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CLIMATE CHANGES AND ADAPTATION POLICIES IN THE BALTIC AND THE ADRIATIC REGIONS

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Abstract
This paper provides an overview of differences and similarities of the current climate changes in the Baltic and Adriatic coastal regions and appropriate adaptation policies on national, regional and European level.

All reparian countries are at different stages of developing and implementing national adaptation strategies. The proposal for an overall BSR wide Climate Change Adaptation Strategy and Action Plan has been launched with the aim to recommend actions for climate change adaptation in the Baltic region. No similar agreement has been concluded yet on the protection of the semi-closed Adriatic Sea, the surface of which is about 1/2 of that of the Baltic Sea, and whose coastal region is home to about 1/4 of that of the Baltic Sea. The differences in the socio-economic characteristics and indicators may be partly responsible for the differring attitudes, actions and reporting concerning the adaptation to climate change, both between individual countries, as well as between the two regions as a whole.

Keywords: Baltic Sea, Adriatic Sea, climate changes, adaptation instruments.

Jel Classification: O13; P28; Q5

INTRODUCTION

The Baltic and the Adriatic seas are both semi-closed, the surface of Adriatic is about half of that of the Baltic Sea.

The Baltic Sea, a region known for a relatively high economic wealth, a high level of education and a high level of environmental awareness among most of its riparian states.

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This region is home to about 90 million people in its catchment area[2] and its further growth is likely to be of comparably high economic stability and prospects.

The Adriatic Sea, home to about 15 million people in its catchment area (about ¼ of that of the Baltic Sea), is characterised by larger socio-economic contrasts. Moreover, Italy, as one of its 6 coastal countries,[3] is the dominating player in terms of population size and the GDP. The differential in terms of the annual GDP/capita is large, varying from 4000 USD for Albania to 35.000 USD for Italy.

The main motivation of the present paper is to give an insight in the differences and similarities in the current climate changes in the Baltic and the Adriatic regions, to compare the evolving adaptation policies and instruments on local, national, regional and European levels, and — where possible- to draw conclusions with respect to the results and effects of the measures undertaken.

The Baltic Sea covers area of 415.000 km^2. The catchment area is four times larger than the sea itself and is populated by approximately 90 million inhabitants. The Baltic Sea, semi-enclosed basin has not been, since its formation, in a steady state because of the expansions and contractions of the Scandinavian ice sheet. Climate variability caused by natural and human actions, is visible on centennial and decadal scales. Changes in the biogeochemistry are present in the Baltic coastal zone. According to Anadón et.al. (2007) characteristics of the Baltic Sea are low salinities, closed circulation in the central basin, and strong horizontal gradients both in salinity and in ecosystem variables resulting in low biodiversity.

According to Graham et. al. (2006) climate models predict for Baltic region, by the end of the 21st century, temperature increases during all seasons with a mean warming of 3–5ºC in the atmosphere and 2–4°C in the sea-surface temperature. A decrease in sea-ice extent by 50–80% over the same period is expected. Changes in precipitation are expected to include wetter winters and in southern parts of the region, drier summers. Anadón et.al. (2007) claim that as a consequence, river runoff during winter might increase by as much as 50%, and the opposite pattern could occur in summer.

The Adriatic Sea is bordered in the west by Italy and in the east by Slovenia, Croatia, Bosnia-Herzegovina, Montenegro, and Albania. It is a semi-enclosed sea that connects to the Ionian Sea at the Strait of Otranto, at its southeast. The Adriatic Sea drainage basin covers 235,000 square kilometres, which is about ½ of that of the Baltic Sea.

Precipitation changes, altered circulation and increased sea surface temperatures that cause increased stratification can help to explain the increased frequency of bottom water hypoxia (low oxygen) or anoxia in coastal zone of the northern Adriatic, as Anadón et.al. (2007) say. Hypoxia or anoxia can alter food webs, may have important effects on biodiversity, and are often associated with mass mortalities of fish and benthic fauna.

1. CLIMATE CHANGE

1.1. Climate changes in the Baltic Sea region

Because the Baltic Sea has limited water exchange and higher projected warming than the global mean, major changes in the biodiversity could occur, as Andersson says (2013).

[2] The EU member states Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Sweden plus the Russian Federation.

[3] The others are Albania, Bosnia and Herzegovina, Croatia, Montenegro and Slovenia.

The future climate may be projected by climate models, some of the *direct climate changes* that scenarios show is increasing annual and seasonal mean temperatures, with the largest increases in the north-eastern part of the region and in winter causing a strongly reduced snow cover.

According to Andersson (2013), the scenarios also show more common and intensified hot temperature extremes and less cold temperature extremes. In winter, there is high probability of precipitation increase but in summer there is possibility of no change or a decrease in the southern part of the region. Increase in precipitation extremes, are expected. It is not yet shore what may happen to wind storms. Some of the *indirect climate changes* that are projected in the Baltic Sea Region are: a reduction in amounts of snow, duration of snow coved and occurrence of sea ice, increases in wintertime river flow and lower and earlier springtime peak flows due to changes in snow cover. The mean annual river flow is expected to increase in the northern parts of the basin, but might decrease in the southern parts. The Baltic Sea salinity may decrease due to the expected increase in total river discharge into the sea.

Sea levels, especially in the southern part, will rise, according to Andersson (2013). An increase in maximal wind speed and frequency of extreme events are predicted in a few simulations.

1.2. Climate change in the Adriatic Sea region

For the north Adriatic coast a long-term trend of rising sea level has been founded and it is assumed that this is due to global changes in the sea level and to land subsidence, especially in deltaic areas. This state is worsen by storms and very strong winds typical for the Adriatic basin such as the Bora (cold, dry, northeastern wind) and Sirocco (southsoutheastern wind) (Adaptation to Climate Change in Coastal Areas of the ECA Region: A contribution to the Umbrella Report on adaptation to climate change in ECA). According to Valiela (2006) the combination of these factors has increased intensity and the frequency of floods in the northern Adriatic coastal areas. According to Dulcic and Grbec (2000), during the past 30 years in the Adriatic Sea, the thermophilic species of ichthyofauna have increased.

Some species, as zooplankton and fish, that were rare become more abundant, and new species are being recorded, as Dulcic and Grbec (2000); Kamburska and Fonda-Umani (2006) claim. The reason may be increasing temperatures and salinity variations in the Adriatic Sea, which intensified after 1988, Russo et al. (2002). Climate changes as changes in wind speed and direction, increases in storm frequency and rainfall, etc. affect water characteristics in the whole marine ecosystem, published by Anadón et.al. (2007) and Russo et al. (2002). According to Anadón et.al. (2007) and Boero (1996 and 2001) a number of phenomena such as blooms of jellyfish (Pelagia noctiluca) and thaliacea harmful algal blooms (by several species of dinoflagellates) and red tides, were triggered by these meteorological and oceanographic changes.

According to Anadón et al. (2007) the Adriatic Sea occasionally experiences big changes related to low temperatures. It faced with oddly low surface temperatures in the winter of 2001 (from 9°C to freezing) that led to mass mortalities of sardines (Sardinella aurita) (Guidetti et al. 2002), and altered food webs. The Bora winds (northern to north-eastern winds passing through the valleys of the Dinaric Alps) associated with decreased temperatures result in the possibility of deep-water formation. Higher temperatures and mild winter conditions cause a deficiency of convection in open-sea. This phenomenon changes deepwater and often reduces spring phytoplankton blooms and export production to the deep layers.

1.3. Comparison of projected climate changes in the Baltic and the Adriatic Sea regions

Table 1. shows Projected climate changes in the Baltic and the Adriatic regions by the end of the 21st century. Second column presents projected change for mean temperature (°C) 2071–2100, compared with the 1961–1990 baseline, for the A1B (a medium-high non-mitigation baseline scenario) emissions scenarios (winter and summer), and it shows bigger winter atmospheric temperature rise in the Baltic (3.74–5.17°C) than in the Adriatic region (1.78–3.55°C), but bigger summer atmospheric temperature rise in the Adriatic (3.10–5.39°C) than in the Baltic region (from 2.12–4.44°C). In the Baltic region bigger increase of atmospheric temperature is projected for winter season, while for the Adriatic region bigger increase of atmospheric temperature is projected for summer season.

Third column indicates projected sea surface tempreature rise from 2 to 4°C in the Baltic and about 4°C in the Adriatic region, so projections show similar sea surface tempreature rise.

Table 1. Projected climate changes by the end of 21st century

Projected CC by the end of 21st century	Atmospheric temperature rise* - in winter - in summer [°C]	Sea surface temperature rise** [°C]	Relative sea level in 2081–2100 compared to 1986–2005 for the medium-low emission scenario RCP4.5***	Flood risks****	Precipitation rise***** - in winter - in summer [mm/season]
Baltic	min. mean max. 3.74 4.46 5.17	2-4	north from ≤-0.4m to ≤-0.2m	north 0–1	min. mean max. 22.29 42.37 54.88
			central from ≤-0.2m to ≤0.2m	central 2-5	
	min. mean max. 2.12 2.74 4.44		south from ≤0.2m to ≤0.5m	south 6–10	min. mean max. -13.37 0.58 10.07
Adriatic	min. mean max. 1.78 2.84 3.55	about 4	0.3–0.4m	north (near Koper) 26–50	min. mean max. -59.45 -28.97 -4.57
	min. mean max. 3.10 4.31 5.39				min. mean max. -60.61 -26.40 -12.78

Note: * Projected change in European regions for mean temperature (°C) 2071–2100, compared with the 1961–1990 baseline, for the A1B (a medium-high non-mitigation baseline scenario) emissions scenarios (winter and summer), showing ensemble minimum, maximum and mean results.
source: http://www.climatecost.cc/images/Policy_brief_1_Projections_05_lowres.pdf, Figure 3.
** Baltic: http://www.esf.org/fileadmin/Public_documents/Publications/MB_Climate_Change_Web.pdf, Impacts of Climate Change on the European Marine and Coastal Environment Ecosystems Approach March 2007
Adriatic: Pasaric, M., Orlic M., Meteorological forcing of the Adriatic: present vs. projected climate conditions, 2004, Geofizika, Vol 21, http://geofizika-journal.gfz.hr/vol_21/Pasaric.pdf
*** Source: adapted from Figure TS-23.b in the Working Group I contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate change (IPCC). Data was supplied by Mark Carson (ZMAW, Germany), contributing author to Chapter 13 of that IPCC report.
**** The multiplication factor by which the frequency of flooding events of a given height is projected to increase between 2010 and 2100 as a result of regional sea level rise under the RCP4.5 scenario. Representative Concentration Pathway-greenhouse gas concentration (not emissions) trajectory adopted by the IPCC for its fifth Assessment Report (AR5) in 2014 named after a possible range of radiative forcing values in the year 2100 relative to pre-industrial values (+6 Wm^{-2})
source: http://www.eea.europa.eu/data-and-maps/figures/increase-in-the-frequency-of
***** Projected change in European regions for mean precipitation (mm/season) 2071-2100 compared with the 1961–1990 baseline for the A1B (a medium-high non-mitigation baseline scenario) emissions scenarios (winter and summer), showing ensemble minimum, maximum and mean results.
Source: http://www.climatecost.cc/images/Policy_brief_1_Projections_05_lowres.pdf, Figure 6.

Fourth column shows relative sea level in 2081–2100 compared to 1986–2005 for the medium-low emission scenario that will be higher in Adriatic (0.3-0.4 m) than in north and central Baltic (north from ≤ -0.4m to≤ -0.2, central from ≤ -0.2m to ≤ 0.2 m), but similar to the south Baltic region (from ≤ 0.2m to ≤ 0.5 m).

Flood risks (fifth column) presents a result of regional sea level rise under the RCP4.5 scenario, the multiplication factor by which the frequency of flooding events of a given height is projected to increase between 2010 and 2100. By going southward in the Baltic region, the risks increase from 0 to 10, which is less than the projected flood risks in the northern Adriatic region, ranging near Koper 26–50.

A comparsion of the period 2071–2100 with the 1961–1990 baseline for the A1B (a medium-high non-mitigation baseline scenario) given in seventh column indicates increases in winter precipitation in the Baltic from 22.29 to 54.88 mm/season and in the Adriatic region from -59.45 to -4.57 mm/season, and similarly increases in summer precipitation in the Baltic from -13.37 to 10.07 mm/season and in Adriatic region from -60.61 to -12.78 mm/season. In both regions bigger precipitation increase is expected in winter regions. Precipitation in the Adriatic is expected to decrease by the end of the 21st century, compared with the values of the 1961–1990 period.

2. ADAPTATION TO CLIMATE CHANGES IN THE BALTIC AND THE ADRIATIC SEA

Starting in 1992, most countries world-wide made together an international treaty called the United Nations Framework Convention on Climate Change in order to cooperatively negotiate what they might do to limit the average global temperature increases and the resulting climate change as well as to find possible solutions to whatever impacts were, by then, inevitable.

By 1995, countries world-wide realized that emission reductions provisions in the Convention were unsuitable. They decided to launch negotiations to strengthen the global response to climate change, and after two years, the Kyoto Protocol was adopted. The Kyoto Protocol was made in ordered to legally bind developed countries to emission reduction targets. The first commitment Protocol’s period started in 2008 and ended in 2012. The second commitment period began on 1 January 2013 and is going to end in 2020.

All countries under consideration in the Baltic and the Adriatic regions signed, ratified and contributed to lead into force United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol. However, as the Kyoto Protocal addresses primarily the mitigation – reduction of greenhouse gas (GHG) emission, and not the adaptation to undesirable or even dangereous climate change. In short-hand, mitigation may be compared with preventive measures, where all countries have to contribute in one way or another to limit the occurence of global warming. Adaptation, on the other hand, has a more curative character, whereby the local, national and regional interests play the foremost role. The following text attempts to give overview of national adaptation strategies, policies and actions to cope with climate changes in the Baltic and the Adriatic sea regions.

2.1. Adaptation to climate change in the Baltic Sea region

The Baltic Sea Region (BSR) is made of eight EU Member States as well as the neighbouring countries including the north-west regions of Russia, Norway and Belarus. The EU Member States — Germany, Poland, Sweden, Estonia, Latvia, Lithuania, Finland, Denmark and Russia all directly border the Baltic Sea as ar some parts of Norway and Belarus in the catchment area of the Baltic Sea.The EU Strategy for the Baltic Sea Region (EUSBSR) was adopted in 2009. in which adaptation to climate change was one of the 15 priority areas identified in the Strategy. At the moment, there are 17 priority areas of which 5 Horizontal Actions within the EUSBSR and climate change adaptation is an action under the Horizontal Action 'Sustainable Development'.

Transnational cooperation on adaptation in the region has been supported by a number of projects funded through for instance the EU Baltic Sea Region Programme that is part of the Interreg programme in the region.

As Andersson (2013) claims, at the EUSBSR flagship final conference on 3rd September 2013 in Riga, Latvia, the proposal for a BSR wide Climate Change Adaptation Strategy and Action Plan, has been launched as a project Baltadapt. The summed up value of such strategy that is macro-regional was positively evaluated by the European Commission in June 2013.

The sectors focused on in the Baltadapt project are food supply, including fishery and agriculture, coastal infrastructure and tourism, because impacts and vulnerabilities are not limited to the biodiversity of the Baltic Sea.

Untill today an adaptation strategy was adopted by 15 EU Member States, and others are under preparation. Some of them have been followed up by action plans and some progress was made in way of integrating adaptation measures into sectoral policies. Adaptation is,however, in most cases still at an early stage.Relatively few concrete measures are being made on the ground. Some of the Member States have developed sector-specific plans which include plans to cope with heat waves and droughts, but only a third carried out a comprehensive vulnerability assessment to underpin policy.

According to Andersson (2013) the Baltadapt Strategy builds on strengthening multi-level governance on cooperation and information sharing via mainstreaming of climate adaptation in the Action Plan of the European Union Strategy for the Baltic Sea Region — EUSBSR, with the aim of triggering positive synergies and avoiding unintended negative impacts of adaptation between sectors.

The goals of the Baltadapt Strategy will thus all contribute to the implementation of local and national strategies as well as the EU Strategy on Climate Adaptation (European Commission, 2013) including the integration of climate adaptation in broader policies or in other strategies by means of cross-border cooperation. For each of the goals of the Baltadapt Strategy there is corresponding information in the Baltadapt AP concerning recommended actions and guidelines.

The enforcement of the Baltadapt Strategy and Action Plan will depend on political approval. Members of governance at all spatial levels are supposed to be implementers (local, regional, national, macro-regional), including also the research communities and the private sector.

2.1.1. Response to climate change in Denmark

According to the Danish Meteorological Institute Copenhagen, a particular concern for Denmark is sea-level rise. As Goodsite et al. (n.d.) claim, the waters around Denmark are expected to rise, on average, by 0.3m to 1m by 2100, Denmark's low-lying capital is very well protected capital is well protected with dikes and other defence measures, but actual 0.5m of rise in sea level might increase the impact of the economy of a 100-year storm from the currently estimated value of € 3 billion to € 5 billion. According to Goodsite et al. (n.d.) Denmark's it is expected for the climate to become warmer as well as wetter and cloudier including more extreme weather events.The IPCC's A1B scenario predicts that by 2050 mean summer temperatures might rise by 0.4°C including more heat waves and mean winter temperatures might decrease by 1.0°C.Also mean annual precipitation would increase by 11%, and the frequency of heavy precipitation events would increase by 6%,in some occasions summers including both droughts and downpours. Also more wind is expected resulting in more powerful storms. The growing season would extend by 21 days, while the frost would decrease by 17 days.

The stated goal of the Danish adaptation strategy (2008) is to ensure that climate change is "considered and integrated into planning and development in the most appropriate way". It does not aim to direct adaptation, but rather offers "sight-lines to enable authorities, businesses and citizens to react promptly and autonomously" to climate challenges (Goodsite et al. n.d.). Given the local nature of many climate impacts and adaptation needs, Denmark has been encouraging local governments to draft adaptation plans. The Ministry of Environment has called for all municipalities to have adaptation action plans by the end of 2013, and a Climate Change Adaptation Squad was established in February 2012 to help them. The national government has made an agreement with municipal authorities to increase municipal investments in adaptation by up to DKK 2.5 billion by 2013, and several legislative changes have also been made, such as amending the Danish Planning Act to enable municipalities to cite adaptation as the basis for local plans (Goodsite et al. n.d.).

Focus of the Danish strategy for adaptation to a changing climate adopted in 2008 is the necessity of adaptation at national level.

In December 2013 Denmark pubblished Denmark's Sixth National Communication on Climate Change Under the United Nations Framework Convention on Climate Change and the Kyoto Protocol and Denmark's First Biennial Report.

2.1.2. Response to climate change in Finland

The National Adaptation Strategy outlines the main expected impacts of climate change in Finland: Average temperatures will rise, by a projected 4–6°C by 2080, with the greatest changes in the winter; average precipitation could increase by 15–25%, and extreme weather events such as storms, heavy rains, floods, droughts and extreme frosts are likely to become more frequent, as Goodsite et al. (n.d.) claim. The damage could affect broad areas in Finland, not just isolated sectors. As Marttila et al. (2005) claim this will have major consequences for farming and water and energy supplies. According to Goodsite et al. (n.d.) tree growth is expected to weaken, groundwater will have lower quality and frost will weaken berry yields. Extreme weather is also expected to cause damages to buildings and infrastructure. Tourism will be affected because of snow cover reduction and changes in ground frost. This will also affect wintering crops in southern Finland and compaction of clay soil. However, there could also be benefits in southern Finland, where this gives the opportunity to harvest wood over the winter period published by Marttila et al. (2005). Population loss might be observed in fish stocks in southern Finland and fish farms might experience trouble in production. It is also possible that some advantages from climate change can be identified. These include longer growing season, longer pasture season, longer period for summer tourism, reduced heating energy needs, more growth in forest, and potential migration of warm-water fish species to Finnish waters founded by Marttila et al. (2005). According to Goodsite et al. (n.d.) the National Adaptation Strategy (adopted 2005) outlined potential measures for planned adaptation and for strengthening adaptive capacity in to be taken by several specific sectors: those using natural resources including agriculture and food production, husbandry, fisheries, forestry, reindeer, game management and water as well as biological diversity, industry, land use, health, tourism and insurance, communities, energy, transport and communication, buildings and construction. The National Strategy for Adaptation to Climate Change was adopted in 2005. The first evaluation report on the implementation of the strategy was published in 2009. A broader evaluation was conducted in 2013 to assess the progress in adaptation as well as to give feedback and recommendation for the revision of the strategy (Ministry of Agriculture and Forestry of Finland, 2005). The revision of the adaptation strategy, The National Adaptation Plan for Climate Change 2022, was adopted in November 2014.

Finland pubblished Finland’s Sixth National Communication under the United Nations Framework Convention on Climate Change in 2013.

The first evaluation of the NAS (Ministry of Agriculture and Forestry 2009) found that adaptation had been acknowledged as a concern in most administrative sectors, but not all sectors had made progress to a sufficient degree. Most advanced was the Environment Administration, in particular measures related to water management.

2.1.3. Response to climate change in Sweden

In Sweden considerable emissions reductions have been achieved particularly in the energy sector. It is assumed that further emissions reductions in the 2050 horizon will be more costly and more difficult to achieve because they will require some emissions reductions in industry, buildings and transport (International Energy Agency, 2013).

A broad climate adaptation responsibility lies on the county administrative boards. They have regional duty in providing support to municipalities for their environmental issues; as well as inter-municipal aspects, such as floods, because climate issues are often transboundary. The municipalities are responsible, for functioning water and sewerage systems, energy and waste facilities, hospitals and health care facilities, schools, welfare etc., at the local level.

The municipal emergency management and civil protection are important themes of adaptation strategies. The responsibility includes both sectored operational planning and physical planning.

Climate change adaptation at a regional level is the duty of the county administrative boards since 2009. The need for climate change adaptation, covers a number of areas such as: regional development, sustainable community planning and housing, nature conservation and environmental protection, food inspection, fishing, farming, social care, communications, crisis management in peacetime and emergency services, cultural environment, gender equality, civil defence, animal protection and veterinary questions. About 30 agencies are working on prevention, increased competence, knowledge, improved preparedness for disruptions in vital public services, but there is no national agency that has the overall responsibility for climate change adaptation. In 2014 Sweden published its Sixth National Communication on Climate Change under the United Nations Framework Convention on Climate Change.

2.1.4. Response to climate change in Cermany

The Federal Government adopted the German Strategy for Adaptation to Climate Change (DAS) on 17 December 2008 (The Federal Government, *German Strategy for Adaptation to Climate Change*). The DAS was followed by the "Adaptation Action Plan of the German Adaptation Strategy" (APA), with aim to support this strategy with specific action, and adopted on August 31, 2011. The action plan consists of concrete steps in the development and implementation of the DAS, it has an integrated approach that takes account sectoral and regional interactions and tries to implement consideration of the possible impacts of climate change in all relevant policies.

According to Zebisch et al. (2008) following the first German vulnerability assessment, the Inter-ministerial Working Group on adaptation in 2011 published a new vulnerability assessment that supports the progress report of the adaptation strategy (due in 2015) (The Federal Government 2008). The estimation focuses on current and short-term vulnerability (2021–2050) which directs most adaptation decisions, while long-term vulnerability (2071–2100) investigates only specific climate change impacts. The assessment is expected to cover all of Germany and 15 sectors that were addressed in the German NAS.

The Sixth National Communication of the Federal Republic of Germany has been published. This report presents German climate protection policies in the context of current legislative, political and socio-economic conditions, explores the effects of climate change and describes policies and measures that have been initiated to reduce greenhouse gas emissions and adapt to climate change. It describes previous and projected effects of those measures, reports on technology transfer, financial support, and activities in the field of public awareness, education and training.

2.1.5. Response to climate change in Poland

Climate policy is often described as overambitious, costly, unrealistic in terms of targets for the Polish economy, so it is not Poland's favorite EU policy (Gradziuk n.d.).

Polish Government adopted the decision of the „White Paper“ on 19th March 2010 that the adaptation strategy to vulnerable sectors and areas should be developed. Decision on elaboration and acceleration of the Strategic Action Plan until 2020 (or short SPA 2020) arose from the necessity to prepare the guiding adaptation activities until 2020 for the sectors and areas vulnerable to climate change. SPA is the element of the research project „KLIMADA“ that covers the period until 2070 and presents the basis for the conclusions presented by the SPA 2020 project.

2.1.6. Response to climate change in Russia

Russia's greenhouse gas (GHG) emissions dropped almost 40% from 1990 to 1998 because of the collapse of Soviet-era.

In 2010 Russian Federation published its Fifth National Communication of the Russian Federation under the UN Framework Convention on Climate Change, in Russian. According to Kokorin and Korppoo (2013), after Russia ratified the Kyoto Protocol, Vladimir Putin emphasized to foreign leaders and journalists that it wasn't true to think that Russia couldn't address the climate problem: after all, it had signed up to the Kyoto Protocol, Russia had had decided to bring the Protocol into force by means of its crucial participation. The Climate Doctrine was launched in time for the Russian president in order not to arrive empty-handed at the 2009 Copenhagen climate summit. It was planned for the protocol to be launched in time for the 2010 climate negotiations round in Cancun but the initial draft was at that time considered too extreme, and a modification of the text was adopted in April 2011. In August 2012, the Ministry of Foreign Affairs submitted an application for Russia to join the Clean Air and Climate Coalition (CCAC) coordinated by UNEP. Officials refused to discusse about the participation in the CCAC and the country's priorities.

Ministry of Economic Development published the most recent example of long-term social and economic development of the Russian Federation until 2030 called Projection which was put on its website in 2013. It was the first time official data was provided on projected peaking of GHG emissions beyond 2020. It showed possibilities for growth from 70 to 75% of the 1990 level during 2013 to 2020, and, after this peak, declining back to 70% of the reference level by 2030. Although the prime minister approved it on 26 March no proposals for action are indicated as to mitigation or adaptation.

The most recent example of this approach comes from the 11th Moscow International Energy Forum in April 2013 the main focus being keeping Russia's share in the global market for fossil fuels unchanged as well as related reconsiderations of national energy strategy climate change not being mentioned. Kokorin and Korppoo (2013) suggests that the country's new energy outlooks on both the global and the Russian level until 2040 were presented by leading Russian organizations that advise the Ministry of Energy and the top level of the government: the Energy Research Institute of Russian Academy of Science (ERIRAS) and the Analytical Centre of the Government.Many technological challenges and threats to global and Russian energy systems were considered, but CO^2 mitigation measures as well as the impacts of climate change were ignored.

2.1.7. Response to climate change in Estonia

Estonia announced Estonia´s sixth national communication under the United Nations Framework Convention on Climate change in 2013. Nearly 90 per cent of emissions originate from fuel combustion, which is why the energy sector is driving the emissions trend. Estonia is participating in two Kyoto mechanisms – international emissions trading and Joint Implementation (Republic of Estonia, 2013). The reduction in activities covereded by the EU Emissions Trading Scheme (ETS) is collectively defined at the EU level. Most of the emissions of the energy sector in Estonia are included in the EU ETS and therefore addressed centrally. Estonia's national target for sectors outside the emissions trading scheme is an 11 percent increase in emissions by 2020 compared to the 2005 level. This target is related, for example, to the transport, agriculture and waste sectors. More concrete long-term environmental development objectives are formulated in the National Environmental Strategy until 2030 endorsed by the Parliament in 2007. It is planned that Estonia´s adaptation strategy will be completed by March 2016 at the latest.

2.1.8. Response to climate change in Lithuania

The *Law on Financial Instruments for Climate Change Management* (Republic of Lithuania, 2009) is Lithuania's document concerning climate change. It was adopted in July 2009 and relates to the duties, obligations and rights, of people who preform economic activities that produce greenhouse gases, and the competence of state bodies and institutions. In November 2012 the Parliament adopted a ‘Strategy for National Climate Management Policy 2013–2050' (Republic of Lithuania, 2014.). The aim of the Strategy is to develop and implement climate change management policy in Lithuania. The Strategy sets short-term (until 2020), indicative mid-term (till 2030 and till 2040) and long-term (until 2050) goals and objectives in the field of climate change mitigation and adaptation. In April 2013 the Action Plan for the goals and objectives (2013–2020) was authorized with the aim to ensure the implementation of the Strategy.

Lithuania’s 6th National Communication and 1st Biennial report under the United Nations Framework Convention on Climate Change was published in 2014.

2.1.9. Response to climate change in Latvia

Laitvia’s 6th National Communication and 1st Biennial report under the United Nations Framework Convention on Climate Change was published in 2014.

The climate policy of Latvia is based on the EU climate change policy (Ministry of Environmental Protection and Regional Development of the Republic of Latvia, 2013), the basic principles of which are set down in several political documents, i.e "National Development Plan 2014–2020"’ Sustainable Development Strategy for Latvia until 2030" "Strategic development plan for Latvia 2010–2013" "Environmental Policy Strategy 2009–2015". Currently Latvia is working on new "Environmental Policy Strategy 2014–2020" and “Climate Change Policy Strategy 2014–2020”.

The process of preparation of a national policy-planning document ccents the need for communications and consultations with specialists and stakeholders (2013–2016) on, for example, the choice of indicators for the detailed evaluation of impacts and risks of the various sectors, with the elaboration of a national strategy (2015–2016) and climate change adaptation (National adaptation policy processes in European countries-2014).

2.2. Adaptation to climate change in the Adriatic Sea region

2.2.1. Climate change adaptation in Croatia

By confirming the Kyoto Protocol, the Republic of Croatia took over the obligation of limiting its greenhouse gas emission in the period 2008–2012 up to 95% of total emission in the base year 1990.

The Republic of Croatia should create a national greenhouse gas inventory and a national communication on climate change in order to report to the United Nations Framework Convention on Climate Change.

The Conference of Parties defined instructions of terms of submitting the national greenhouse gas inventory and national communication. Since 2002 Croatia published Six National Communications. The sixth conference covered the four-year period from 2008 to 2011 and gave some informations for 2012 and 2013 (Republic of Croatia, 2014).

The framework for the long term low-emission development strategy for Croatia until 2050 has been launched (backed by the United Nations Development Programme). All sectors: energy, industrial processes, transport, buildings, agriculture, forestry, tourism and waste management are included with the goal of reducing the greenhouse gas emissions to 80–95% by 2050 compared to 1990 (Republic of Croatia, 2014).

This is reflected in The National Air Protection Act, that is supposed to regulate the development and implementation of a NAS and a NAP.

2.2.2. Climate change adaptation in Italy

The Italian Ministry for the Environment, land and sea (IMELS) is responsible for the foundation and setting of a national actions and strategy for adaptation to climate change. It focuses on the admission of adaptation into sectoral policies, while Regional Governments implement local adaptation actions; some regions have started working on adaptation, by researches and monitoring.

The duty of IMELS is also drafting a national plan to reduce greenhouse gas emissions, which is proposed for adoption to the Inter-Ministerial Committee for Economic Planning — CIPE. IMELS has started to prepare the Italian National Adaptation Strategy to climate change. NAS is supposed to give guidance for short and long-term adaptation and to support the adaptation in existing sectoral policies (Ministry for the Environment, Land and Sea, Italy, 2013).

A national project, 'Elementi per una Strategia Nazionale di Adattamento ai Cambiamenti Climatici' (SNAC) or 'Elements to develop a National Adaptation Strategy to Climate Change' has been funded by IMELS, from 2012 to 2014 (European Environment Agency, 2014). The scientific/technical coordination of this national project has been givento the Euro-Mediterranean Center on Climate Change (CMCC). A scientific literature gives informations on past, present and future climate change and on impacts and vulnerabilities of micro/macro sectors to climate change (water resources; desertification, soil degradation and droughts; hydrogeological risk; biodiversity and ecosystems; health; forestry; agriculture, aquaculture and fishery; energy; coastal zones; tourism; urban settlements; and critical infrastructure). In two case studies about climate change, the areas of the Alps and Apennines, and the Po river basin the vulnerability assessments were needed. Italy published its „Sixth National Communication under the UN Framework Convention on Climate Change Italy“ in December 2013.

2.2.3. Climate change adaptation in Albania

Albania, according to the First National Communication (Republic of Albania, 2002) is a relatively low net emitter of greenhouse gases.

Albania has relatively low carbon dioxide (CO^2) emissions per capita (Energy and Environment for Sustainable Development Center, 2006), mainly due to the fact that over 90% of electricity is generated by hydro-sources. Very high CO^2 emissions on a per-GDP basis are explained mainly due to high energy intensity.

Energy sector contributes to emissions of more than 60%. Simulations predict that total emissions will rise by more than five times, by 2020.

Apart from the laws on ratification of the UNFCCC and the Kyoto Protocol from Albania's parliament, there are no laws there are no laws dealing specifically climate change (ECNC 2009). Since the energy sector emits significant proportion of greenhouse gas emissions, the sector is the focus of the analysis and recommendations to mitigate climate change. The legislative framework on energy in Albania at the moment has a many items of legislation.

The NSDI (National Strategy for Development and Integration 2007–2013, adopted in 2008, Republic of Albania Council of Ministers) is a key national strategic document that also includes climate change related issues and measures. It identifies that Albania has a relatively low impact on global environment through low per capita GHG emissions, but there are several measures for climate change mitigation or adaptation already included in the strategy although their primary aim is not explicitly climate change related.

2.3. Comparison of adaptation to climate changes in the Baltic and the Adriatic Sea regions

Table 2. shows climate changes adaptation policy of coastal Baltic and Adriatic coastal countries. Differences in adaptation policy among Baltic countries are visible in the status of formulating and adaptation of National Adaptation Strategy and National Adaptation Plan or Sectoral Adaptation Plan. In the observed region, Denmark, Finland, Germany and Lithuania adopted both a National Adaptation Strategy and a National Adaptation Plan or Sectoral Adaptation Plan, Sweden, Poland, Russia adopted a National Adaptation Strategy but don´t have yet either a National Adaptation Plan or a Sectoral Adaptation Plan. Latvia is the only country that doesn´t have yet a National Adaptation Strategy and National Adaptation Plan or Sectoral Adaptation Plan. Table shows climate changes adaptation policy of coastal Adriatic sea countries. Not a single riparianof the Adriatic adopted either a National Adaptation Strategy or a National Adaptation Plan/Sectoral Adaptation Plan.

According to Bosnjakovic (2012) the EU need to do much more to adapt to the consequences of global warming, and to explore how to make the best out of it. The same is true in particular for the Baltic and the Adriatic regions. It is questionable whether the EU, with its real power relatively diminishing on the global scale, and dependent as it is on energy imports, with an ageing population and possessing only limited military muscle, will be able to influence climate change policies in the rest of the world.

Table 2. Climate changes adaptation policy of coastal Baltic and Adriatic countries

Baltic coastal country	National Communication under the UNFCC	NAS* NAP/SAP	Adriatic coastal country	National Communication under the UNFCC	NAS NAP/SAP
Denmark	sixth published	from 2008 from 2012	Croatia	sixth published	no policy no policy
Finland	sixth published	from 2004 from 2008	Italy	sixth published	started with formulating NAS from 2012 no policy
Sweden	sixth published	from 2009 no policy	Albania	second published	no policy no policy
Germany	sixth published	from 2008 from 2011	Slovenia	sixth published	no policy no policy
Poland	sixth published	from 2013 no policy	BiH	second published	no policy no policy
Russia	fifth published	from 2009	Montenegro	first published	no policy no policy
Estonia	sixth published	no policy no policy			
Lithuania	sixth published	from 2012 from 2013			
Latvia	sixth published	no policy no policy			

Note: * NAS — National Adaptation Strategy; NAP/SAP — National Adaptation Plan or Sectoral Adaptation Plan; Source: *National adaptation policy proccesses in European countries 2014,* Table ES1.

3. SOCIO-ECONOMIC CHARACTERISTICS OF THE RIPARIAN STATES

Some socio-economic indicators, relevant for the present paper, are summarised in Table 3.

Column 2 describes the relative economic strength of a country in terms of the *Gross Domestic Product* (GDP) per inhabitant in 2014. In the Adriatic region, there is a sub-division between the three EU member states with GDP per capita above $ 20.000 (Croatia, Italy, Slovenia), and the three other countries with GDP per capita of $ 15.000 or less (Albania, Bosnia and Herzegovina, Montenegro). In the Baltic region, the GDP per capita of all riparian states is above $ 20.000.

Column 3 gives the UNDP *Human Development Index* (HDI) of a country for the year 2013. HDI includes as main components: life expectancy at birth; mean and expected years of schooling; and gross national income per capita. The three wealthier riparians of the Adriatic have been qualified as „very highly developed“ (world-wide rank between 1 and 49), whereas the three less wealthy Adriatic riparians are still in the category „highly developed“ (world-wide rank between 50 and 102). For the Baltic region, all riparians qualify as „very highly developed“, with the exception of the Russian Federation, which with the rank 57 is still considered as „highly developed“.

Column 4 gives the *Environmental Performance Index* (EPI), annually released by the Yale University for countries world-wide. The EPI is based on environmental health criteria (such as human health impacts; air quality; water and sanitation), and on ecosystem vitality (such as water resources; agriculture; forests; fisheries; biodiversity and habitat; and climate and energy). The six riparians of the Adriatic range from the

very good rank 15 (Slovenia) to the rather disappointing rank 107 (Bosnia and Herzegovina). The eight EU riparians of the Baltic Sea range in EPI rank between place 6 (Germany) and place 49 (Lithuania), whereby the new EU member states (Estonia, Latvia, Lithuania, Poland) are performing significantly less well than the older EU member states (Denmark, Finland, Germany, Sweden). However all EU member states perform by far better than the Russian Federation (rank 73).

Table 3. Socio-economic charateristics of riparian countries in the Adriatic and Baltic Sea regions

Country	GDP per capita ($ x1000) in 2014*	HDI rank in 2013**	EPI rank in 2014***	Transparency rank**** in 2014
Albania	11	95	67	110
Bosnia/Herzegovina	10	86	107	80
Croatia	21	47	45	61
Italy	35	26	22	69
Montenegro	15	51	62	76
Slovenia	30	25	15	39
Denmark	44	10	13	1
Estonia	27	33	20	26
Finland	40	24	18	3
Germany	46	6	6	12
Latvia	24	48	40	43
Lithuania	27	35	49	39
Poland	25	35	30	35
Russian Federation	25	57	73	136
Sweden	46	12	9	4

Note: * GDP: Gross Domestic Product per capita, based on IMF 2014, in international Dollars.
** HDI: Human Development Index, from the UNDP Human Development Report 2014. HDI rrankings in 2013: 1-49 very high human development; 50-102 High human development.
*** EPI: Environmental Performance Index 2014 (Yale University).
**** Transparency International Corruption Perceptions Index.

Column 4 gives the *Environmental Performance Index* (EPI), annually released by the Yale University for countries world-wide. The EPI is based on environmental health criteria (such as human health impacts; air quality; water and sanitation), and on ecosystem vitality (such as water resources; agriculture; forests; fisheries; biodiversity and habitat; and climate and energy). The six riparians of the Adriatic range from the very good rank 15 (Slovenia) to the rather disappointing rank 107 (Bosnia and Herzegovina). The eight EU riparians of the Baltic Sea range in EPI rank between place 6 (Germany) and place 49 (Lithuania), whereby the new EU member states (Estonia, Latvia, Lithuania, Poland) are performing significantly less well than the older EU member states (Denmark, Finland, Germany, Sweden). However all EU member states perform by far better than the Russian Federation (rank 73).

Column 5 gives the *Corruption Perceptions Index*, a measure of the perceived levels of public sector corruption, provided by the independent organisation Transparency International in 175 countries and territories. In this respect, the Adriatic riparians rank relatively low, with the best mark for Slovenia (rank 39), and by far the worst for Albania (rank 110). In the Baltic Sea region, the riparian EU states do quite well, with Denmark, Finland and Sweden placed at the world top (ranks 1, 3 and 4). On the other hand, the Russian Federation is placed at the very disappointing rank 136, which casts serious doubts about the credibility, even on official reporting from that country.

Taken together, the differences in the above mentioned and discussed socio-economic characteristics and indicators – GDP per capita, Human Development Index, Environmental Performance Index, Corruption Perceptions Index — may be partly responsible for the differring attitudes, actions and reporting concerning the adaptation to climate change, both between individual countries, as well as between the two regions as a whole, under consideration in the present paper.

CONCLUSION

Comparison of projected climate changes by the end of the 21st century shows: bigger increase of atmospheric temperature in the Baltic region is projected for winter season, while for the Adriatic region bigger increase of atmospheric temperature is projected for summer season. Projections show similar sea surface tempreature rise in both regions, with maximum of 4°C. Relative sea level in 2081-2100 compared to 1986–2005 for the medium-low emission scenario will be higher in Adriatic (0.3-0.4 m) than in north and central Baltic (north from ≤ -0.4m to≤ -0.2, central from ≤ -0.2m to ≤ 0.2 m), but similar to the south Baltic region (from ≤ 0.2m to ≤ 0.5 m).

Flood risks increase by going southward in the Baltic region (from 0 to 10) which is less than projected flood risks in the Adriatic, true at least in its northern part (near Koper 26-50).

Projections indicate increase in winter precipitation in the Baltic (from 22.29 to 54.88 mm/season) and in Adriatic region (from -59.45 to -4.57 mm/season), as increase in summer precipitation in the Baltic (from -13,37 to 10.07 mm/season) and in Adriatic region (from -60.61 to - 12.78 mm/season), but projections show negative values for precipitation in the Adriatic. The Adriatic region will be compelled to cope with the consequences of an overall decrease in precipitation.

Projections predict slightly bigger climate changes in the Baltic than in the Adriatic region.

All reparian countries are at different stages of developing and implementing national adaptation strategies. According to Swart, et al. (2009), the progress made till now depends on a numerous factors including the assessment of current and future vulnerability, the magnitude and nature of observed impacts, and the existing capacity to adapt.

Comparing Baltic and Adriatic national adaptation policies leads to some further conclusions. Whereas all coastal countries of the two observed regions signed and ratified United Nations Framework Convention on Climate Change (UNFCCC), as well as the Kyoto Protocol, significant differences exist in preparing, implementing or adopting either a National Adaptation Strategy or a National Adaptation Plan, or a Sectoral Adaptation Plan.

Four (Denmark, Finland, Germany and Lithuania) out of the Baltic riparian countries adopted both a National Adaptation Strategy and National Adaptation Plan/Sectoral Adaptation Plan, another three (Sweden, Poland, Russia) adopted a National Adaptation Strategy without having yet a National Adaptation Plan/Sectoral Adaptation Plan. Latvia is the only Baltic country not having adopted either of these.

Not a single country among the six Adriatic riparian states, Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro, Slovenia has adopted yet either a National Adaptation Strategy, or a National Adaptation Plan/Sectoral Adaptation Plan.

As Andersson (2013) claims, at the EUSBSR flagship final conference on 3rd September 2013 in Riga, Latvia, the proposal for a BSR wide Climate Change Adaptation Strategy and Action Plan, has been launched as a project Baltadapt.

The goals of the Baltadapt Strategy will expectedly contribute to the implementation of local and national strategies as well as the EU Strategy on Climate Adaptation, including the integration of climate adaptation in broader policies or in other strategies by means of cross-border cooperation. For each of the goals of the Baltadapt Strategy there is corresponding information in the Baltadapt AP concerning recommended actions and guidelines.

The enforcement of the Baltadapt Strategy and Action Plan will depend on political approval. Members of governance at all spatial levels are supposed to be implementers (local, regional, national, macro-regional), including also the research communities and the private sector.

Till now there is no similar proposed or adopted comprehensive strategy for the Adriatic region.

Both observed regions, but in particular the Adriatic, have to do much more to adapt to the consequences of global warming, and to explore how to make the best out of it.

Taken together, the differences in the following socio-economic characteristics and indicators — GDP per capita, Human Development Index, Environmental Performance Index, Corruption Perceptions Index — may be partly responsible for the differring attitudes, actions and reporting concerning the adaptation to climate change, both between individual countries, as well as between the two regions as a whole, under consideration in the present paper.

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