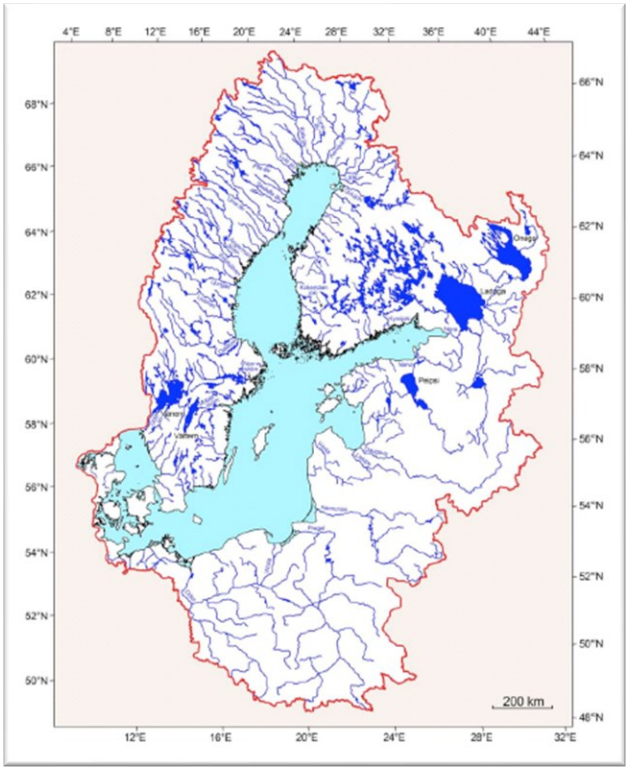
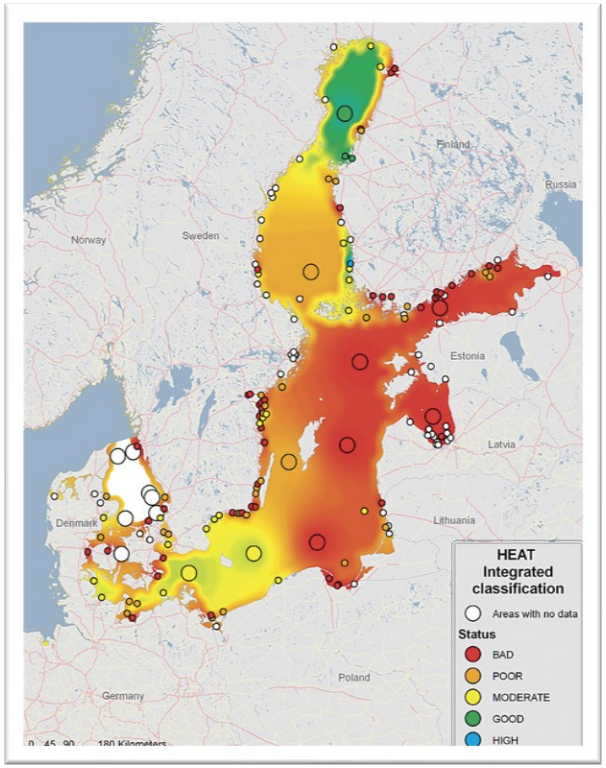
Potential use of algae and invertebrates for nutrient sequestration and removal from the Baltic Sea

Jonne Kotta

Estonian Marine Institute, University of Tartu

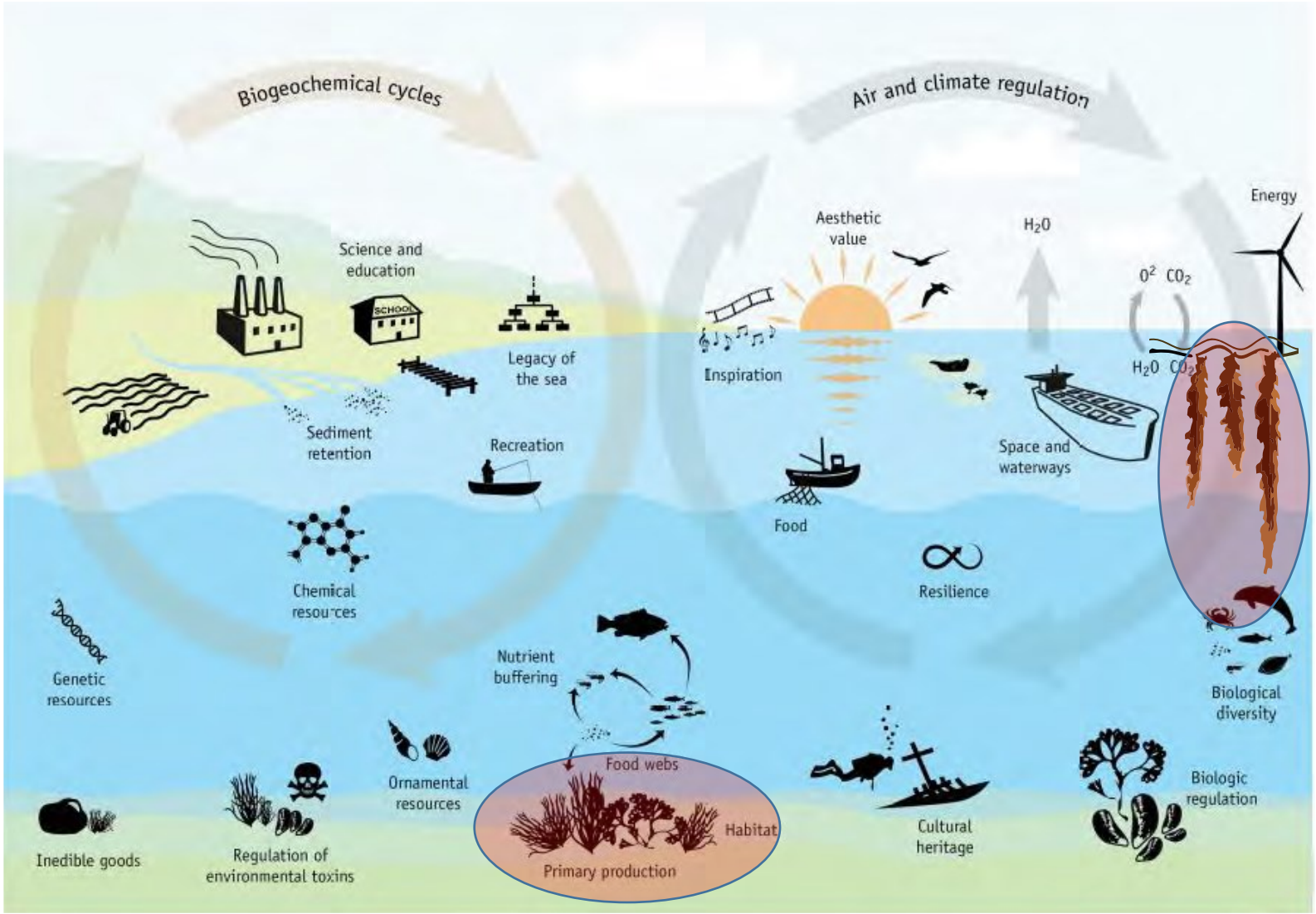
Large watershed area & legacy nutrients → eutrophication problems





Source: HELCOM

Ecosystem goods and services provided by the Baltic Sea ecosystem



Source: BalticSTERN 2013

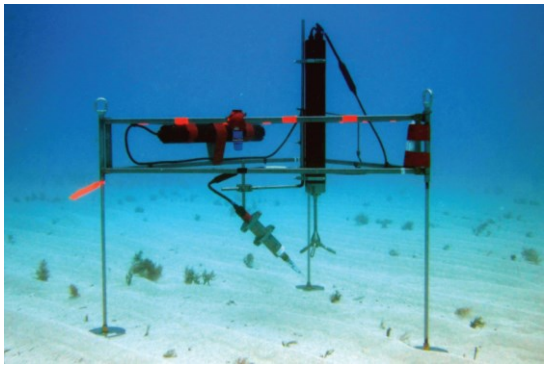
The need for process-based and quantitative estimations of ecosystem services

Most of our ***current understanding of the spatial flow of services*** from marine ecosystems relies on the ***presence of structural components of ecosystems and the qualitative*** (or semi-quantitative) ***assessment of their contributions*** to specific services.

Source: Inácio et al. (2020)

The need for process-based and quantitative estimations of ecosystem services

Spatially-defined and quantitative estimates of the flow of marine ecosystem services are needed more than ever ***if we want to assess and predict expected changes of various management scenarios under current and future climate conditions***.

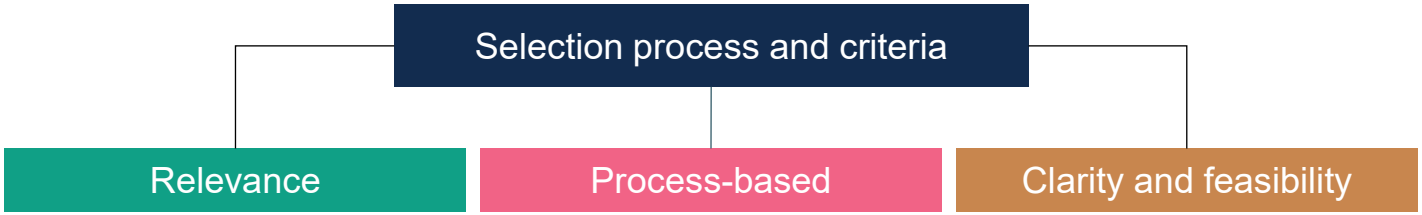


Source: Wahl et al. (2015), Pansch and Hiebenthal (2019), Berg et al. (2022)

The need for process-based and quantitative estimations of ecosystem services

What and where?

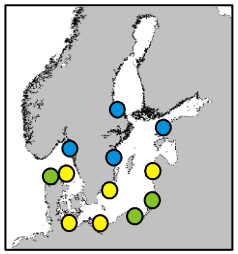
What, where, how much?



General modelling approach

Structure:

e.g., point data of species biomass

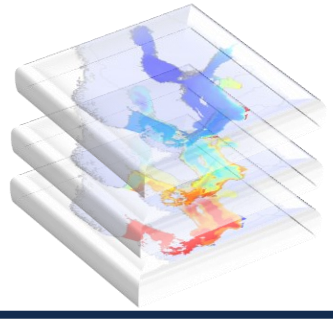


Machine learning

e.g., BRT

Environment:

GIS-layers of environmental data

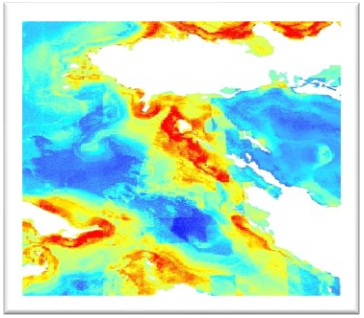


Functioning:

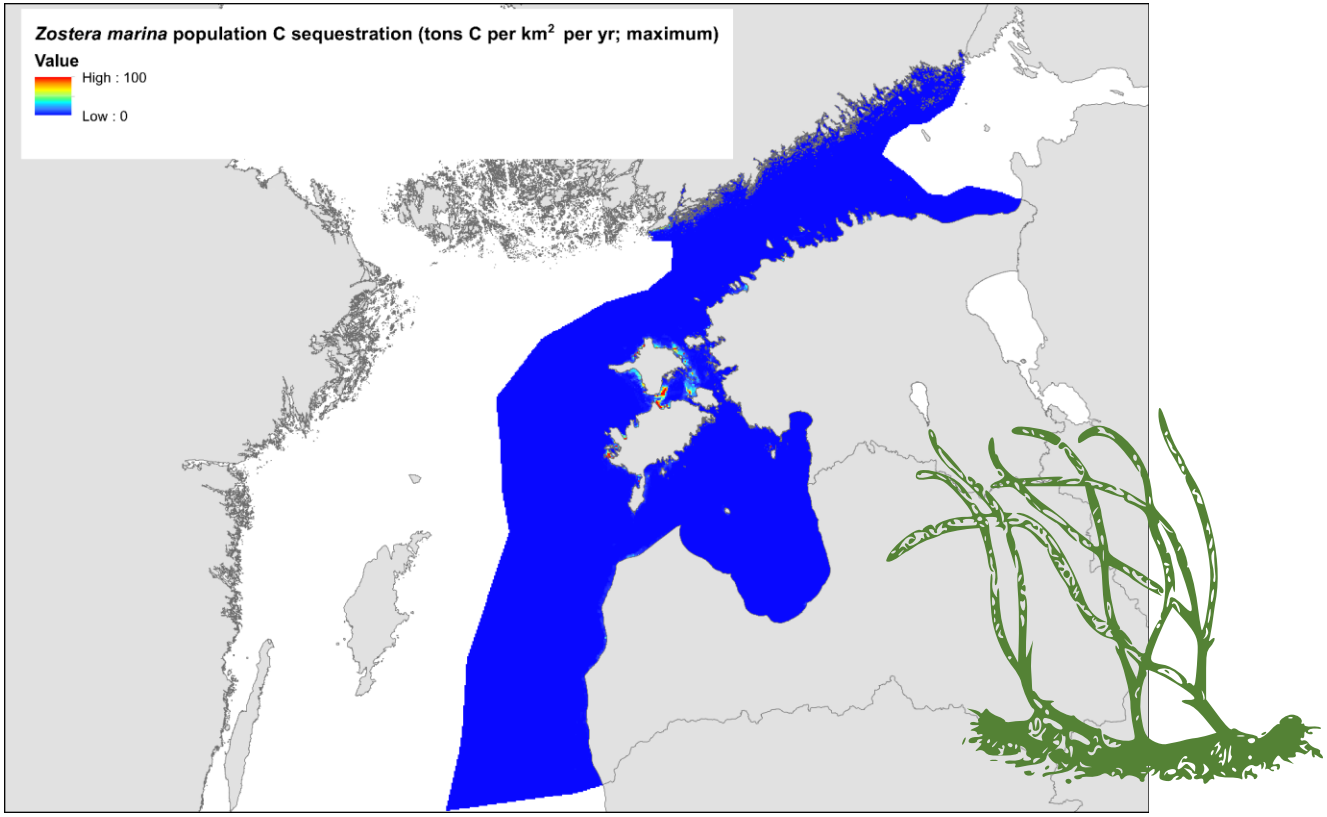
e.g., primary production, nutrients assimilation and content, growth deploying **Dynamic Energy Budget** modelling and similar

Spatial prediction:

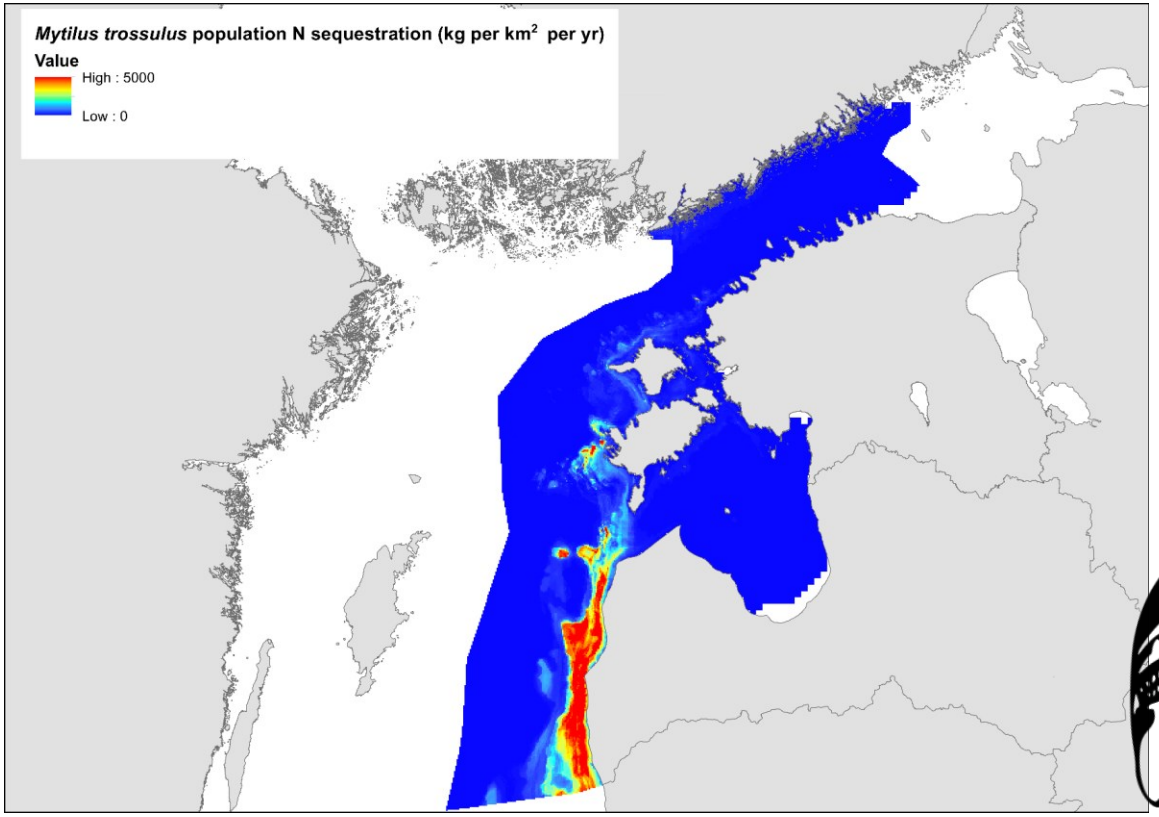
e.g., NPC sequestration maps



Regulating and maintenance



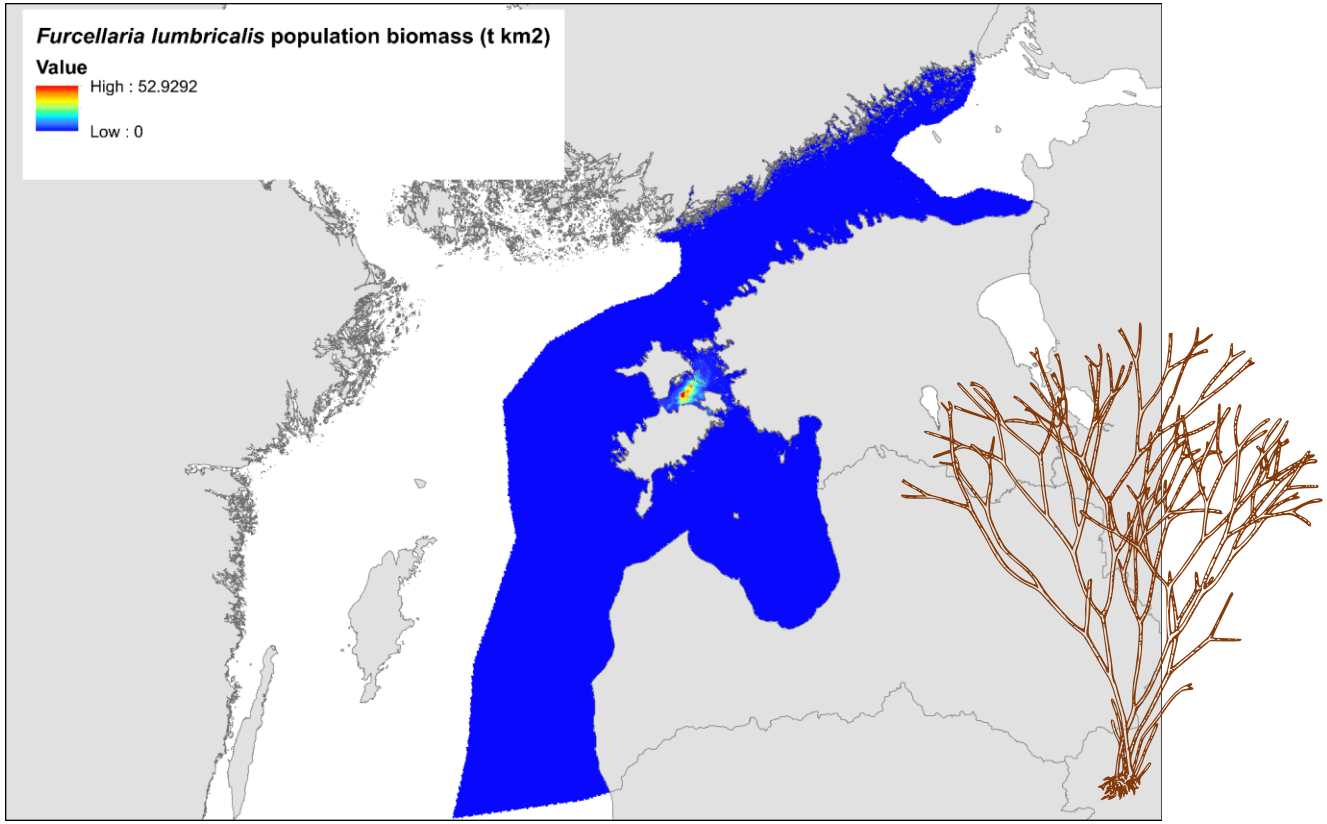
Regulating and maintenance



Accelerate blue economy solutions

(1) Economic benefits + (2) Restoring valuable habitats

Provisioning services (harvesting)



Source: BalticSTERN 2013

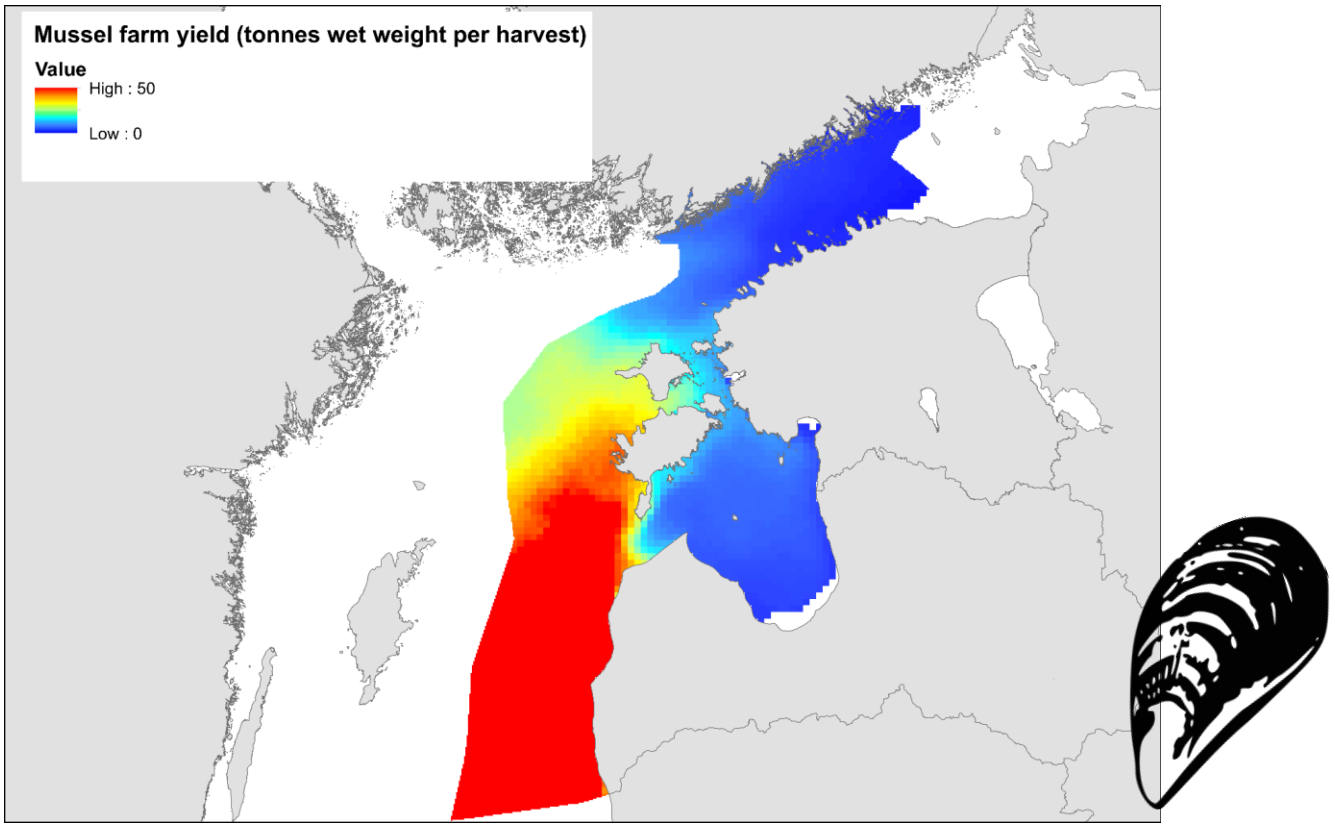
A potential of algal and mussel farming

legacy

NP

$$NP_{farm\ yield} = NP_{content} \times growth$$

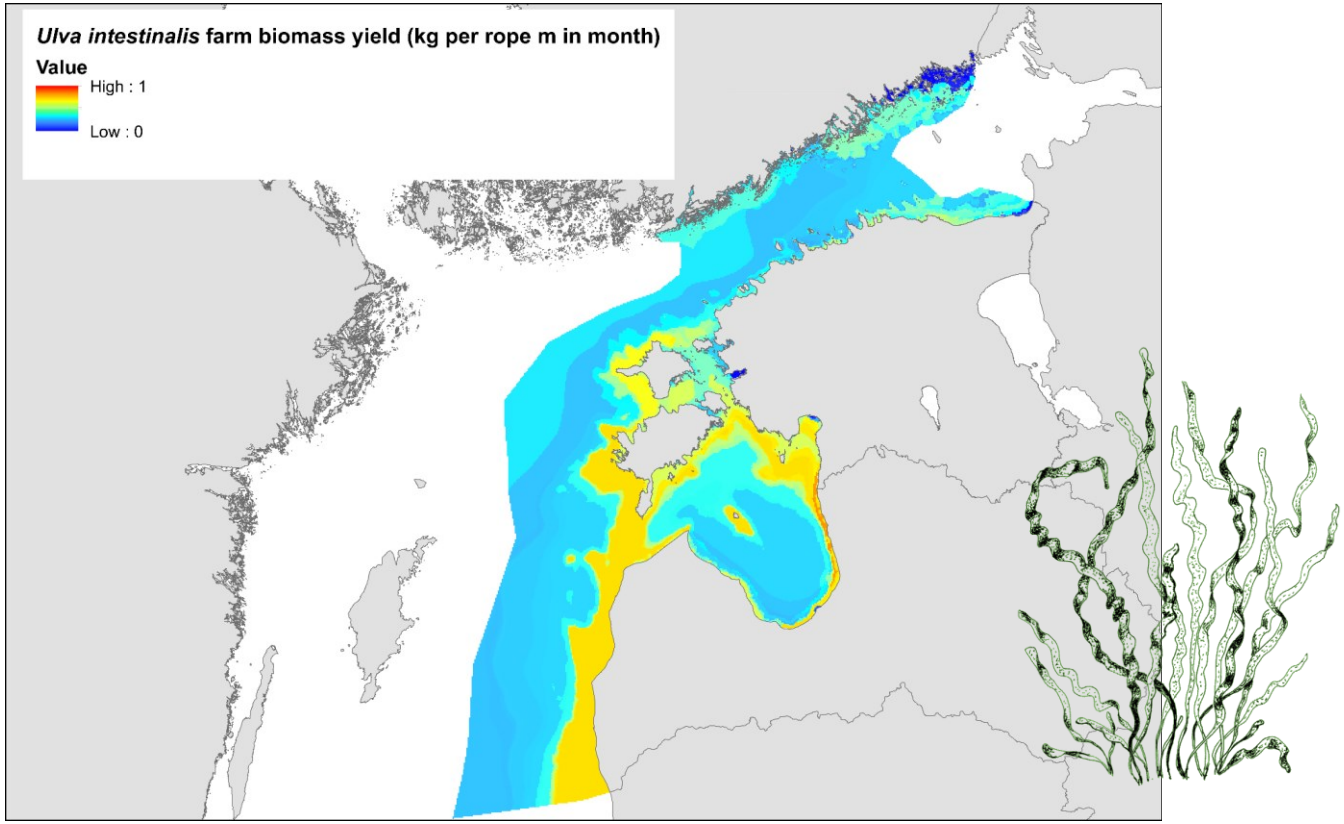
Provisioning services (cultivation)



Blue innovation (small mussels)

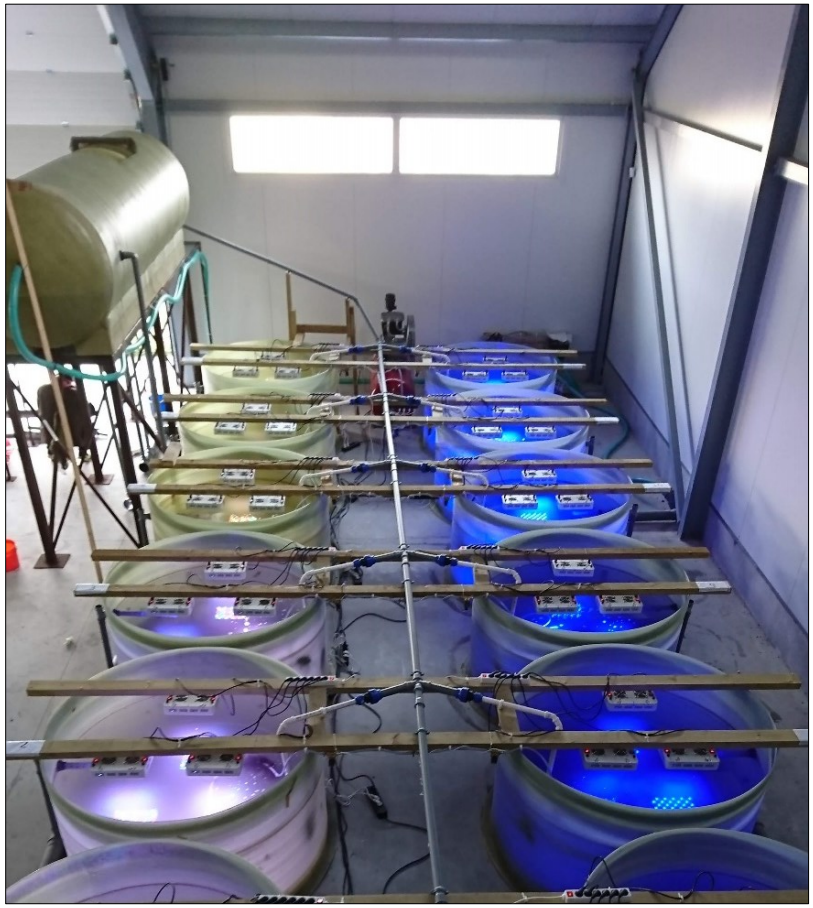
1. Optimize farming and harvesting technology
2. Low energy meat extraction

Provisioning services (cultivation)



Blue innovation (first cultivation trials)

Cultivation on land and at sea



ODSS – Operational Decision Support System

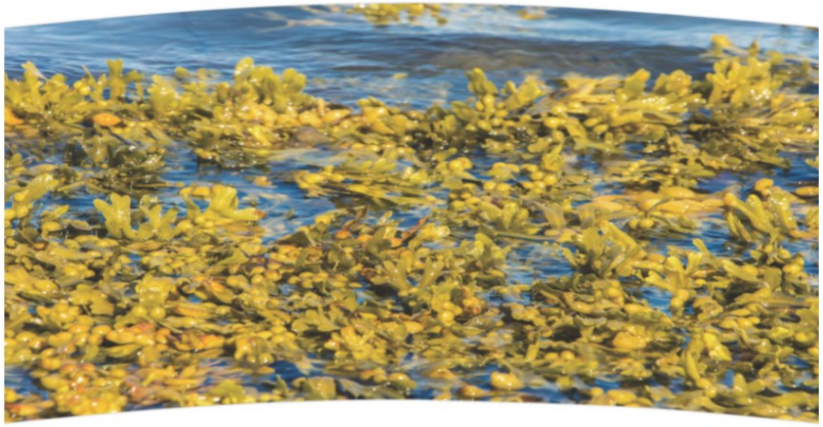
BBG GRASS Menu

Operational Decision Support System (ODSS)

The application for the Baltic blue mussel and macroalgal farming - a platform enabling upload, analysis and sharing of information

Interreg Baltic Sea Region Baltic Blue Growth — EUROPEAN UNION EUROPEAN REGIONAL DEVELOPMENT FUND

Interreg Baltic Sea Region GRASS — EUROPEAN UNION EUROPEAN REGIONAL DEVELOPMENT FUND



GRASS: Growing Algae Sustainably in the Baltic Sea

http://www.sea.ee/bbg-odss

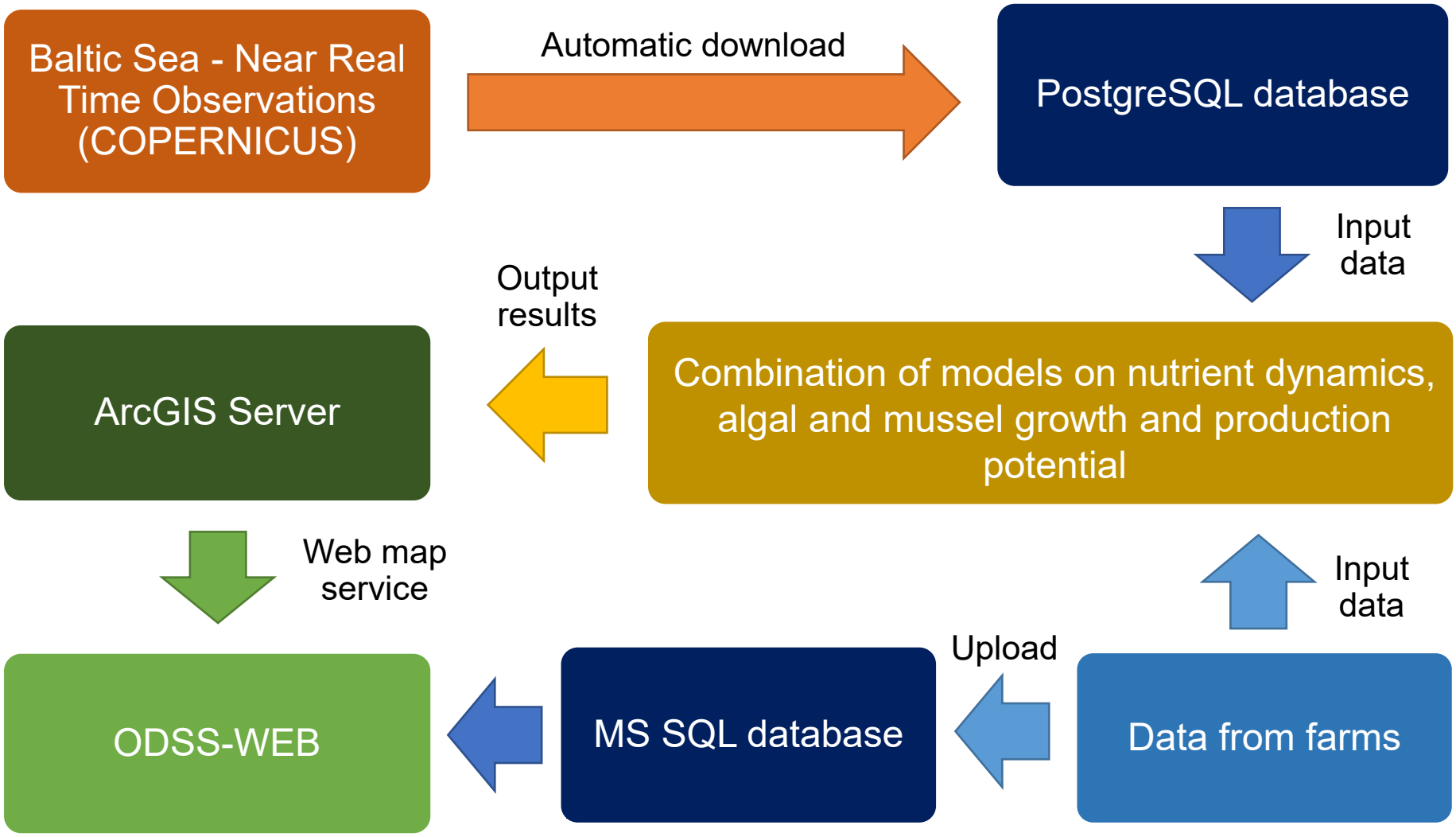
ODSS – Operational Decision Support System

Helps different end-users to **make effective decisions about algal and mussel farming in the Baltic Sea**

These decisions are **based on the best monitoring and modelling data**

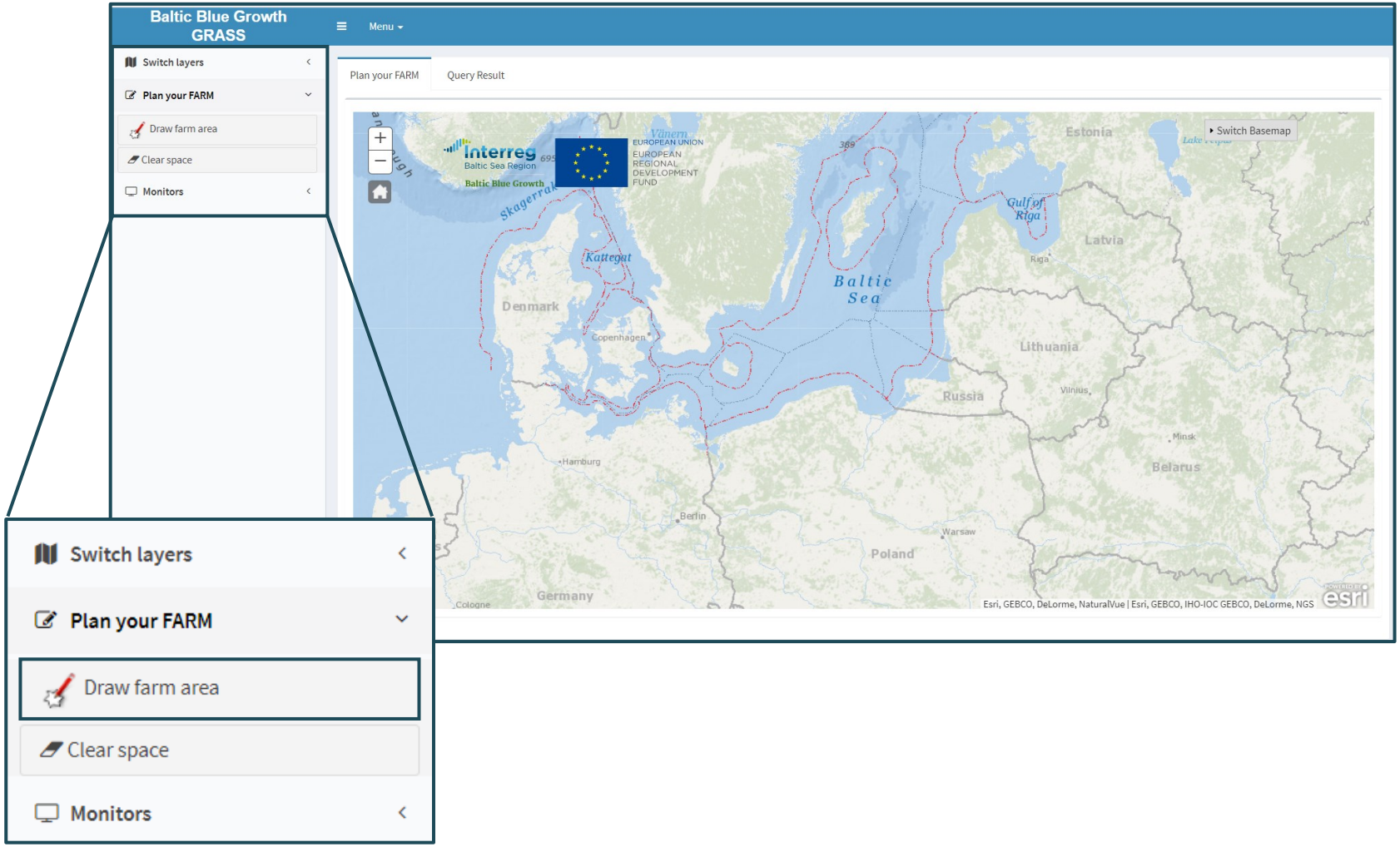
Raises the capacity of different users to **make decisions along the environmental, economic and socio-economic dimensions of LTA**

ODSS data flow



ODSS in action

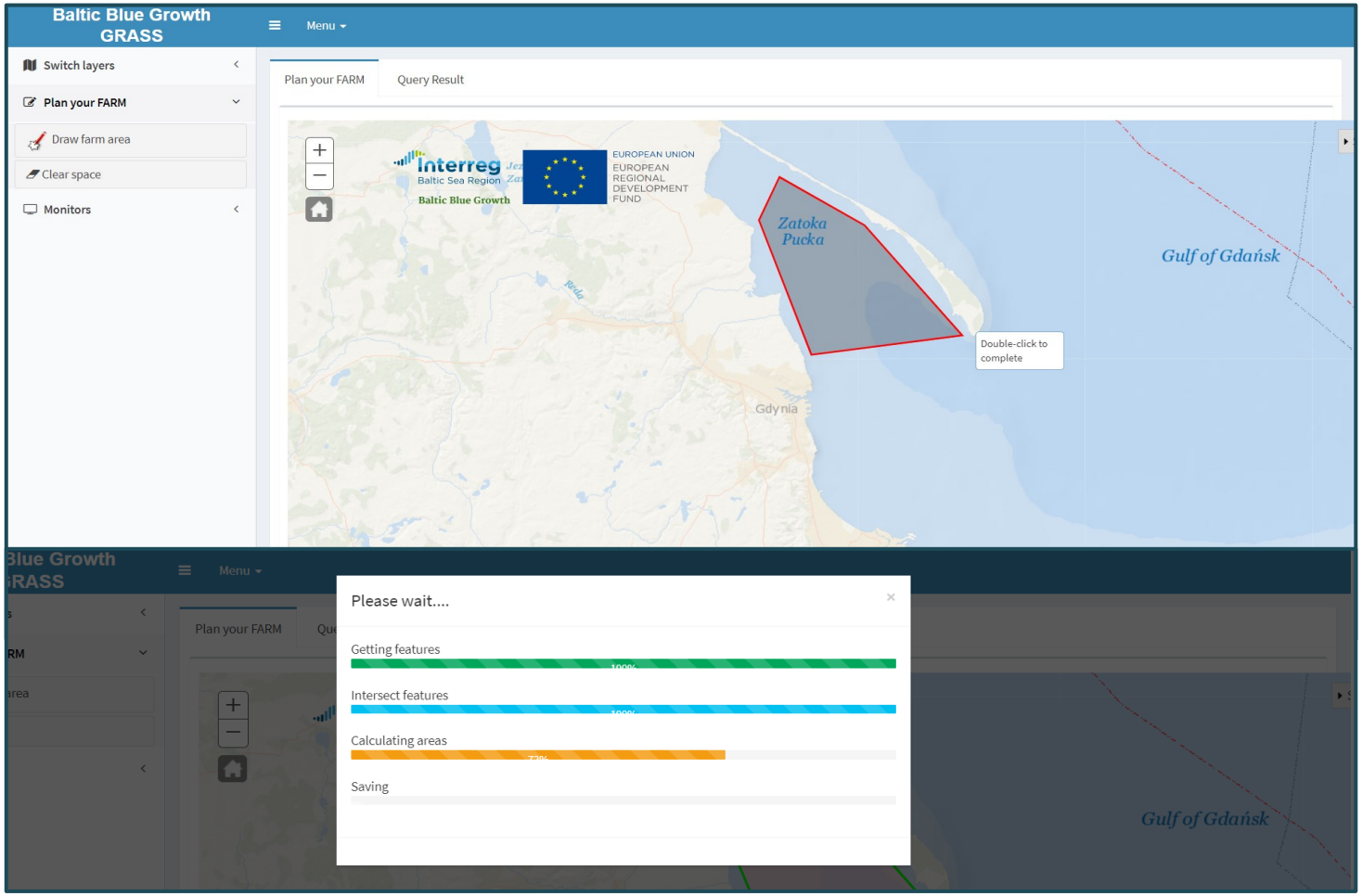
Draw the area of the farm using the integrated tool



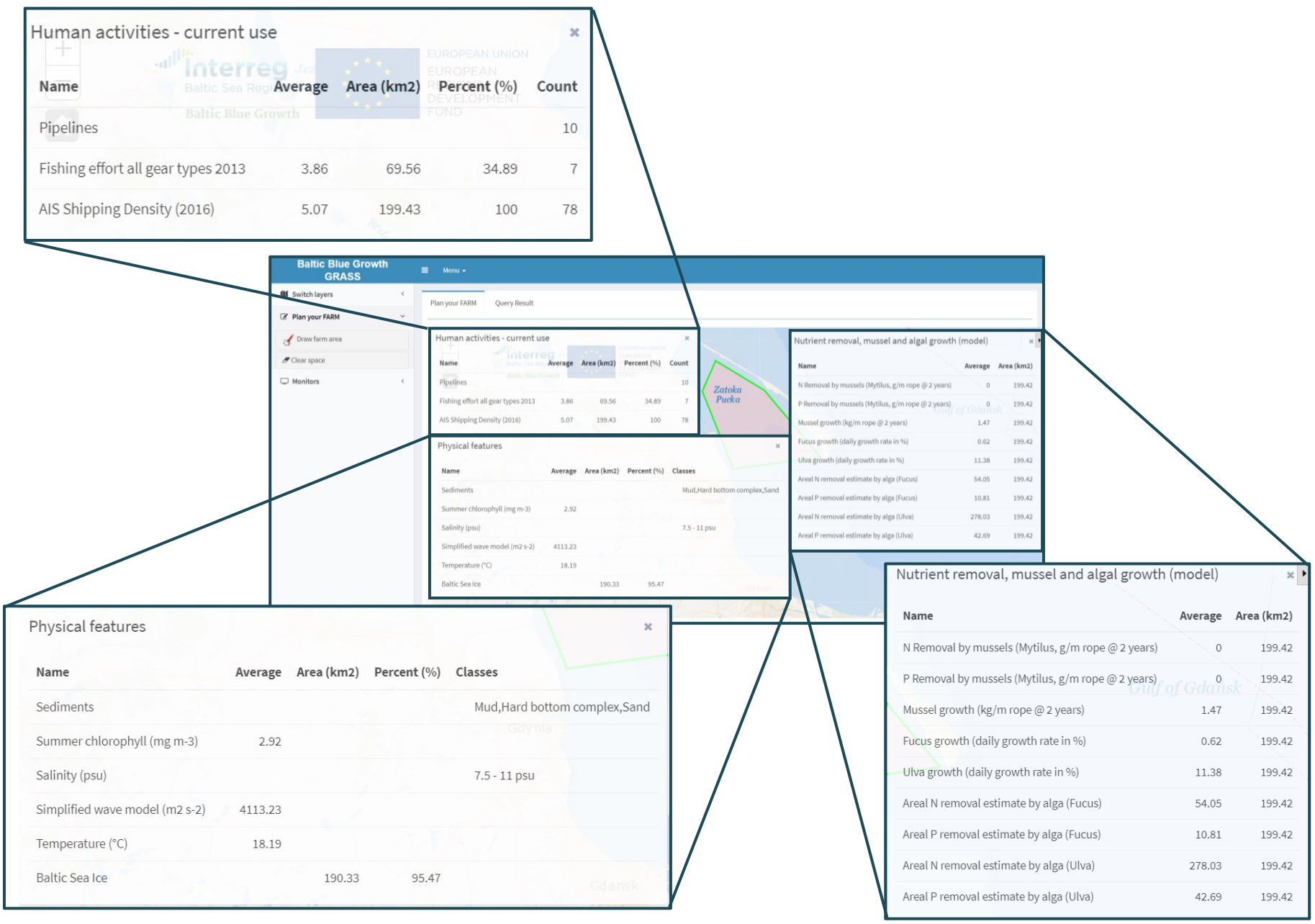
http://www.sea.ee/bbg-odss/Map/MapMain

ODSS in action

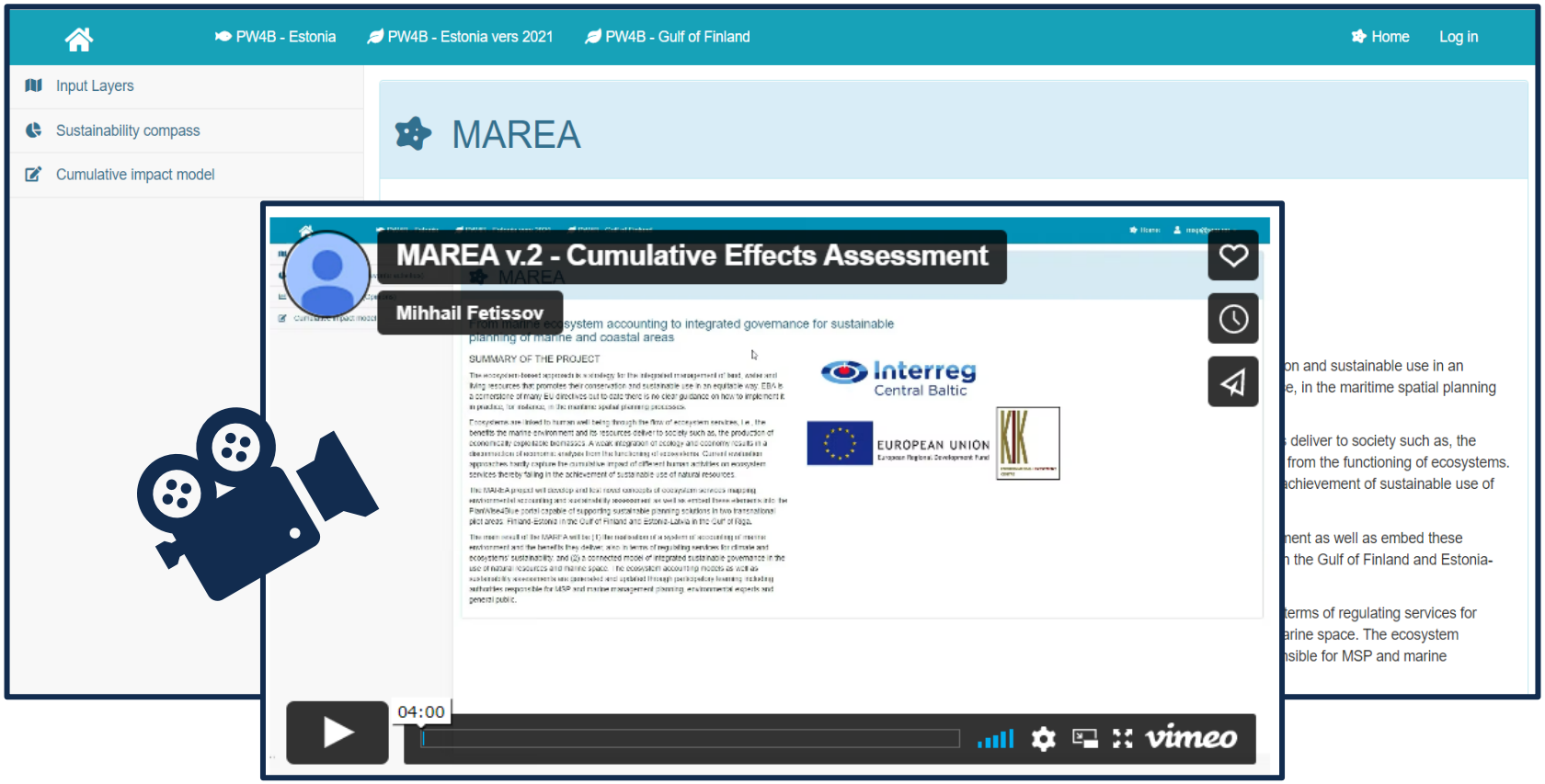
Given the selected area the tool will gather the associated information and calculate the features of the planned farm



ODSS in action

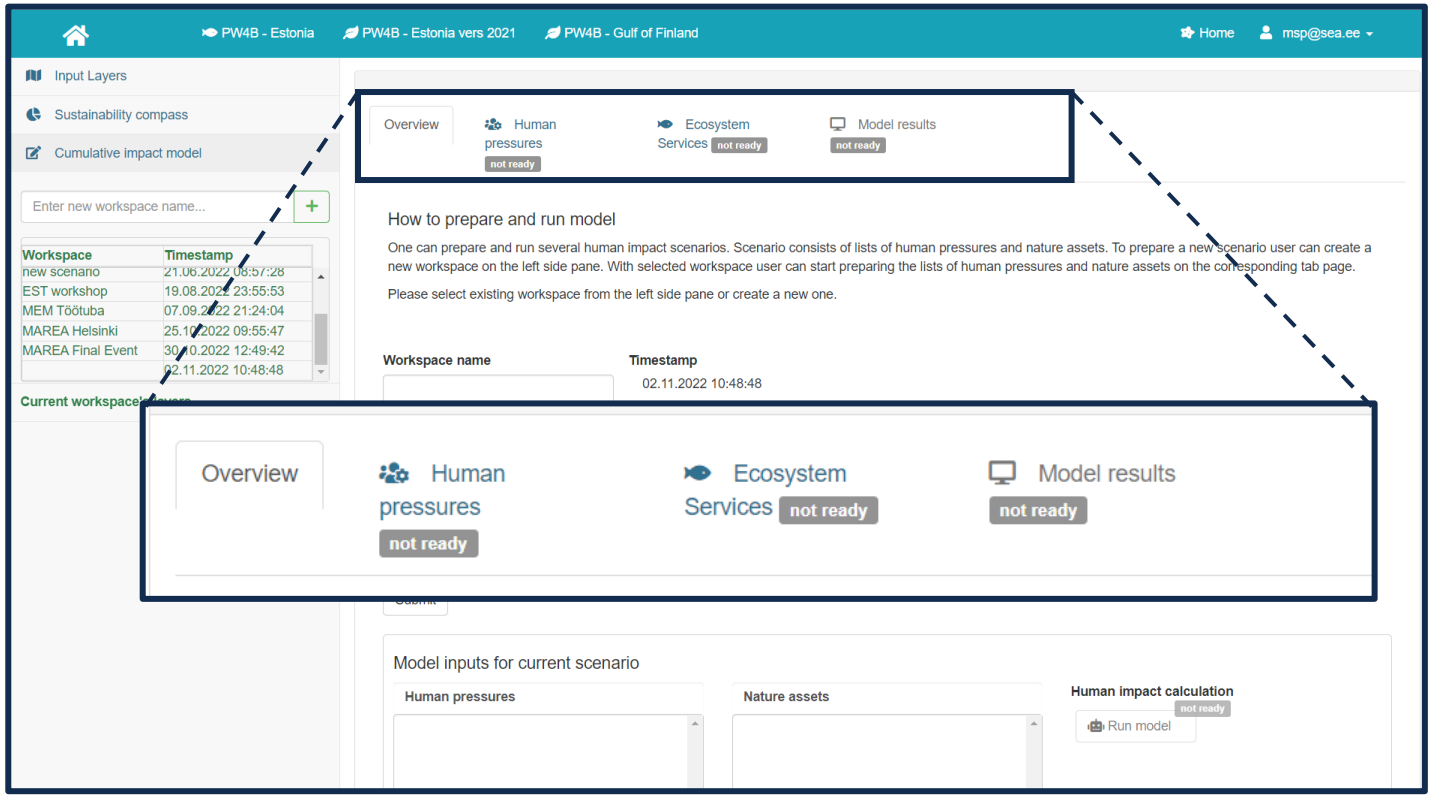


PlanWise4Blue to run cumulative impact assessment analyses



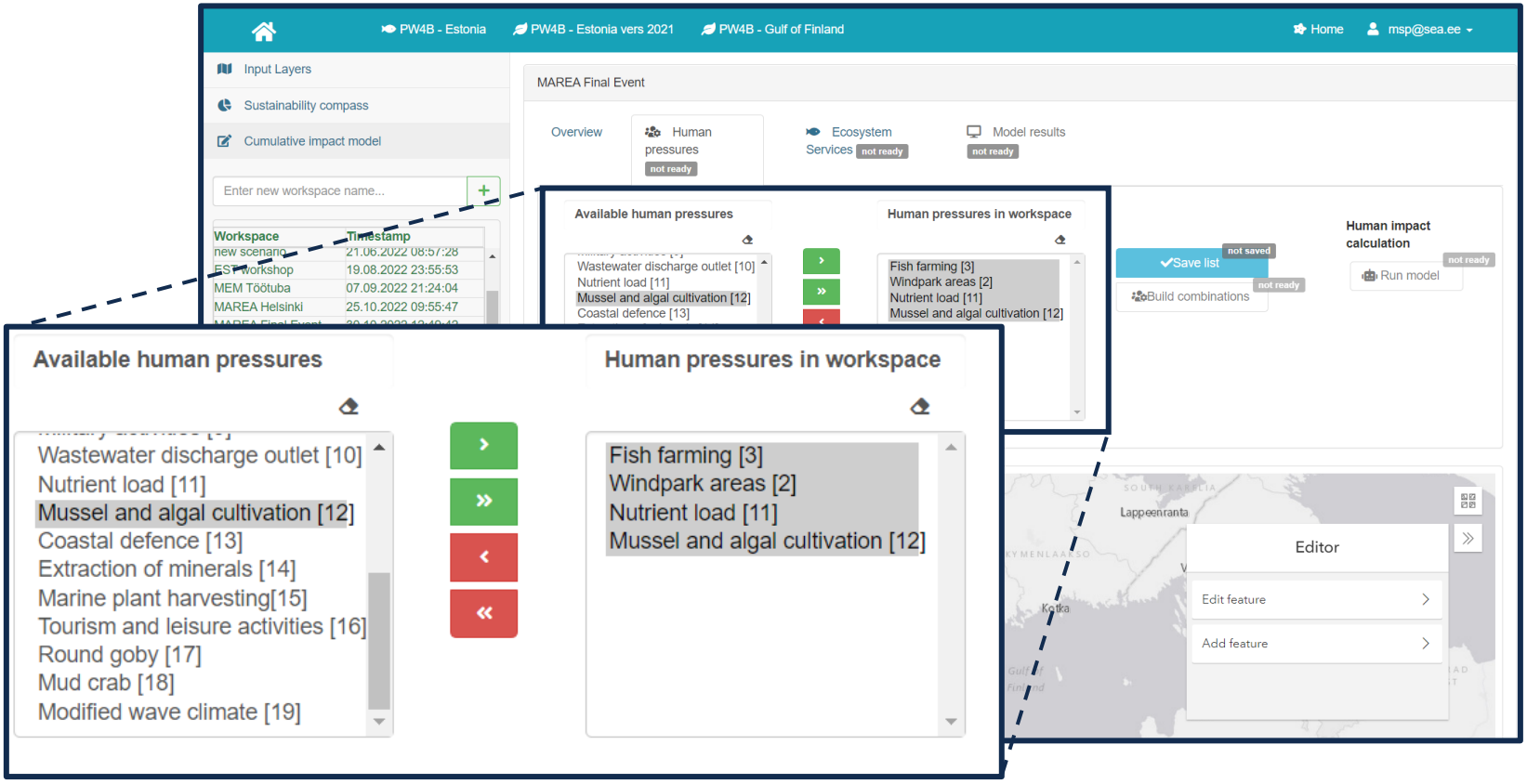
https://gis.sea.ee/marea

PlanWise4Blue in action



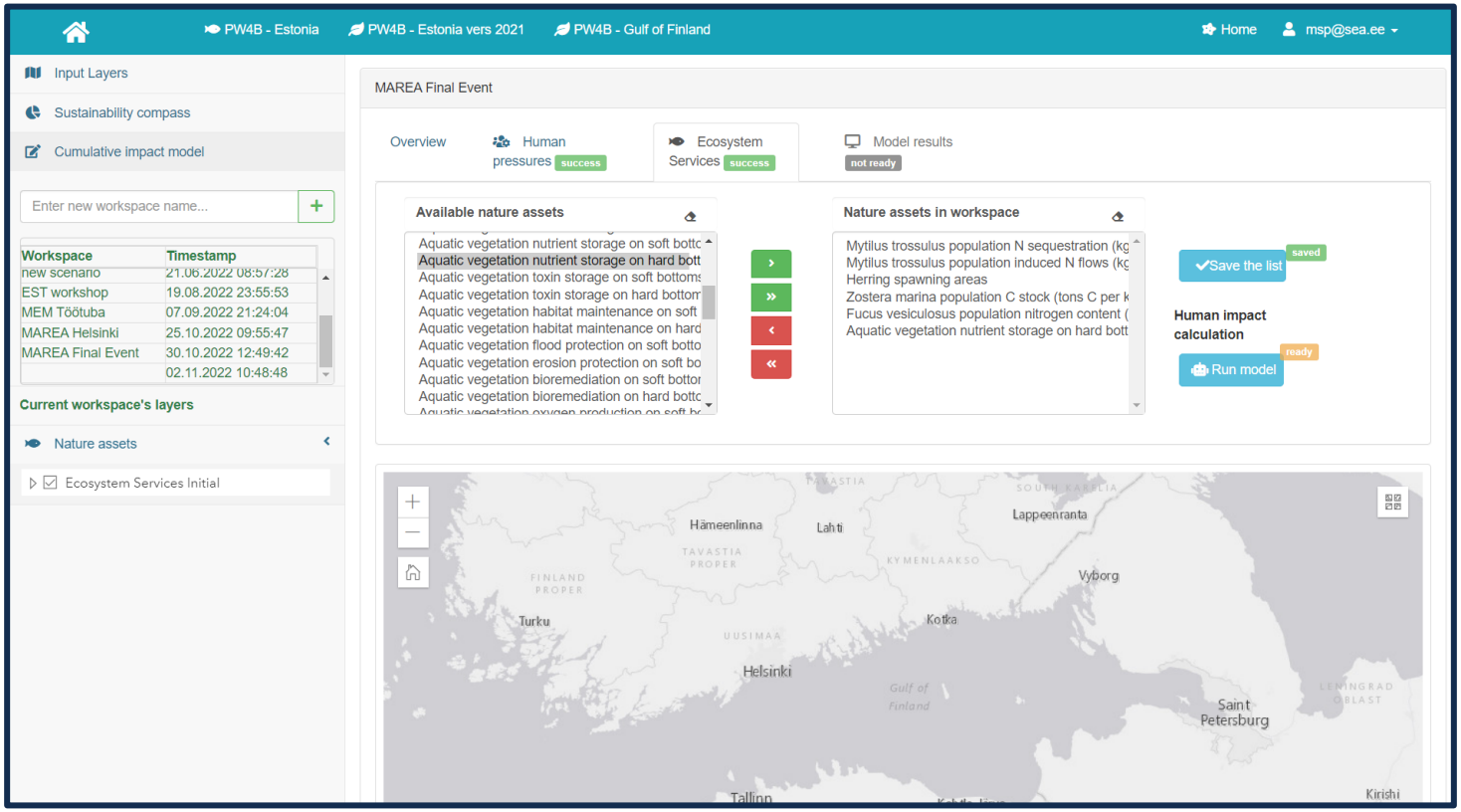
PlanWise4Blue in action

Selecting human pressures for our scenario



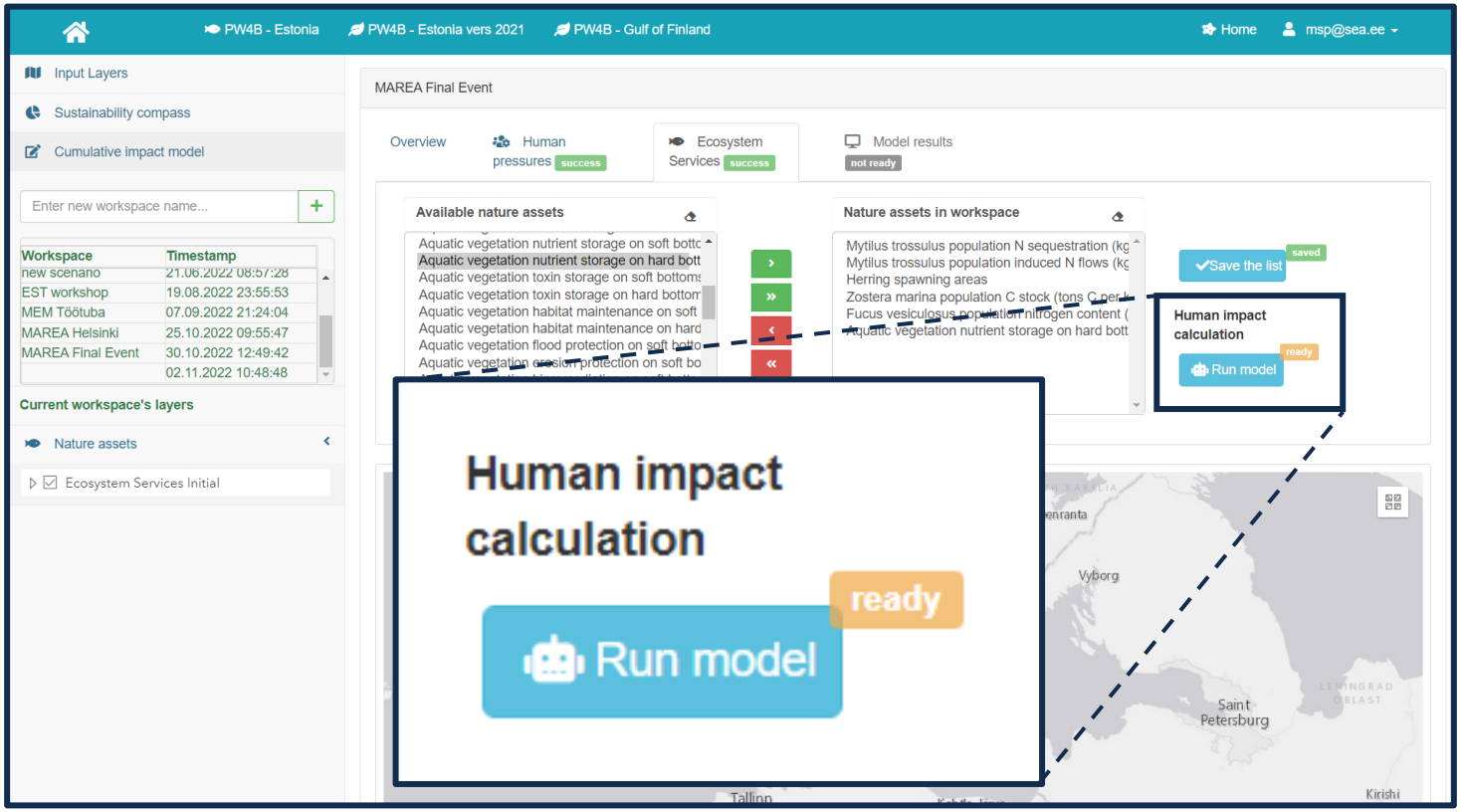
PlanWise4Blue in action

Selecting nature assets



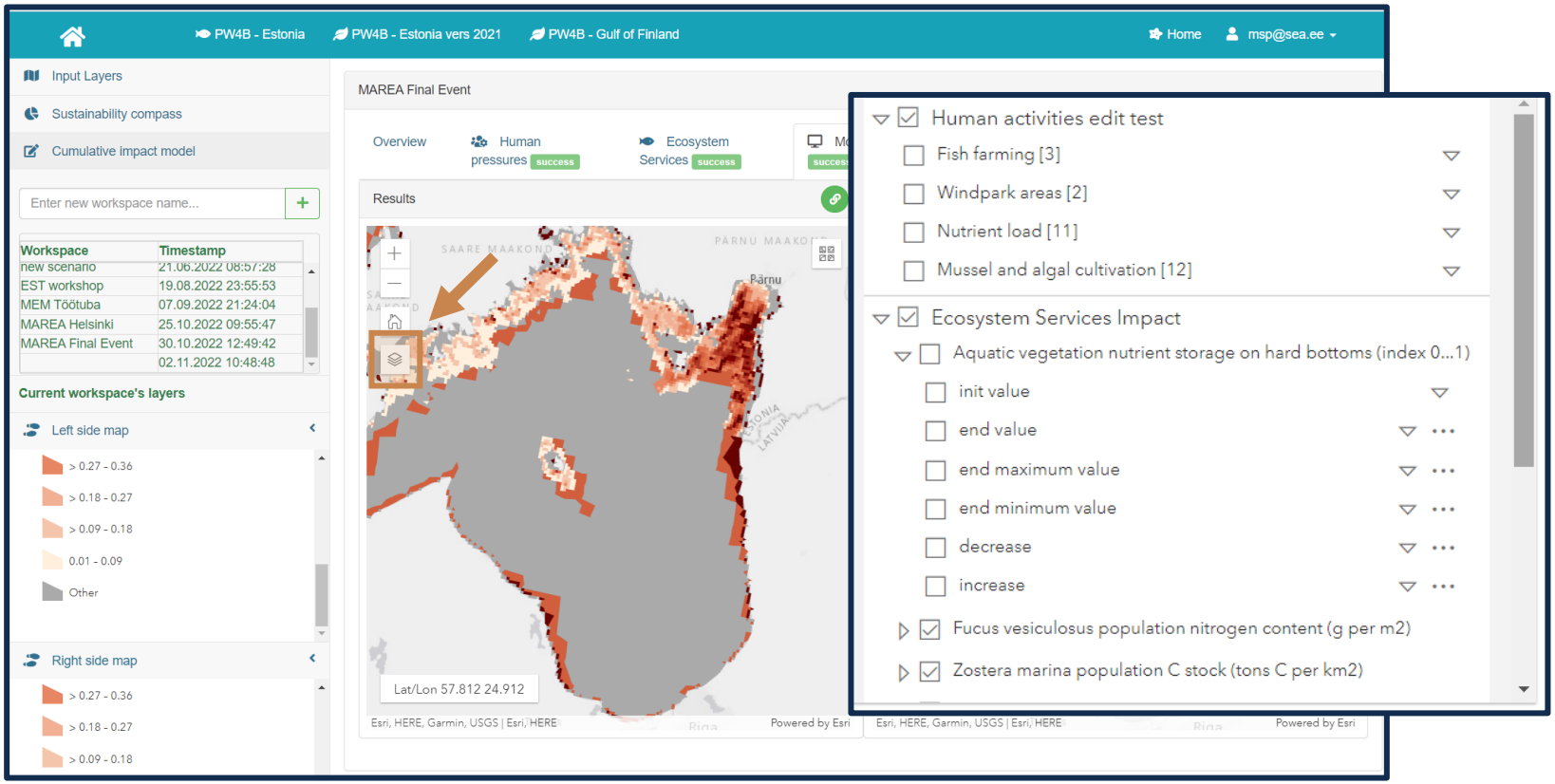
PlanWise4Blue in action

Running the model



PlanWise4Blue in action

The results



Future directions

European Commission

Horizon 2020
European Union funding
for Research & Innovation

MARBEFES

MSP4BIO

BLUE4ALL

Funded by
the European Union

OLAMUR: Grant agreement ID: 101094065