



EUROPEAN UNION
European Regional Development Fund



Interreg
Central Baltic



MAREA

PlanWise4Blue geoportal – visualization and practical applications (WP4)

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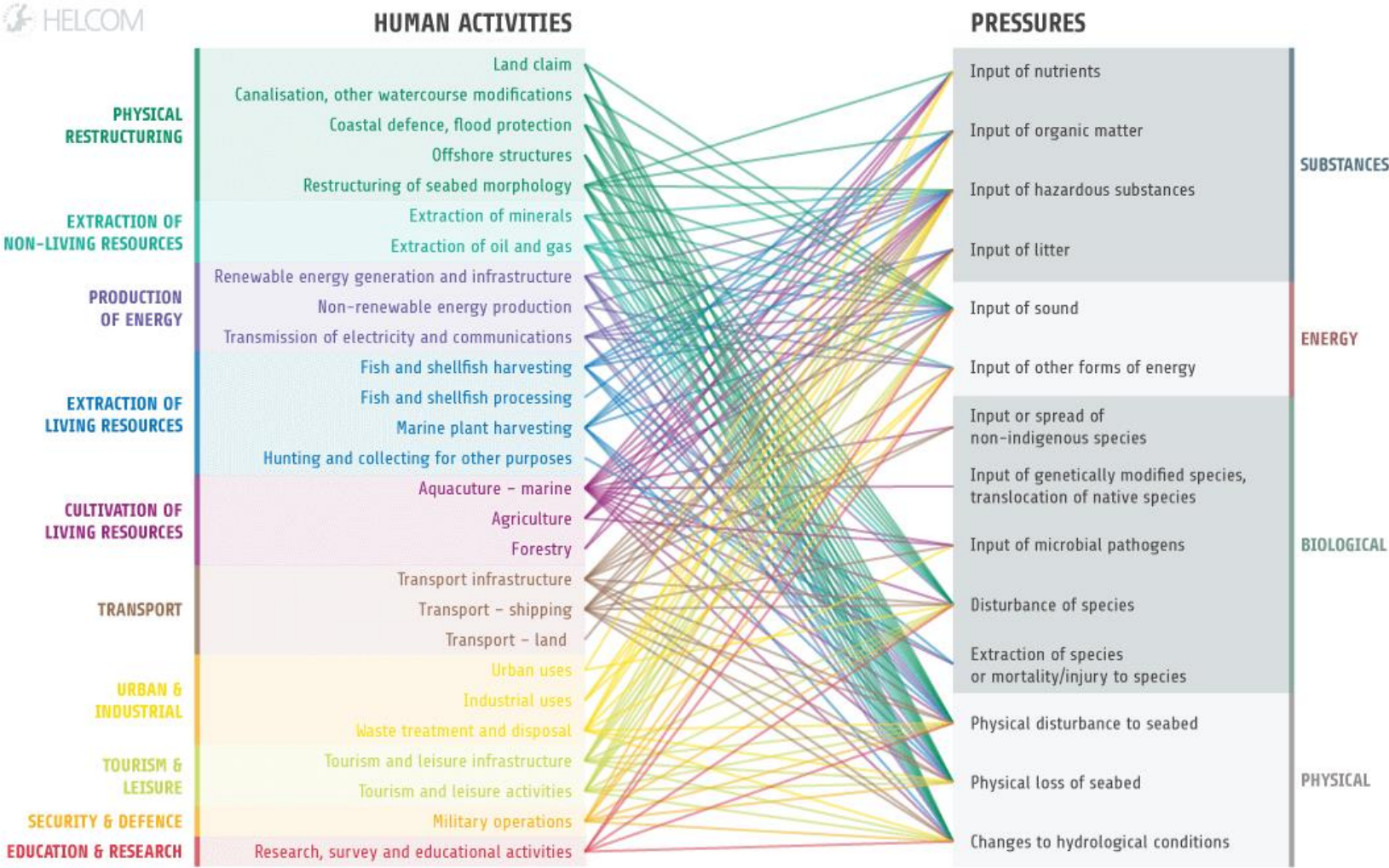
PlanWise4Blue geoportal

- a) Cumulative impact assessment tool for ES
- b) Sustainability compass
- c) Environmental accounting

The screenshot shows the PlanWise4Blue geoportal interface. At the top, there is a teal navigation bar with a home icon on the left, followed by three tabs: 'PW4B - Estonia', 'PW4B - Estonia vers 2021', and 'PW4B - Gulf of Finland'. On the right side of the navigation bar are 'Home' and 'Log in' links. Below the navigation bar is a sidebar on the left with three menu items: 'Input Layers', 'Sustainability compass', and 'Cumulative impact model'. The main content area features a light blue header with the 'MAREA' logo (a star with four dots) and the text 'MAREA'. Below this header, the text reads: 'From marine ecosystem accounting to integrated governance for sustainable planning of marine and coastal areas'.

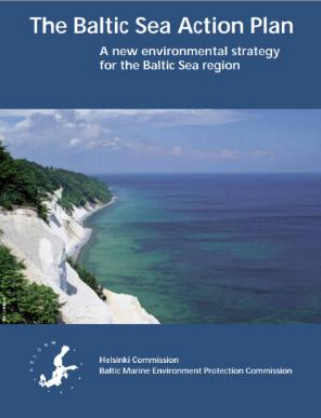
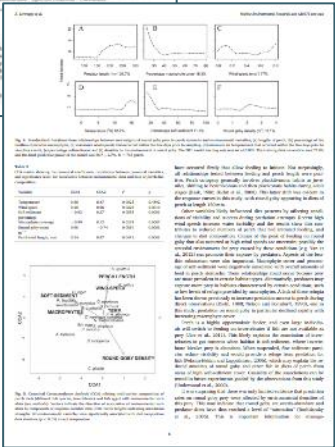
How to evaluate the combined impacts of human pressures on nature assets?

Marine ecosystems (the Baltic Sea is not the exception) are **exposed to a diversifying and intensifying set of human pressures**, suffering in many cases irreversible changes



How to evaluate the combined impacts of human pressures on nature assets?

The **multiplicity of pressures** acting simultaneously on marine ecosystems **require data and analysis demanding schemes**.



Disconnection in the flow of knowledge between science (specific/technical) and policy (general/layman approach).

A promising solution: PlanWise4Blue

User-friendly online-based tool able to quantify the cumulative human impacts through the explicit incorporation of modelling and mapping advances of MAREA and previous projects and available empirical evidence of the effects of human pressures on nature assets.

Home PW4B - Estonia PW4B - Estonia vers 2021 PW4B - Gulf of Finland

- Input Layers
- Joint decision model (Favorite activities)
- Joint decision model (Opinions)
- Cumulative impact model

MAREA

From marine ecosystem accounting to integrated governance for sustainable planning of marine and coastal areas

SUMMARY OF THE PROJECT

The ecosystem-based approach is a strategy for the integrated management of land, water and living resources that promotes their conservation and sustainable use in an equitable way. EBA is a cornerstone of many EU directives but to date there is no clear guidance on how to implement it in practice, for instance, in the maritime spatial planning processes.

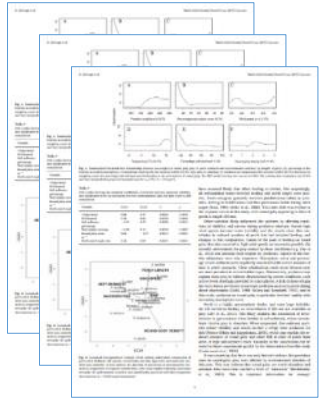
Ecosystems are linked to human well-being through the flow of ecosystem services, i.e., the benefits the marine environment and its resources deliver to society such as, the production of economically exploitable biomasses. A weak integration of ecology and economy results in a disconnection of economic analysis from the functioning of ecosystems. Current evaluation approaches hardly capture the cumulative impact of different human activities on ecosystem services thereby failing in the achievement of sustainable use of natural resources.

The MAREA project will develop and test novel concepts of ecosystem services mapping, environmental accounting and sustainability assessment as well as embed these elements into the PlanWise4Blue portal capable of supporting sustainable planning solutions in two transnational pilot areas: Finland-Estonia in the Gulf of Finland and Estonia-Latvia in the Gulf of Riga.

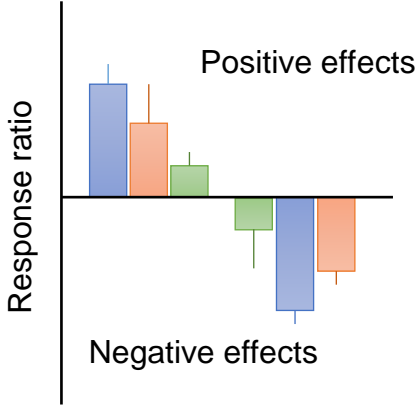
EUROPEAN UNION
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Behind the user-friendly interface...

Knowledge inventory



Extract data from relevant publications



Meta-analyses and calculation of effect sizes

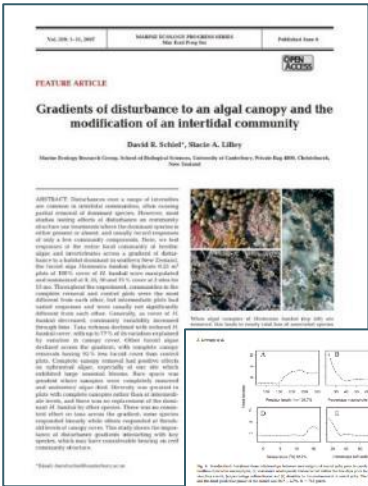


Nature value ID	env_layer_name	dredging	windpark	fish farming	shipping	underwater cable	commercial fish	harbours
1	Bird - Benthos feeders	1	1	1	0.9	1	1	0.9
2	Bird - Fish feeders	0.75	1	0.9	0.9	1	0.9	0.9
3	Bird - Migration routes	1	0.75	1	0.9	1	1	1
4	Bird - Wintering areas	1	0.75	0.9	0.9	1	1	0.9
5	Bird - Herbivores	0.7	0.85	0.7	0.9	1	1	0.8
6	Fish - Herring spawning areas	0.75	1	0.9	1	1	1	0.9
7	Fish - Pikeperch spawning areas	0.75	0.9	0.9	1	1	1	0.9
8	Fish - Whitefish spawning areas	0.75	1	0.75	1	1	1	0.9
9	Habitat - Charophytes	0.5	1	0.5	1	0.9	1	0.75
10	Habitat - Fucus	0.9	1	0.9	1	1	1	0.9
11	Habitat - Furcellaria	0.75	1	0.75	1	1	1	0.9
12	Habitat - Higher plants	0.9	1	0.9	1	1	1	0.9
13	Habitat - Richness flora and fauna	0.5	1	0.9	1	1	1	0.9
14	Habitat - Suspension feeders	1	1.25	1	1	1	1	0.9
15	Habitat - Zostera	0.75	1	0.75	1	1	1	0.9
16	Seals - All species	0.9	0.75	0.9	0.9	1	0.9	0.9
17	HD - Sandbanks	0.66	1	0.76	1	0.98	1	0.86
18	HD - Mudflats and sandflats	0.63	1.06	0.89	1	1	1	0.9
19	HD - Reefs	0.79	1.06	0.89	1	1	1	0.9

Matrix of effects

The tool *integrates current empirical evidence through meta-analysis to define the effects* of human pressures on nature assets (including ecosystems services).

Data extraction from publications:

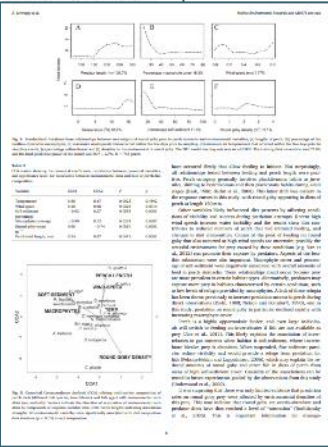


Types of studies:

Field observations

Field manipulations

Laboratory experiments



Impact



$$\text{Effect size (response ratio)} = \text{Impact/Control}$$

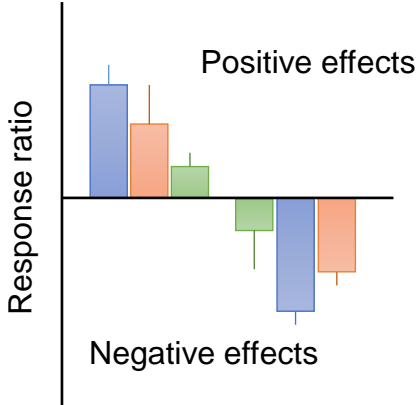
± Uncertainty*

Control

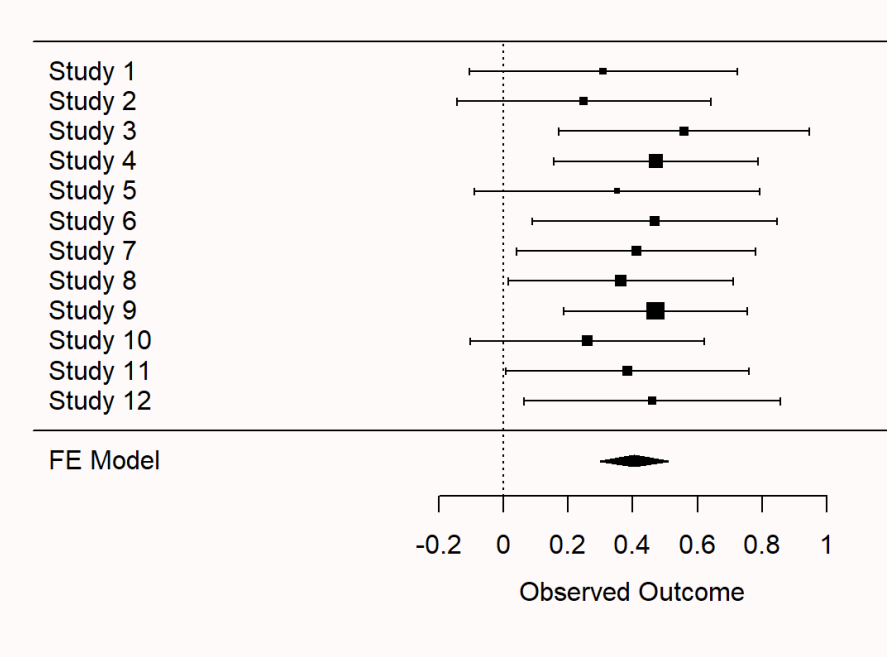


* Sample size (more is better)

Meta-analysis (amalgamation of similar studies):



Nature value ID	env_layer_name	dredging	windpark	fish farming	shipping	underwater cable	commercial fishi	harbours
1	Bird - Benthos feeders	1	1	1	0.9	1	1	0.9
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19	HD - Reefs	0.79	1.06	0.89	1	1	1	0.9



Number of studies (more is better)

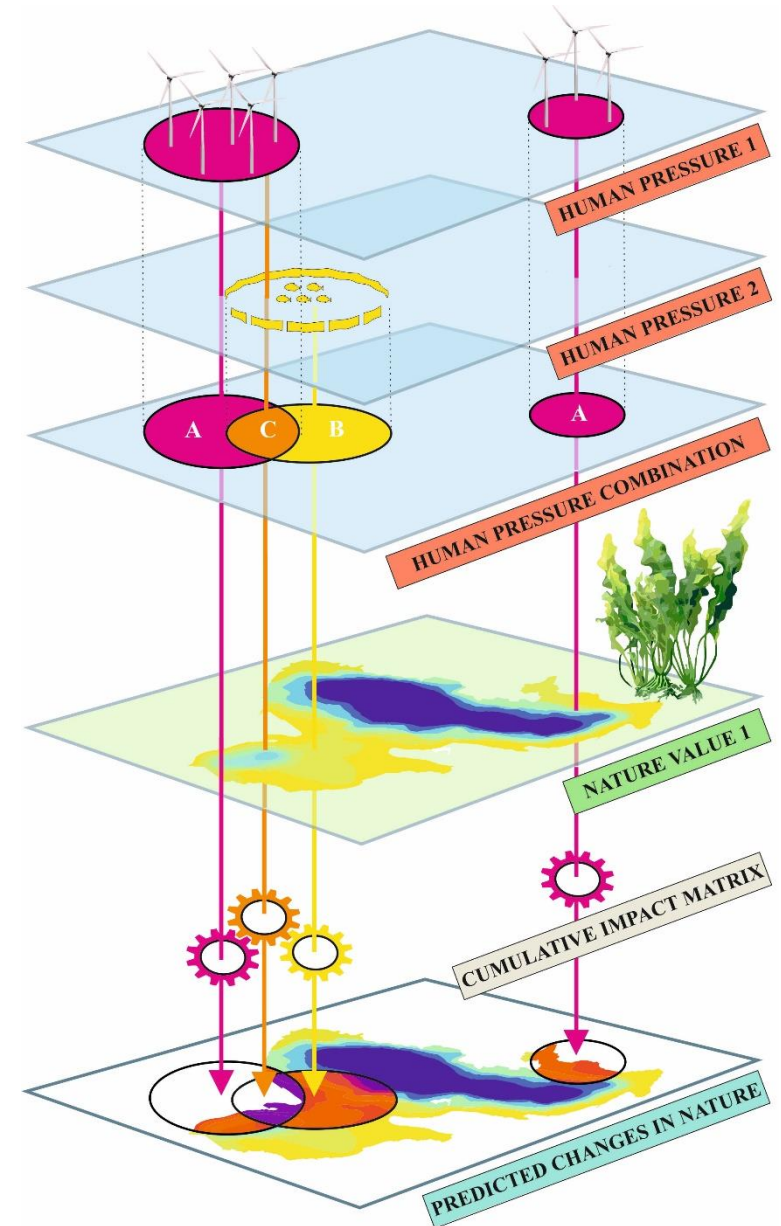
Purposes of uncertainty estimates:

1. Provides precision to assessment calculations (immediate)
2. Indicates research areas the deserve more attention (future)

Behind the user-friendly interface...

Cumulative Impact Assessment

- **Combines layers of nature asset values and human pressures** (derived from project efforts and European data infrastructure).
- **Incorporates evidence on how different human pressures affect different nature assets.**
- **Quantifies in real-time the effects of these pressures** at 1 km² scale based on the current best available data and knowledge.



Cumulative impact model

Home PW4B - Estonia PW4B - Estonia vers 2021 PW4B - Gulf of Finland Home msp@sea.ee

Input Layers Sustainability compass Cumulative impact model

+

Workspace	Timestamp
scenario 2	01.06.2022 23:00:02
SYKE Workshop	17.06.2022 14:37:12
new scenario	21.06.2022 08:57:28
EST workshop	19.08.2022 23:55:53
MEM Töötuba	07.09.2022 21:24:04
MAREA Helsinki	25.10.2022 09:55:47

Current workspace's layers

MAREA Helsinki

Overview Human pressures Ecosystem Services Model results not ready

not ready not ready

How to prepare and run model

One can prepare and run several human impact scenarios. Scenario consists of lists of human pressures and nature assets. To prepare a new scenario user can create a new workspace on the left side pane. With selected workspace user can start preparing the lists of human pressures and nature assets on the corresponding tab page.

Please select existing workspace from the left side pane or create a new one.

Workspace name **Timestamp** 25.10.2022 09:55:47

Description

Model inputs for current scenario

Human pressures

Nature assets

Human impact calculation not ready

Cumulative impact model

The screenshot displays the Cumulative Impact Model web application interface. At the top, a teal header bar contains navigation icons, project names (PW4B - Estonia, PW4B - Estonia vers 2021, PW4B - Gulf of Finland), and user information (Home, msp@sea.ee).

Left Panel:

- Input Layers:** Sustainability compass, Cumulative impact model.
- Workspace:** A table listing workspace entries with their timestamps.
- Current workspace's layers:** A list of human pressures with checkboxes.

Workspace	Timestamp
scenario 2	01.06.2022 23:00:02
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MAREA Helsinki	25.10.2022 09:55:47

- Extraction of minerals [14]
- Harbours [8]
- Pelagic trawling [6]
- Shipping intensity [4]
- Windpark areas [2]
- Dredging and dumping areas [1]

Main Panel (MAREA Helsinki):

- Overview:** Human pressures (not ready), Ecosystem Services (not ready), Model results (not ready).
- Available human pressures:** Underwater cables [5], Pelagic trawling [6], Benthic trawling [7], Harbours [8], Military activities [9], Wastewater discharge outlet [10], Nutrient load [11], Mussel and algal cultivation [12], Coastal defence [13], Extraction of minerals [14], Marine plant harvestindof151.
- Human pressures in workspace:** Dredging and dumping areas [1], Windpark areas [2], Shipping intensity [4], Pelagic trawling [6], Harbours [8], Extraction of minerals [14].
- Human impact calculation:** Run model (not ready).
- Buttons:** Save list (saved), Build combinations (ready).

Map Panel:

- Map of the Baltic Sea region showing cumulative impact results with color-coded overlays (green, yellow, red, blue).
- Editor panel: Edit feature, Add feature.
- Coordinates: Lat/Lon 59.789 28.708.
- Map data sources: Esri, HERE, Garmin, USGS | Esri, HERE.
- Powered by Esri.

Cumulative impact model

Home PW4B - Estonia PW4B - Estonia vers 2021 PW4B - Gulf of Finland Home msp@sea.ee

Input Layers Sustainability compass Cumulative impact model

MAREA Helsinki +

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Current workspace's layers

- Human pressures
 - Extraction of minerals [14]
 - Harbours [8]
 - Pelagic trawling [6]
 - Shipping intensity [4]
 - Windpark areas [2]
 - Dredging and dumping areas [1]

MAREA Helsinki

Overview Human pressures **success** Ecosystem Services **not ready** Model results **not ready**

Available human pressures

- Underwater cables [5]
- Pelagic trawling [6]**
- Benthic trawling [7]
- Harbours [8]**
- Military activities [9]
- Wastewater discharge outlet [10]
- Nutrient load [11]
- Mussel and algal cultivation [12]
- Coastal defence [13]
- Extraction of minerals [14]**
- Marine plant harvesting [15]

Human pressures in workspace

- Dredging and dumping areas [1]
- Windpark areas [2]
- Shipping intensity [4]
- Pelagic trawling [6]
- Harbours [8]
- Extraction of minerals [14]

Human impact calculation

Save list **saved**

Build combinations **success**

Run model **not ready**

Editor

- Edit feature >
- Add feature >

Powered by Esri

Cumulative impact model

Home PW4B - Estonia PW4B - Estonia vers 2021 PW4B - Gulf of Finland Home msp@sea.ee

Input Layers

Sustainability compass

Cumulative impact model

Enter new workspace name... +

Workspace	Timestamp
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Current workspace's layers

Nature assets

- Ecosystem Services Initial
 - Aquatic vegetation material (index 0...1)
 - Furcellaria lumbricalis population biomass (t km2)
 - Ulva intestinalis farm growth rate (% per day)
 - Ulva intestinalis farm biomass yield (kg per rope m in month)
 - Fucus vesiculosus farm growth rate (% per day)

MAREA Helsinki

Overview **Human pressures** **Ecosystem Services** Model results **not ready**

Available nature assets

- Aquatic vegetation material (index 0...1)
- Furcellaria lumbricalis population biomass (t km2)
- Ulva intestinalis farm growth rate (% per day)
- Ulva intestinalis farm biomass yield (kg per rope m in month)
- Fucus vesiculosus farm growth rate (% per day)
- Fucus vesiculosus farm biomass yield (kg per m3 in season)
- Mussel farm yield (tonnes wet weight per harvest)
- Farmed mussel length (cm)
- Trout farm yield (tonnes wet weight per year)
- Farmed trout length (cm)

Nature assets in workspace

- Aquatic vegetation material (index 0...1)
- Furcellaria lumbricalis population biomass (t km2)
- Ulva intestinalis farm growth rate (% per day)
- Ulva intestinalis farm biomass yield (kg per rope m in month)
- Fucus vesiculosus farm growth rate (% per day)

Save the list **saved**

Human impact calculation

Run model **ready**

Map showing the Gulf of Riga and surrounding areas, including Tallinn, Kohtla-Järve, Kingisepp, Kirishi, Veikii Novgorod, Pskov, Tartu, Pärnu, and Ventpils. The map displays the Gulf of Riga and the Baltic Sea coastline.

Cumulative impact model

Home | PW4B - Estonia | PW4B - Estonia vers 2021 | PW4B - Gulf of Finland | Home | msp@sea.ee

Input Layers | Sustainability compass | Cumulative impact model

Enter new workspace name... +

Workspace	Timestamp
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Current workspace's layers

Left side map < | No legend

Right side map < | No legend

MAREA Helsinki

Overview | Human pressures **success** | Ecosystem Services **success** | Model results **success**

Results

Lat/Lon 59.800 26.500

Esri, HERE, Garmin, USGS | Esri, HERE

Powered by Esri

Cumulative impact model

🏠
Home msp@sea.ee

PW4B - Estonia
PW4B - Estonia vers 2021
PW4B - Gulf of Finland

Input Layers

Sustainability compass

Cumulative impact model

Enter new workspace name... +

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Current workspace's layers

Left side map <

No legend

Right side map <

No legend

MAREA Helsinki

Overview
Human pressures success
Ecosystem Services success
Model results success

Results

- Human activities edit test
- Ecosystem Services Impact
 - Fucus vesiculosus farm growth rate (% per day)
 - Ulva intestinalis farm biomass yield (kg per rope m in month)
 - Ulva intestinalis farm growth rate (% per day)
 - Furcellaria lumbricalis population biomass (t km2)
 - Aquatic vegetation material (index 0...1)
 - init value v
 - end value v ...
 - end maximum value v ...
 - end minimum value v ...
 - decrease v ...
 - increase v ...

Lat/Lon 61.588 27.571

Esri, HERE, Garmin, USGS | Esri, HERE

Results

- Human activities edit test
- Ecosystem Services Impact
 - Fucus vesiculosus farm growth rate (% per day)
 - Ulva intestinalis farm biomass yield (kg per rope m in month)
 - Ulva intestinalis farm growth rate (% per day)
 - Furcellaria lumbricalis population biomass (t km2)
 - Aquatic vegetation material (index 0...1)
 - init value v
 - end value v ...
 - end maximum value v ...
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 - decrease v ...
 - increase v ...

Lat/Lon 59.268 22.770

Esri, HERE, Garmin, USGS | Esri, HERE

Cumulative impact model

🏠
🏠 Home 👤 msp@sea.ee

PW4B - Estonia
PW4B - Estonia vers 2021
PW4B - Gulf of Finland

Input Layers

Sustainability compass

Cumulative impact model

Enter new workspace name... +

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Current workspace's layers

Left side map

Ecosystem Services Impact

Aquatic vegetation material (index 0...1)

init value

- > 0.9 - 1
- > 0.81 - 0.9
- > 0.73 - 0.81
- > 0.63 - 0.73

Right side map

Ecosystem Services Impact

Aquatic vegetation material (index 0...1)

end value

- > 0.9 - 1
- > 0.81 - 0.9
- > 0.73 - 0.81

MAREA Helsinki

Overview Human pressures success Ecosystem Services success Model results success

Results

Lat/Lon 61.357 27.198

Results

Lat/Lon 60.702 22.649

Cumulative impact model

Home PW4B - Estonia PW4B - Estonia vers 2021 PW4B - Gulf of Finland Home msp@sea.ee

Input Layers Sustainability compass Cumulative impact model

Enter new workspace name... +

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Current workspace's layers

Left side map

Ecosystem Services Impact

Aquatic vegetation material (index 0...1)

init value

- > 0.9 - 1
- > 0.81 - 0.9
- > 0.73 - 0.81
- > 0.63 - 0.73

Right side map

Ecosystem Services Impact

Aquatic vegetation material (index 0...1)

end value

- > 0.9 - 1
- > 0.81 - 0.9
- > 0.73 - 0.81

MAREA Helsinki

Overview Human pressures success Ecosystem Services success Model results success

Results

Powered by Esri

Cumulative impact model

Home PW4B - Estonia PW4B - Estonia vers 2021 PW4B - Gulf of Finland Home msp@sea.ee

Input Layers Sustainability compass Cumulative impact model

Enter new workspace name... +

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Current workspace's layers

Left side map

Ecosystem Services Impact
Aquatic vegetation material (index 0...1)
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Right side map

Ecosystem Services Impact
Aquatic vegetation material (index 0...1)
end value

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MAREA Helsinki

Overview Human pressures success Ecosystem Services success Model results success

Results Results

Lat/Lon 58.792 21.718
Esri, HERE, Garmin, USGS | Esri, HERE Powered by Esri

Lat/Lon 59.398 20.872
Esri, HERE, Garmin, USGS | Esri, HERE Powered by Esri

Sustainability compass

Go forward one page (Alt+Right Arrow) Right-click or pull down to show history Estonia PW4B - Estonia vers 2021 PW4B - Gulf of Finland Home msp@sea.ee

Input Layers

- Sustainability compass
- Cumulative impact model

Activities performed Clear

- algae valorization/ algal cultivation
- fish farming/mussel farming
- wind

Themes Clear

- Economy
- Financial/Economic measure
- Human well-being
- Natural system
- Physical infrastructure
- Social system

Mean/Goal Clear

- Ecological system integrity: maintaining biological diversity and productivity
- No systematic extraction of substances, exceeding the capacity of the environment to neutralise their harmful effects
- No systematic release of substances, exceeding the capacity of the environment to neutralise their harmful effects
- Work and economy: access to varied and satisfying opportunities for work and business, especially rural areas
- Safety and support to living and working environments
- Education and capabilities' expansion: Independent and free education, open scientific debate, wisdom and knowledge
- Human well-being, freedom, privacy, individual human rights, peace, justice and happiness

Flow graph Table view

Copy table EXCEL Add row Delete row Copy row Search:

Activities performed	Location	Initial interest/problem	Keyword	Solution/Action to be done	Feasibility	Obstacles for achievement	Indicator	Status	Mean/Goal	Theme
wind	Finland	Risks for fauna. Disturbance during construction	Fauna	"Using sounds or "warning signals" to deter e.g. seals from construction sites. Using a "bubble curtain" to reduce sound waves"	High	None	Missing	Objective achieved	1. Ecological system integrity: maintaining biological diversity and productivity	Natural system
algae valorization/ algal cultivation	Saaremaa Island	Companies have a high environmental impact	Greenhouse gas emission	Achieve zero net GHG emission through the deployment of innovative technologies (e.g. solar panels) and co-production of macroalgae	high	no existing system of emission quotas, entrepreneurs are not motivated to reduce emissions	Amount of GHG emitted	Almost achieved	3. No systematic release of substances, exceeding the capacity of the environment to neutralise their harmful effects	Natural system
fish farming/mussel farming	Tagalaht	Companies have a high environmental impact	Greenhouse gas emission	Achieve zero net GHG emission through the deployment of innovative technologies (e.g. solar panels) and co-production of mussels	high	no existing system of emission quotas, entrepreneurs are not motivated to reduce emissions	Amount of GHG emitted	Achieved	3. No systematic release of substances, exceeding the capacity of the environment to neutralise their harmful effects	Natural system
wind	Finland	Recycling of wind turbine blades is challenging due to materials used in their production	Resource use and recycling	Adaptation of new practices and recycling methods	High	In recent years: talks about how to use these in concrete	Recycling rate	Objective not yet achieved	3. No systematic release of substances, exceeding the capacity of the environment to neutralise their harmful effects	Natural system
wind	Finland	Recycling of wind turbine blades is challenging due to materials used in their production	Resource use and recycling	Adaptation of new practices and recycling methods	High	In recent years: talks about how to use these in concrete	Recycling rate	Objective not yet achieved	3. No systematic release of substances, exceeding the capacity of the environment to neutralise their harmful effects	Natural system

Sustainability compass

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PW4B - Estonia | PW4B - Estonia vers 2021 | PW4B - Gulf of Finland

- Input Layers
- Sustainability compass
- Cumulative impact model

Activities performed ✕ Clear

algae valorization/ algal cultivation
fish farming/mussel farming
wind

Themes ✕ Clear

Economy
Financial/Economic measure
Human well-being
Natural system
Physical infrastructure
Social system

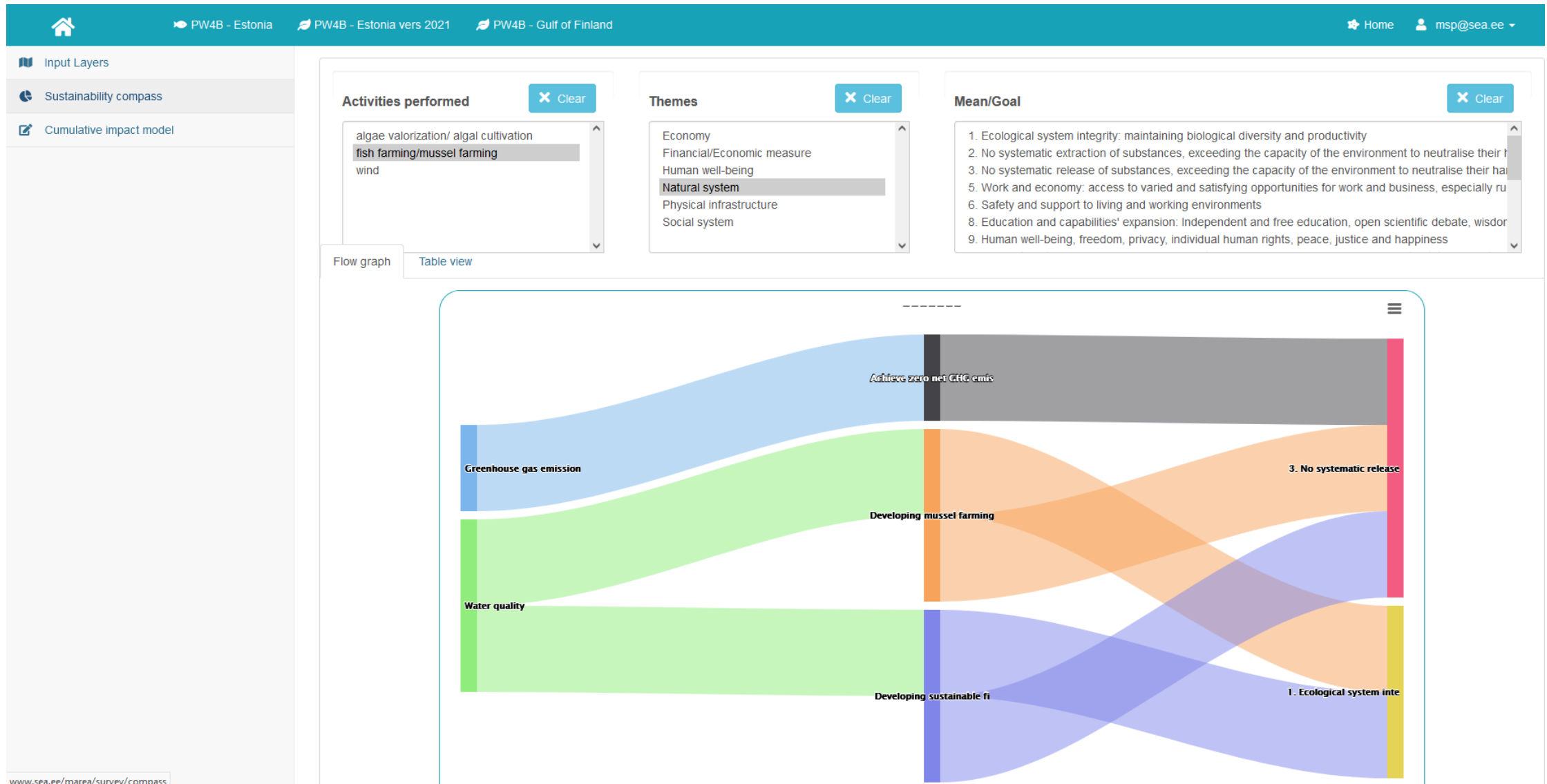
Mean/Goal ✕ Clear

1. Ecological system integrity: maintaining biological diversity and productivity
2. No systematic extraction of substances, exceeding the capacity of the environment to neutralise their f
3. No systematic release of substances, exceeding the capacity of the environment to neutralise their ha
5. Work and economy: access to varied and satisfying opportunities for work and business, especially ru
6. Safety and support to living and working environments
8. Education and capabilities' expansion: Independent and free education, open scientific debate, wisdor
9. Human well-being, freedom, privacy, individual human rights, peace, justice and happiness

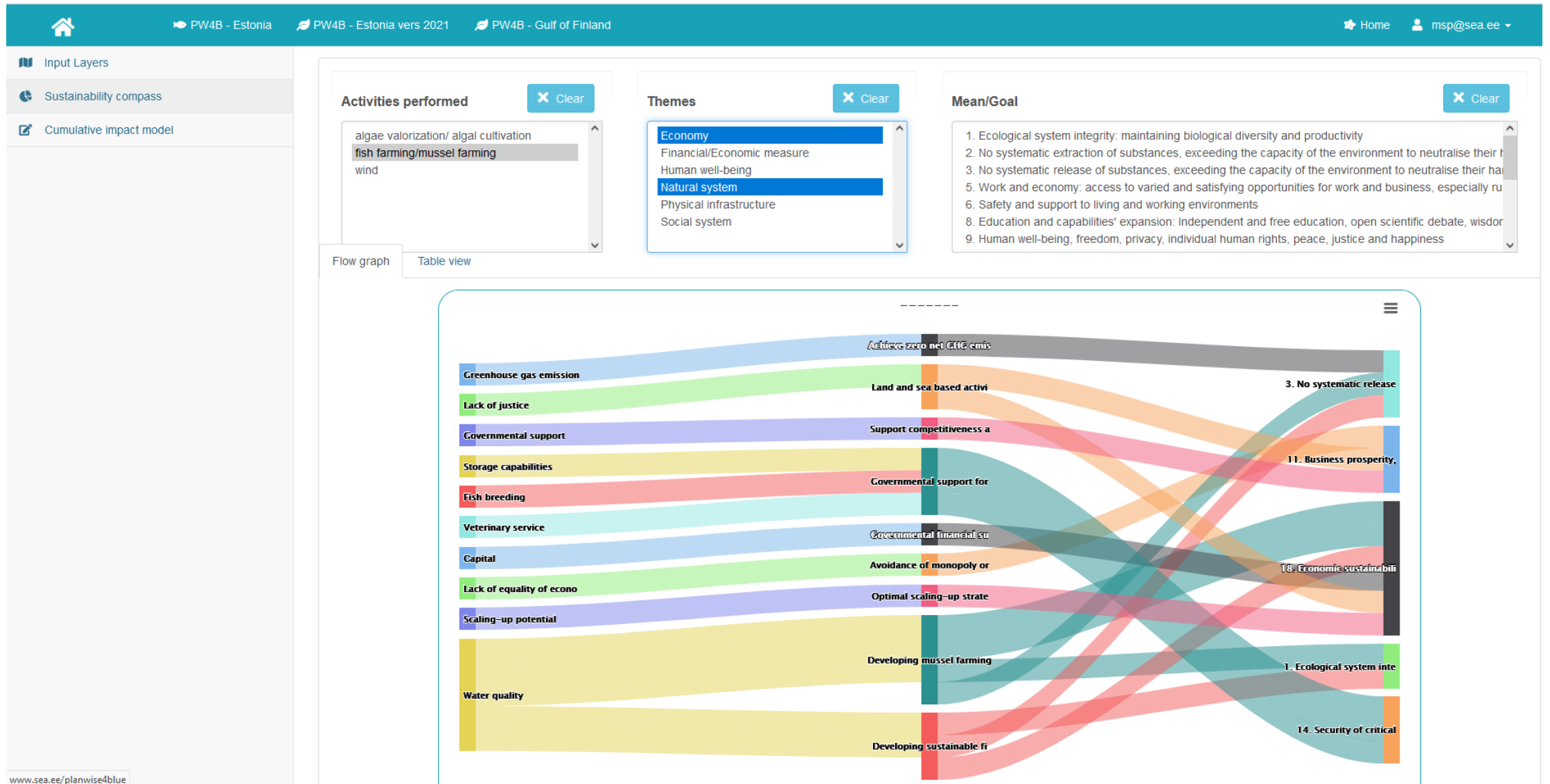
Flow graph
Table view

www.sea.ee/marea/map/ess_map

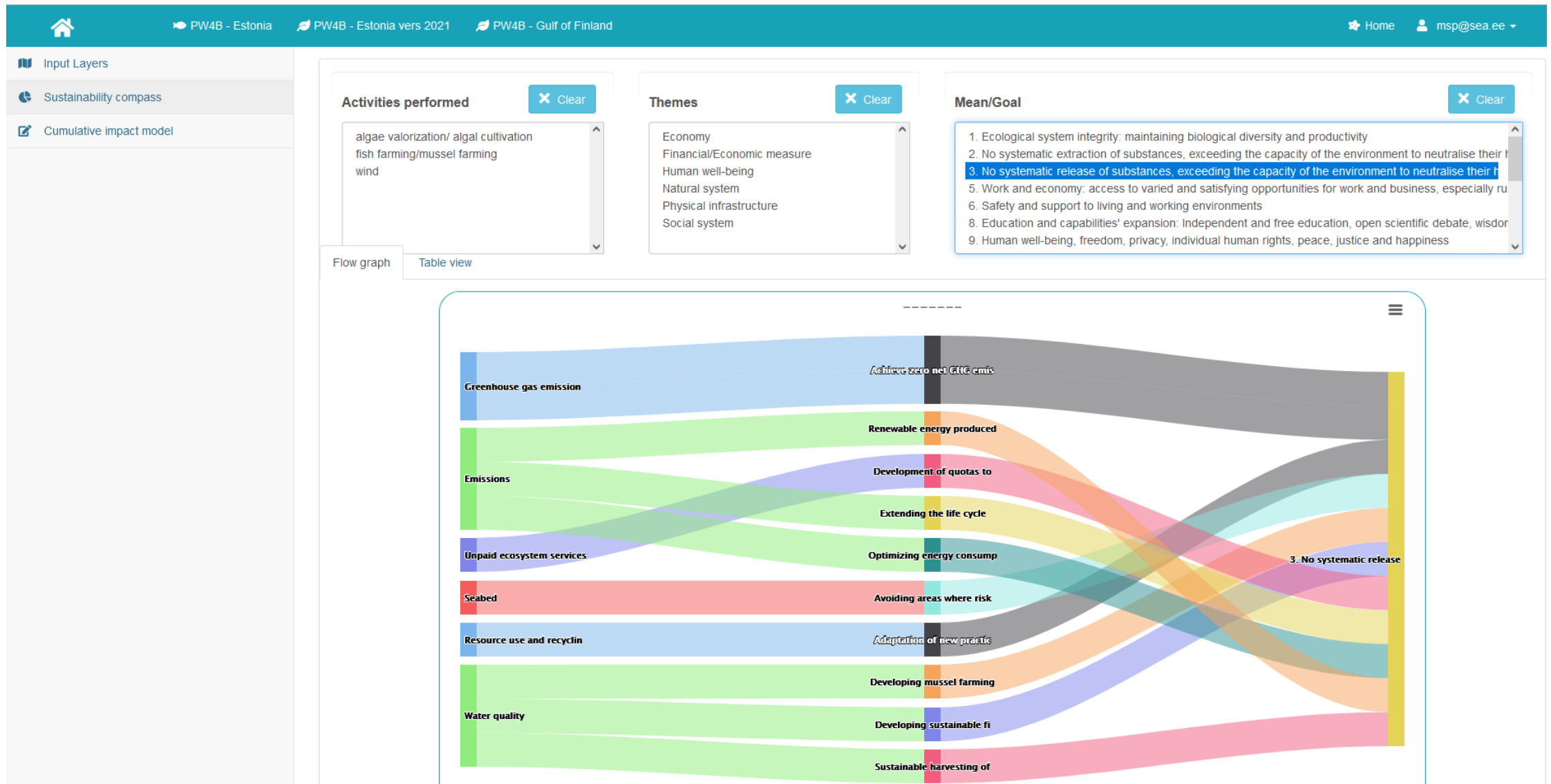
Sustainability compass



Sustainability compass



Sustainability compass



Environmental accounting

New modules based on state-of-the-art economic approaches are being implemented in PW4B for valuing the supply of relevant ecosystem services (e.g., mussel production under farming conditions, carbon sequestration and stock for *Zostera marina*).

For more information: <http://www.sea.ee/planwise4blue/home/material>

The screenshot shows the PlanWise4Blue website interface. On the left is a dark blue sidebar with five navigation buttons, each with an icon and text: a house icon for 'Home', a fish icon for 'PlanWise4Blue - Estonia', a leaf icon for 'PlanWise4Blue - Estonia vers 2021', another leaf icon for 'PlanWise4Blue - Gulf of Finland', and a star icon for 'PlanWise4Blue - Baltic Sea'. The main content area is white and titled 'Supporting material'. It contains four sections: 'Publications' with two bullet points, 'Invasive species information' with three bullet points, and 'MAREA Project deliverables' with six bullet points. Two green arrows point to the right from the text 'Deliverable 2.1.1 Conceptual model of Natural Capital Accounting' and 'Output 2.1.1 Conceptual model of Natural Capital Accounting' in the MAREA section.

Supporting material

Publications

- Article: 'PlanWise4Blue online tool to integrate evidence-based knowledge into cumulative effects assessments: Linking human pressures to multiple nature assets'
- Report: 'PlanWise4Blue Estonia' (in Estonian)

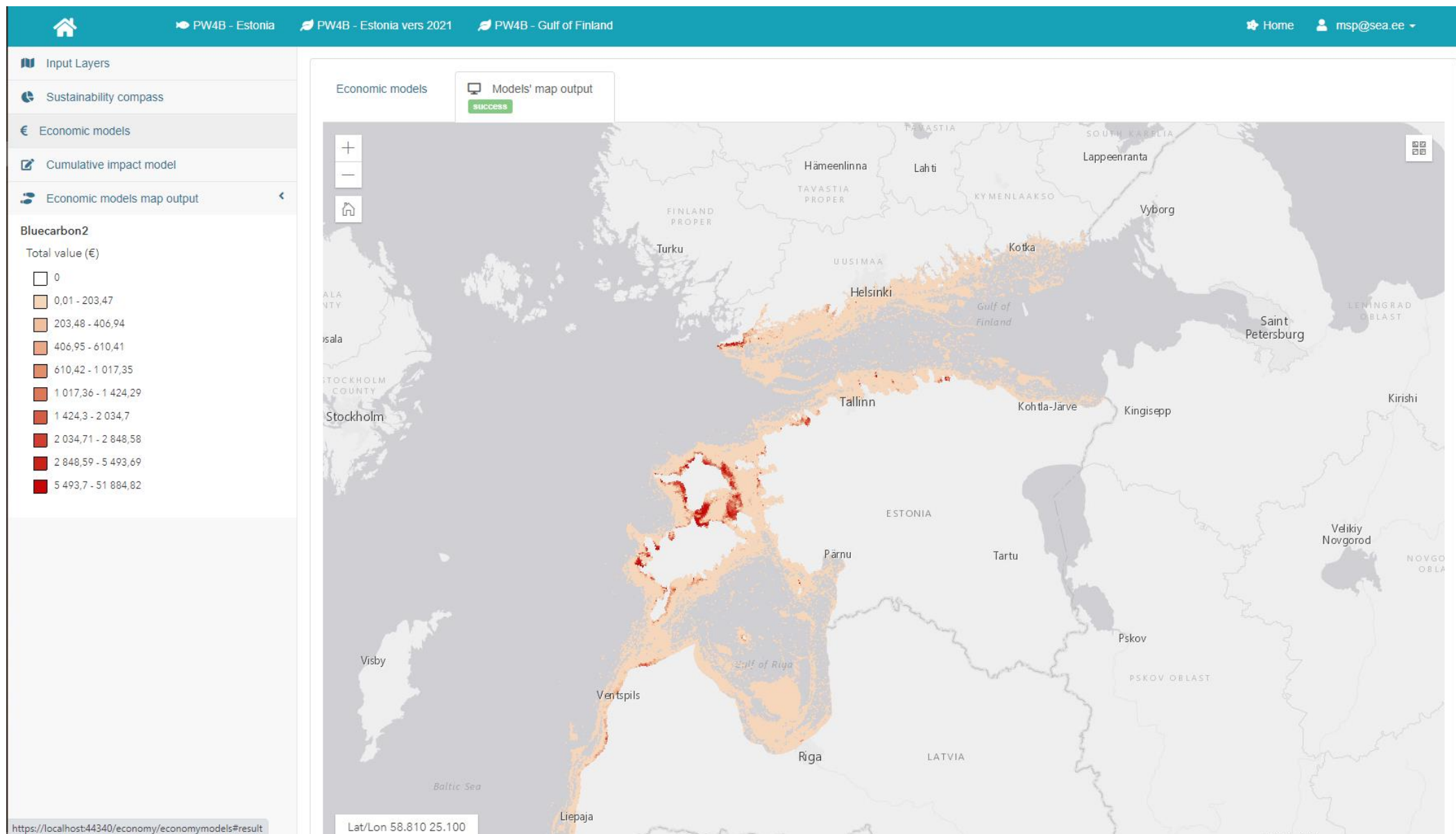
Invasive species information

- Mudcrab factsheet
- Rändkrabi infoleht
- Инфолист: Краб Харриса

MAREA Project deliverables

- Deliverable 1.1.1 Models and maps
- Deliverable 2.1.1 Conceptual model of Natural Capital Accounting
- Deliverable 3.1 Concept and user guide Sustainability Compass
- Deliverable 4.1.1 Geoportal
- Output 2.1.1 Conceptual model of Natural Capital Accounting
- Output T1.1 Models and maps

Environmental accounting



Environmental accounting

Home PW4B - Estonia PW4B - Estonia vers 2021 PW4B - Gulf of Finland Home msp@sea.ee

Input Layers Sustainability compass Economic models Cumulative impact model

Economic models Models' map output success

Blue carbon valuation

Mathematical expressions for the valuation of blue carbon (VE) based on the valuation of carbon sequestration (VE_CSR) and carbon stocks (VE_CST) for a given ecosystem of interest in a given year.

Price for carbon sequestration (euros per tC)
90.9426

Price for carbon stock (euros per tC)
422.7047791

Rate of return
0.025

Run model SUCCESS

Blue mussel farming valuation

Mathematical expressions and example calculations for resource rent (RR) and ecosystem asset (VA) for blue mussel biomass production under farm conditions.

Price (euros per tonne wet weight)
350

Inflation rate
1.02

Farm operational costs (Euros per year)
10000

Farm investment costs (Euros)
50000

Farm other investment costs (Euros)
15000

Expected lifetime of farm investment costs (years)
20

Expected lifetime of farm other investment costs (years)
10

Interest rate
0.05

Run model READY



EUROPEAN UNION
European Regional Development Fund



Interreg
Central Baltic



MAREA

Thank you for your attention

Acknowledgements: This study is supported by European Regional Development Fund, INTERREG Central Baltic project MAREA “From MARine Ecosystem Accounting to integrated governance for sustainable planning of marine and coastal areas” and the Estonian Environmental Investment Centre

