vidzeme coast (area 1)** is considered as high risk area. Severe and average erosion (5-10 m/15%/yr-1) with damage to property and infrastructure during W, NW and N storms with surge level over 2.0 m for more then eight hours. Northernmost part of area (10 km) is subject more to flooding then the coastal erosion.

- **Gulf of Riga south coast (area 2)** is considered as average risk area. Average erosion (0-10 m/15%/yr-1) with damage to property and infrastructure during W, NW and N storms with surge level over 1.7 m for more then eight hours. In local short sections close to Daugava and Gauja embouchures erosion and flooding risk is high.

- **Gulf of Riga Kurzeme coast (area 3)** is considered as average risk area. Severe and average erosion (5-10 m/10%/yr-1) with damage to property and infrastructure during NW and N storms with surge level over 1.5 m for more then five hours. In local short coastal sections related to Roja, Mērsrags and Engure ports erosion risk is high. Flooding risk is low and very low.

- **Coast of the Irbe Strait (area 4)** is considered as low risk area. Week erosion (0-5 m/15%/yr-1) with damage to property and infrastructure during W, NW and N storms with surge level over 1.3 m for more then eight hours. In 5 km long coastal section close to Cape Kolka erosion risk is high. Flooding risk is low and very low.

- **Coast of the Baltic Proper (area 5)** is considered as high risk area and most threatened by erosion in more frequent storms. Severe and average erosion (5-15 m/20%/yr-1) with damage to property

![Figure 4: Coastal zones with different erosion and flooding risk degree due to local determining conditions. (Lapinskis, 2012).](image-url)
and infrastructure during SW, W, NW and N storms with surge level over 1.2 m for more then five hours. In local coastal sections related to Liepāja, Pāvilosta and Ventspils ports erosion risk is extremely high. Southernmost part of area (Lithuanian border - Liepāja) is subject to local flooding risk.
References


References


CM (2008): Informatīvais ziņojums Par piemērošanos (adaptāciju) klimata pārmaiņām [Informative Report on adaptation to climate change], approved by the Council of Ministers 05.08.2008.


References


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ECORYS (2012b): Blue growth scenarios and drivers for sustainable growth from the oceans, seas and coasts: maritime sub-function profile report cruise tourism (4.3). Rotterdam, Brussels: ECORYS, European Commission, DG MARE.


References


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