Sustainable management solutions for marine environment

The Baltic Sea is one of the most intensively used seas of the world and therefore impacted by many burdens affecting the sustainability of the marine environment. The rapidly growing demand of shipping, fisheries, aquaculture, the energy sector and increasing nutrient loads from agriculture are some of the burdens affecting the sustainability of the marine environment. Allowing sustainable industries to develop demands political will, scientific insight and international cooperation. Spatial decision support tools (DST) help us to allocate sea space for different human uses without compromising sustainability. DST are designed to assist decision-makers by illustrating different possible outcomes. However, to function effectively, DST require the integration of ecological knowledge and environmental data with the outcomes of different management strategies. International cooperation is paramount to gather sufficient and suitable data to generate management decisions affecting areas beyond state borders such as Gulf of Finland. *Read more about DST from here.*

PlanWise4Blue portal: DST to assess cumulative impacts on marine environment

Pressures from human activities can be categorized broadly into inputs of substances and energy, biological and physical pressures (*Table 1*). Typically several pressures occur in the environment rather than a single pressure (*Figure 2).* These multiple and combined pressures cause cumulative impacts. Increasing maritime activities and undermanaged coastal resources threaten the sustainability of the marine environment and maritime-based economies.

Table 1. Cumulative anthropogenic pressures on natural environment and eco-system services

Pressures	
PHYSICAL	Physical loss (permanent effects on the seabed) Physical disturbance (temporary or reversible effects)
ENERGY	Input of continuous anthropogenic sounds affecting the marine environment Input of impulsive anthropogenic sound affecting the marine environment Input of other form of energy
SUBSTANCES	Input of hazardous substances Input of nutrients
BIOLOGICAL	Disturbance of species (nesting, resting and feeding areas) due to human presence Fishing Mortality of mammals and seabirds

ADRIENNE uses harmonized mapping methods to describe environmental conditions, distinguish ecologically valuable areas, ecological values and services. These datasets provide tools to engage in sustainable resource management and to promote transboundary co-ordination and impact assessment in neighbouring countries around the Gulf of Finland.

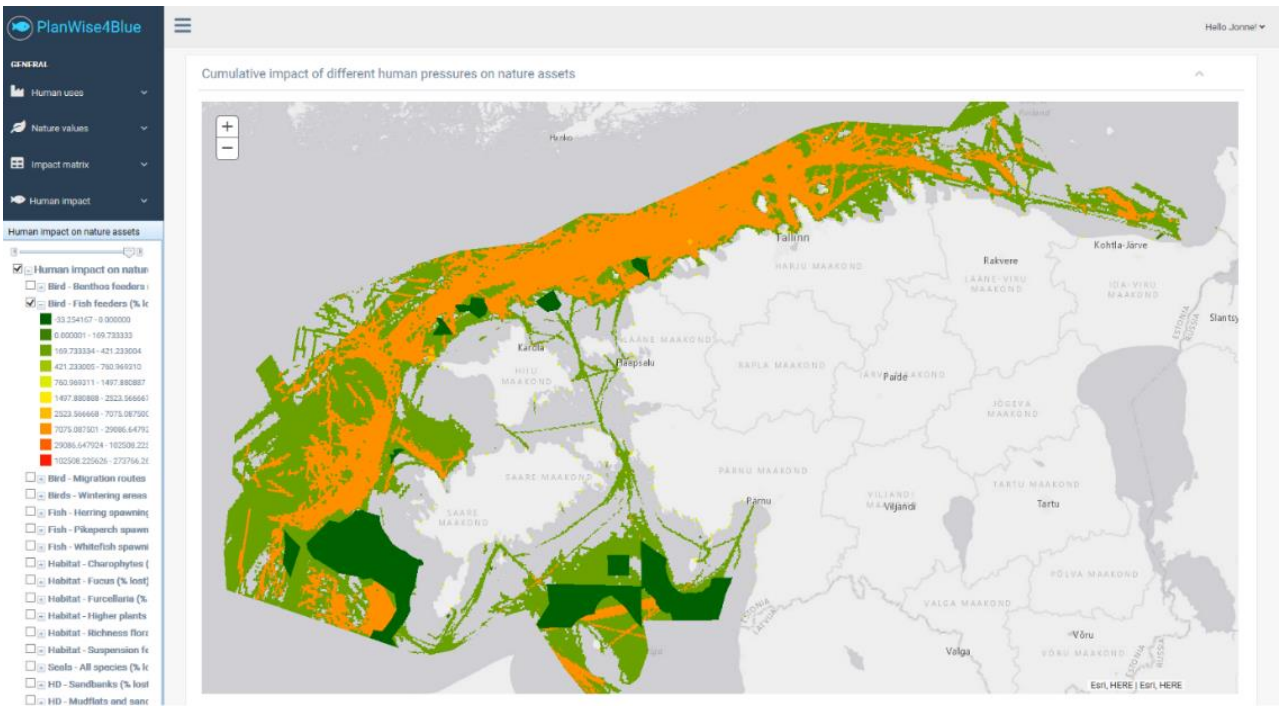

Figure 1. User interface of PW4B tool. Available: http://www.sea.ee/planwise4blue

Human impact is analysed from a transboundary perspective, considering developments in different parts of the Baltic Sea, their overall impact and synergy. Such scenario modelling demonstrates how adverse consequences of eutrophication and climate change can be mitigated by applying smarter spatial allocation of different human uses.

The **PlanWise4Blue** (PW4B) DST tool can be used to estimate cumulative effects of various human activities on nature assets**.** It does not require special GIS software or GIS knowledge by the user. This knowledge can give decision-makers a head start in assessing the spatial extent of different types of human activity in specific locations.

PW4B tool characteristics

- Open source online tool.
- Based on the best available scientific data.
- Capable of quantifying both single and combined effects of human activities and uses on a broad range of marine nature values.
- The PW4B algorithm is based on spatial maps of environmental data (e.g. bird population density) and impact coefficients, which determines expected ecological changes for a given combination of human activities in a selected area.
- PW4B is dynamic: users can upload novel information on the marine environment and this ecological knowledge is then used to quantify cumulative effects.

Further development of PW4B in Adrienne

The most important improvement to the PW4B DST tool is regular updating of the model data, i.e. environmental data and knowledge of ecological effects, and when needed, refinements to model algorithms. This will result in enhanced predictions and a reduction in uncertainty in particular regions, as well as the ability to measure the accuracy of the model and to stream-line modelling and calculation processes. In the Adrienne project, data were collected and integrated into PW4B standardised database on pressures and human activities from Estonia, Finland and Russia. Development and optimization of the portal's IT technical solution is planned so that large-scale analyses can be performed in near real-time. Currently, all data and models are hosted at the Estonian Marine Institute, University of Tartu. In future, the PW4B will be dynamically linked to the HELCOM data portal to enable automatic updates of relevant human use and nature data.

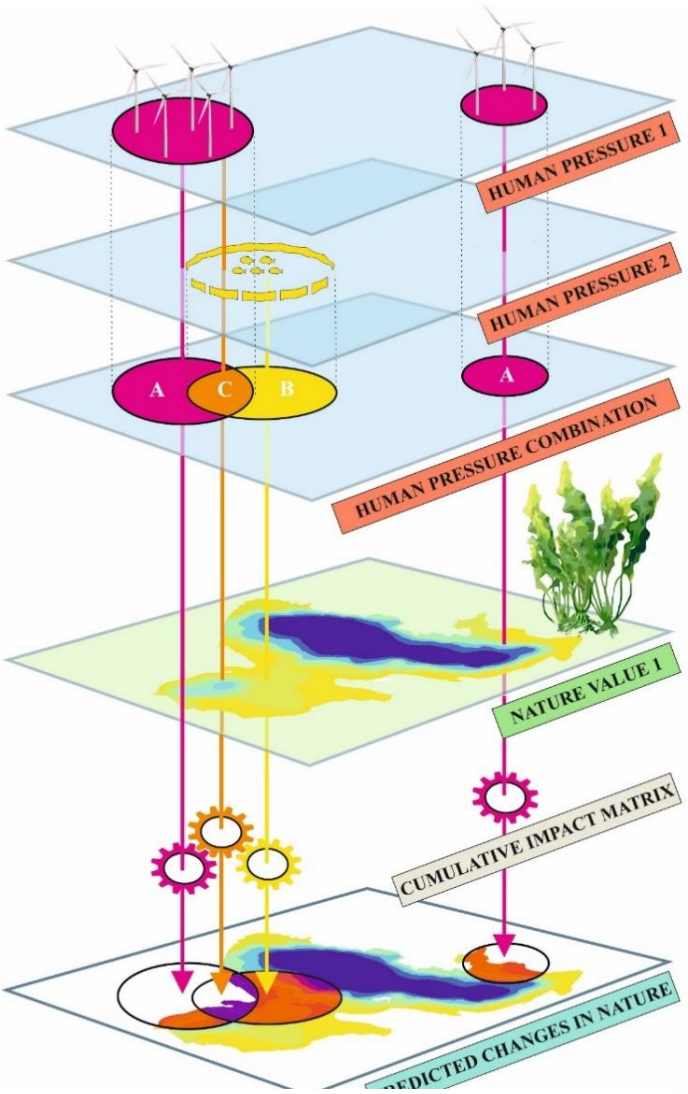

Figure 2. A scheme of the cumulative impact assessment by the PW4B DST. The tool first classifies the region of interest based on the unique combination of human activities found in each area. In this example, separate and cumulative effects of two human pressures (wind park and aquaculture development) are applied on a single habitat (a seaweed habitat). The resulting map represents predicted quantified cumulative effects of these pressures onto habitat in this location. More: https://adrienne.ut.ee/project?lang=en

More information:
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http://www.sea.ee/adrienne; https://adrienne.ut.ee/project/?lang=en