



Plausible future developments for the Baltic Sea Region

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The challenge

The Baltic Sea is an ecologically vulnerable aquatic ecosystem greatly influenced by human activities and the climatic system:

- many years of diffuse and point nutrient loads have caused strong eutrophication and large areas of dead sea bottoms; and
- the risk of increasing runoff in future climates may accelerate nutrient loads while the resilience of the ecosystem is weakened due to higher surface water temperatures.

Need for long term socio-economic pathways

- The environmental problems in the Baltic Sea are characterized by **slow human response** and **significant time lags** due to repository capacity of pollutants
 - Environmental targets and objectives can only be obtained in the **long term**
 - Both **societal activities** and the changes in the **climatic system** in the future will impact on possibilities to meet environmental targets
 - In order to investigate **challenges and uncertainties** originating from climate and society...
- ⇒ it appears reasonable to apply long time horizons to societal scenarios as is done for climate scenarios and to evaluate and debate the magnitude and extent of environmental change in the Baltic Sea

The Global Shared Socio-economic Pathways (SSPs)

- Plausible alternative trends in the evolution of society and natural systems over the 21st century
- Two elements: i) narrative storyline; ii) set of quantified measures of development
- Reference pathways: no climate change (RCPs) and no new climate policies (SPAs)
- Developed to evaluate how varying levels of climate change and policies affect the reference socioeconomic and environmental conditions in the SSPs ...
- ...and what the challenges in those futures might be to mitigate and adapt

Sources: O'Neill et al., 2014; 2017; van Vuuren et al., 2014



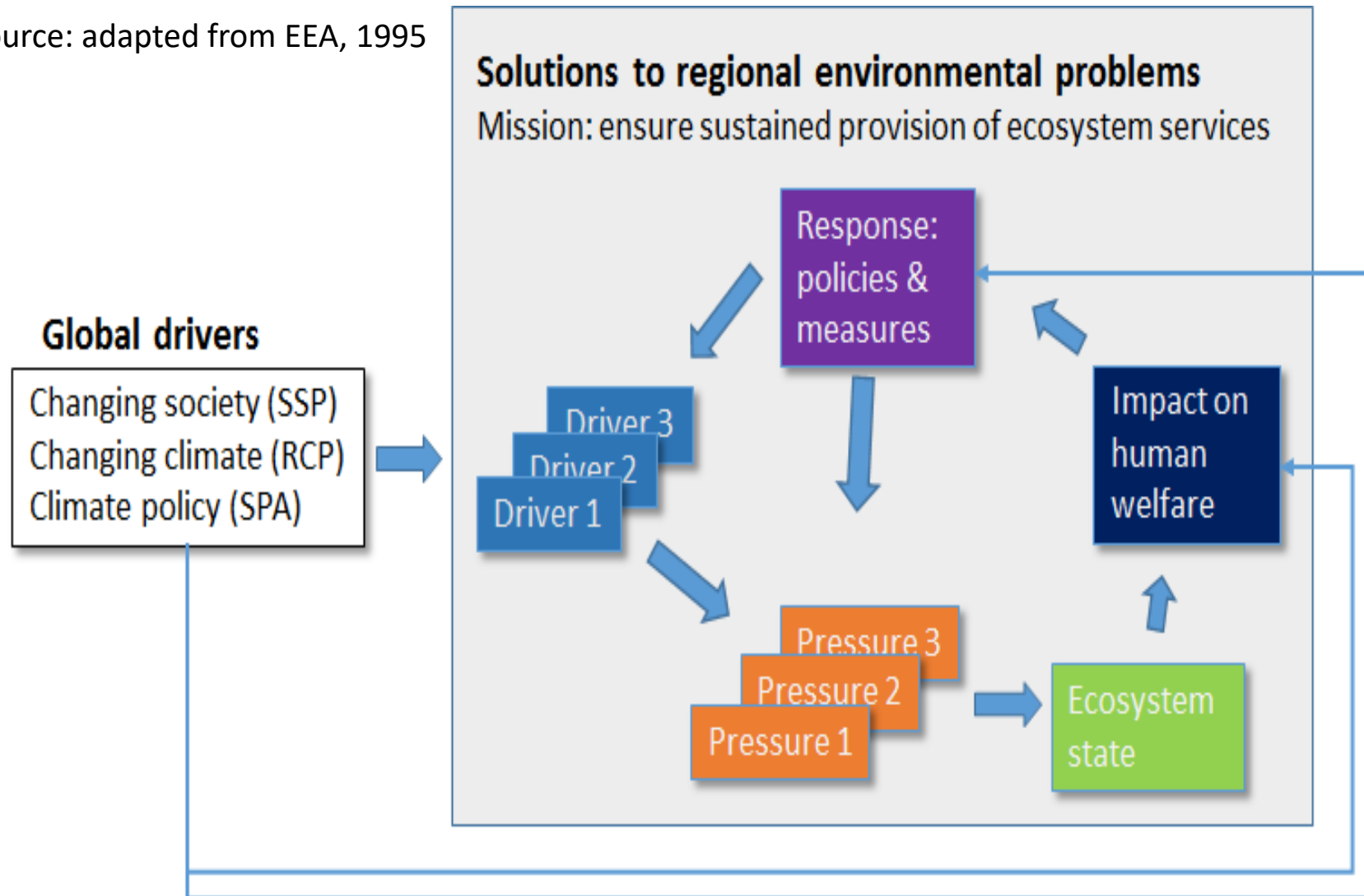
General orientations of the SSPs

- **SSP 1 - Sustainability** – taking the green road (commitment to achieving development goals, increasing environmental awareness and gradual move towards less resource intensive lifestyle; policy changes are driven by changing attitudes)
- **SSP 2 - Middle of the Road** (consistent with typical patterns of past developments re. economic growth, demographic transition etc.)
- **SSP 3 – Regional Rivalry** – A Rocky Road (globalisation trends can be reversed by a number of events – e.g. regional rivalries – weakening progress towards development goals)
- **SSP 4 – Inequality** – A Road Divided (across- and within country inequality due to unequal investments in education, skill-based technological development; slow-down of middle class growth)
- **SSP 5 – Fossil Fueled Development** – Taking the Highway (accelerated globalisation and rapid development of developing countries; improvement in effectiveness of institutions)

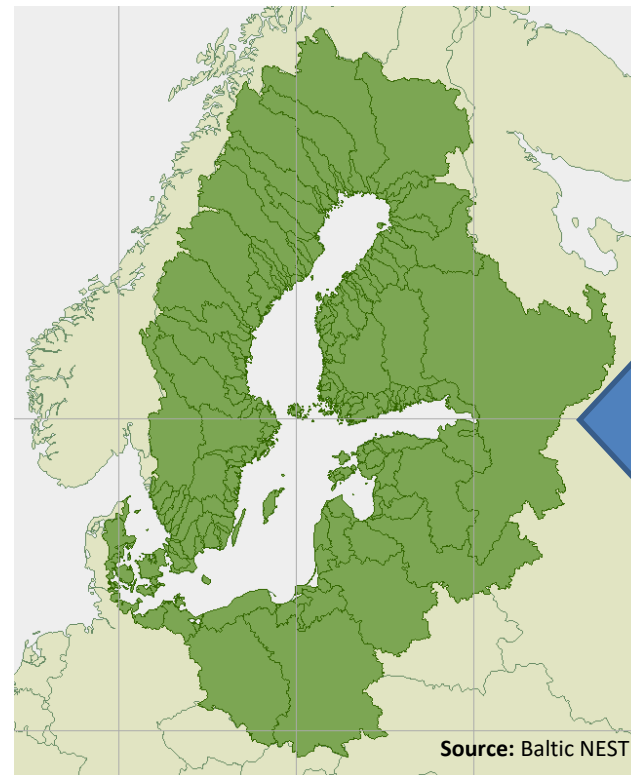
Source: O'Neill et al. 2017

DPSIR Framework

Source: adapted from EEA, 1995



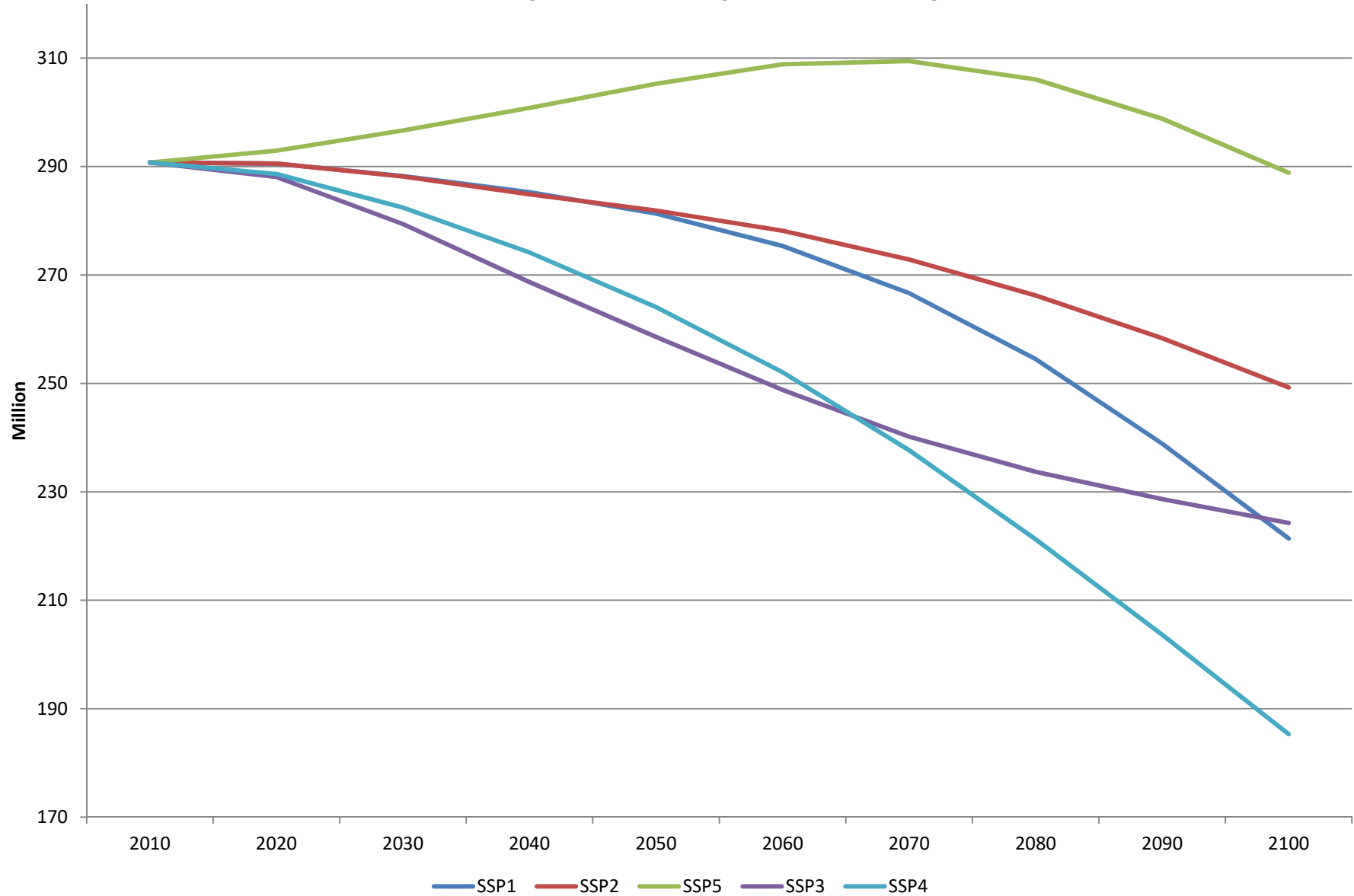
Elements of extended SSPs for the Baltic Sea Region



GLOBAL drivers downscaled

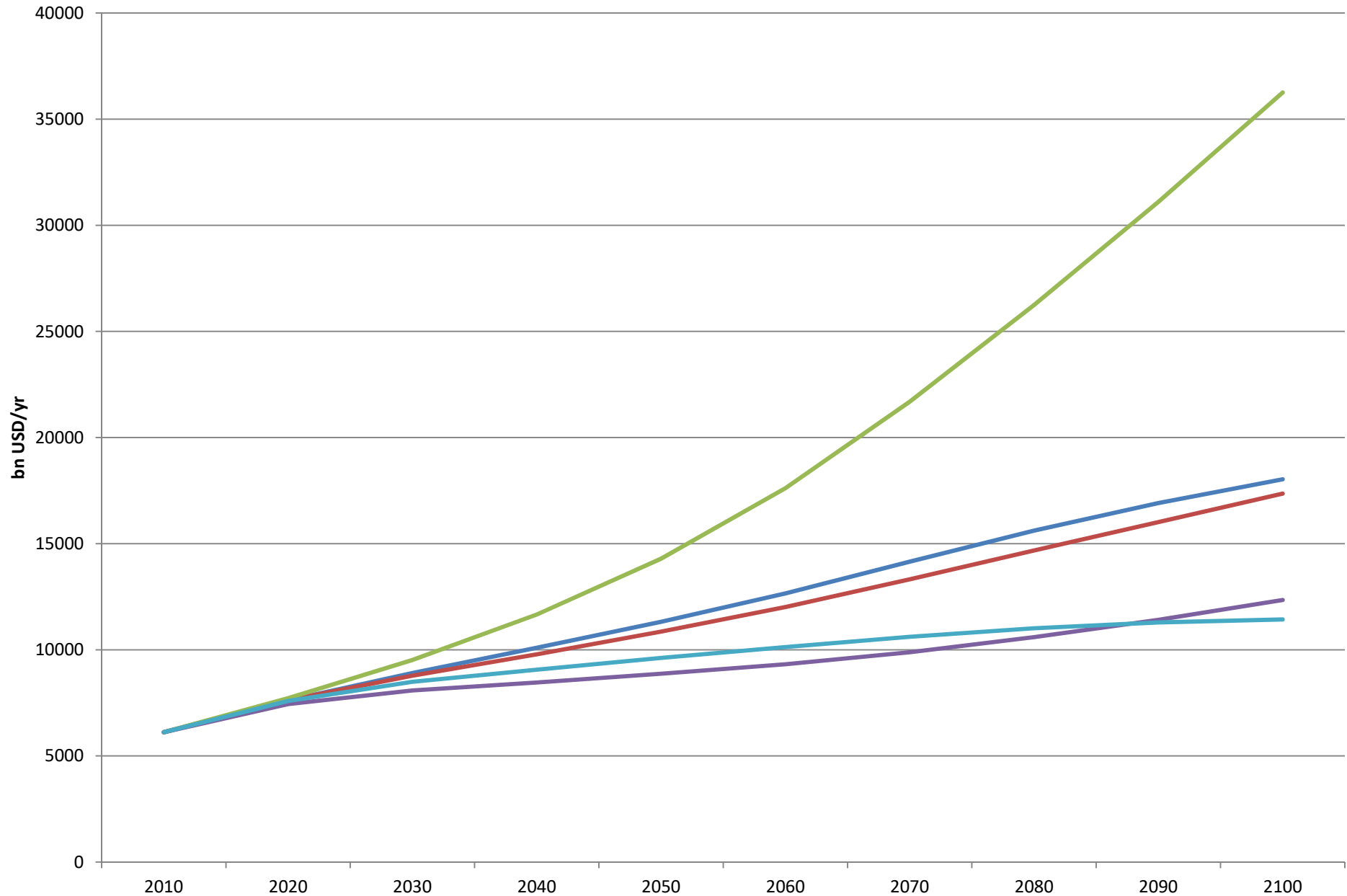
Global population growth
Urbanization
Technological development,
digitalization
Economy &
life styles
Policies & institutions
Environment &
natural resources

Total Baltic Sea Riparian Population by SSP



Source: SSP database

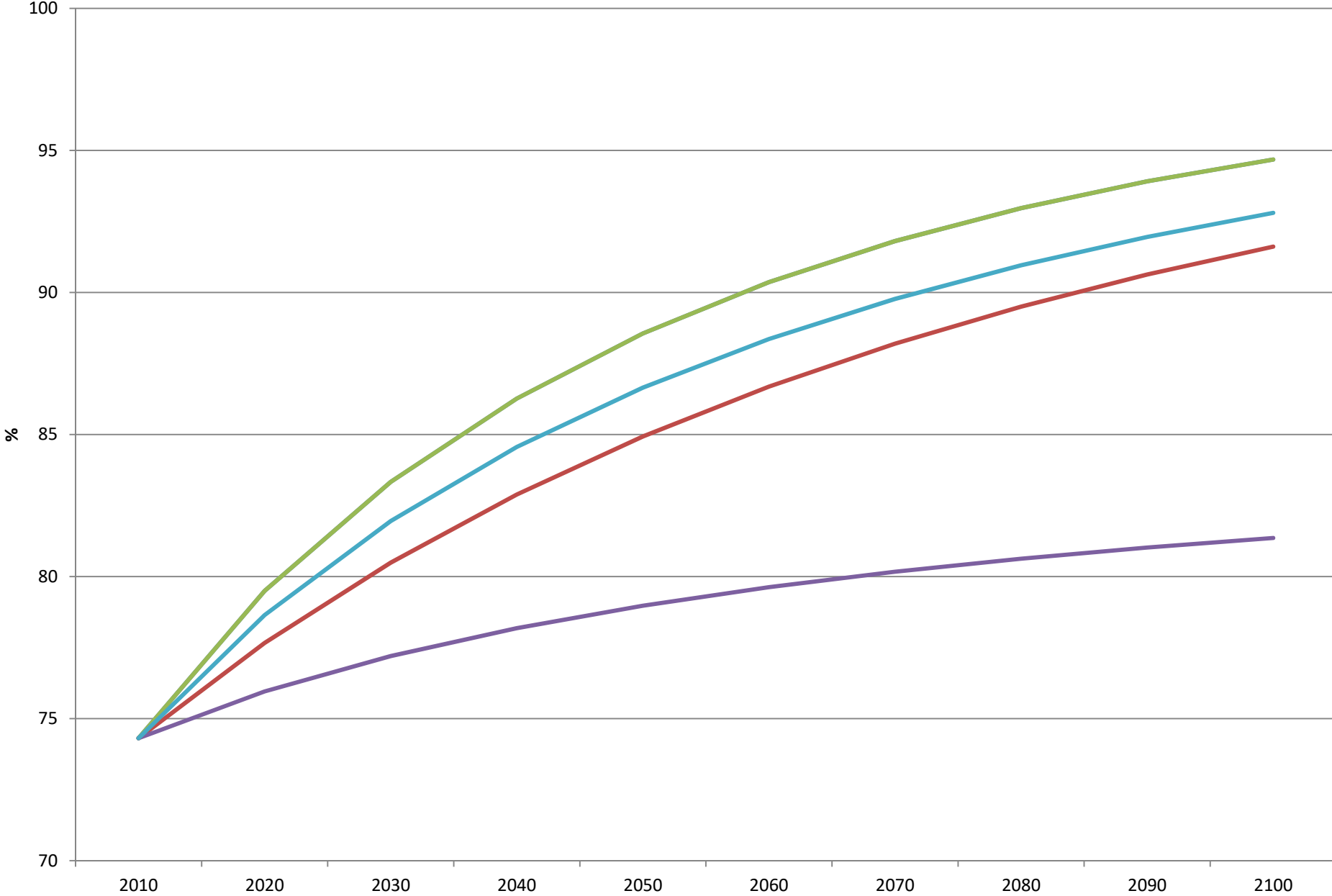
Total GDP, BS countries



Source: SSP database

— SSP1 — SSP2 — SSP5 — SSP3 — SSP4

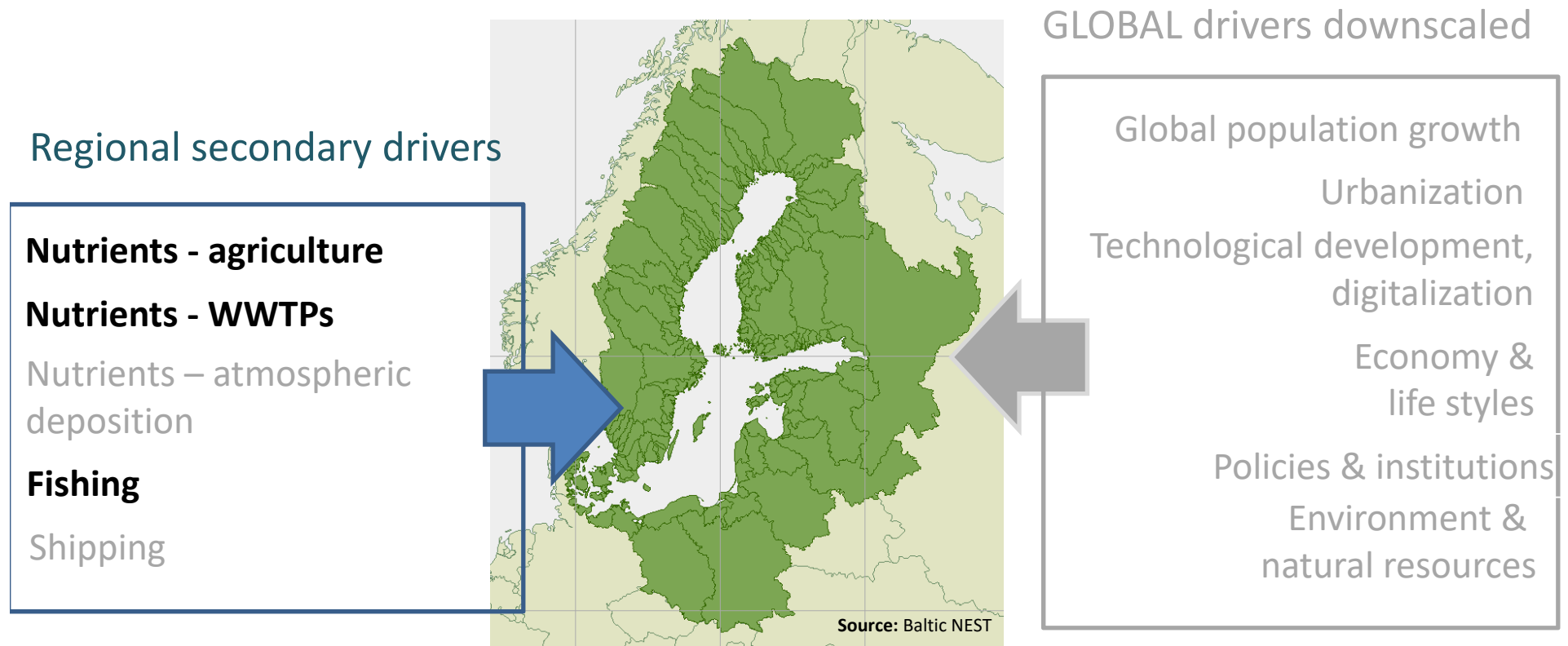
Average urbanisation in BS riparian countries by SSP



Source: SSP database

SSP1 SSP2 SSP5 SSP3 SSP4

Elements of extended SSPs for the Baltic Sea Region





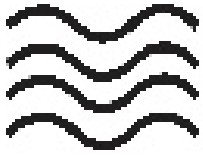
Agriculture

SSP1	<ul style="list-style-type: none">• Increased plant-based diet• High N efficiency, high share local & organic produce• Reduced agricultural land cover
SSP2	<ul style="list-style-type: none">• Current diet continues• Varying success with N efficiency, intensification in eastern part• Stable agricultural land cover
SSP3	<ul style="list-style-type: none">• Current diet continues• Focus on self-sufficiency within region, little export, no N efficiency• Fewer livestock => reduced agricultural land cover
SSP4	<ul style="list-style-type: none">• Current diet continues• Industrial high-productive farming with pockets of small-scale, low-productive farming• Region is net exporter of high quality produce; focus on N efficiency in high-income areas
SSP5	<ul style="list-style-type: none">• Increased meat and dairy in diet• Globalised, export oriented sector, no focus on N efficiency, intensification• Increased livestock => expansion of agricultural land cover



Fisheries

SSP1	<ul style="list-style-type: none">• Sustainable fisheries with high quality products• Circular economy in aquaculture• Small-scale, low impact fishes promoted; avoidance of habitat damaging gear and by-catch
SSP2	<ul style="list-style-type: none">• Sub-optimal management of fisheries with declining number of fishermen & larger vessels• Herring & sprat used for fodder; fishfood for human consumption only local & reduced quality• Habitat damaging fishing gears allowed; little focus to avoid bycatch
SSP3	<ul style="list-style-type: none">• Sub-optimal management of fisheries with lack of international cooperation• No control of seal hunting and only few no-take zones• Despite high pollutant levels, fish used for human consumption and fish meal and feed
SSP4	<ul style="list-style-type: none">• Rapid exploitation of resources and weakened supra-national regulation benefitting large-scale fishing businesses; fish caught use in aquaculture• Aquaculture dominant source for fish for consumption
SSP5	<ul style="list-style-type: none">• Sub-optimal management of fisheries; large-scale fishing focusing on maximising profits• Habitat destructive gear and bycatch allowed• Industrial scale development of freshwater and marine aquaculture with no nutrient focus



WWTPS

SSP1	<ul style="list-style-type: none">• Sophisticated and comprehensive treatment, urban and rural• Separation of rainwater and sanitation• Stringent HELCOM recommendations met in long term
SSP2	<ul style="list-style-type: none">• Current programmes continue and urban efficient wwtp but rural areas lag behind• HELCOM recommendations met in urban areas only
SSP3	<ul style="list-style-type: none">• After current investments, no technology replacement or updates• Declining treatment levels over time• Some tertiary wwtps degrade to secondary and secondary wwtps to primary treatment• Current regulations and recommendations will not be met
SSP4	<ul style="list-style-type: none">• Private entities take over future investments in wealthy areas; improved technology• Focus on fast and visible impacts in coastal areas and recreation hotspots• Current regulations and HELCOM recommendations are met in high-income areas
SSP5	<ul style="list-style-type: none">• New investments made to serve growing urban areas; focus on human health rather than environmental quality• Some upgrading due to technology spill-overs from other sectors• Stringent HELCOM recommendations only partially met

Conclusion/Discussion

Aims:

- provide a consistent and long-term context for communicating, debating and analysing a plausible range of futures that will affect the Baltic Sea to varying degrees
- enable a more holistic and integrated approach to studying multiple pressures by developing common narratives, that can bind together multiple stressors on one ecosystem

Why is it useful to develop scenarios?

- can help reorient policy options according to the future context that inevitably will be affected by the consequences of current actions or lack of same
- enhance communication among and between researchers, stakeholders and decision-makers
- widen perspectives of possible futures & illuminate key issues that may otherwise be missed
- improve the flexibility of how society responds to environmental uncertainty and the risk of system break down;

SSPs and regional environmental problems

- Common starting point for detailed assumptions that are used as input in integrated impact assessments
- Enables a better comparison across studies
- Generic descriptions allows for a variety of detailed quantitative assumptions
- Added advantage of using the integrated framework of RCPs and SSPs

Thank you for your attention

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