BASMATI

Baltic Sea Maritime Spatial Planning for Sustainable Ecosystem Services

Baltic Explorer web-map and multi-touch application

Deliverable 5.5

BONUS BASMATI

Baltic Explorer web-map and multi-touch application

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Contents

BONUS BASMATI in Brief

BONUS call 2015:
Blue Baltic
Project coordinator:
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Project partners:
Aalborg University, Denmark (AAU)
Aarhus University, Denmark (AU)
Finnish Geospatial Research Institute, Finland (FGI)
Latvian Institute of Aquatic Ecology, Latvia (LIAE)
Leibniz Institute for Baltic Sea Research Warnemünde, Germany (IOW)
Nordregio, Sweden (Nordregio)
University of Turku, Finland (UTU)
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Theme 4.3 Maritime spatial planning from local to Baltic Sea region scale
Subthemes:
Theme 2.3 Integrated approaches to coastal management and Theme 4.1 Governance structures, policy performance and policy instruments
https://www.bonusportal.org/projects/blue_baltic_2017-2020

Project abstract:
Maritime Spatial Planning (MSP) requires a spatially explicit framework for decision-making, and on that background the overall objective of BONUS BASMATI is to develop integrated and innovative solutions for MSP from the local to the Baltic Sea Region scale. This is to be realised through multi-level governance structures and interactive information technology aiming at developing an ecologically and socio-economically sound network of protected marine areas covering the Baltic Sea. Based on the results of former MSP projects, the BONUS BASMATI project sets out to analyse governance systems and their information needs regarding MSP in the Baltic Sea region in order to develop an operational, transnational model for MSP, while maintaining compliance with existing governance systems. It also develops methods and tools for assessments of different plan-proposals, while including spatially explicit pressures and effects on maritime ecosystem services in order to create the Baltic Explorer, which is a spatial decision support system (SDSS) for the Baltic Sea region to facilitate broad access to information. During the project running until 2020, new data will be produced and tested in assessments corresponding to policy goals. The data will support the combined analysis of the three elements of the concept of ecosystem services: the capacity, flow and benefit of provisioning, regulating and cultural services. A central aim of the project is to facilitate cross-border collaboration, and the project is carried out in close cooperation with relevant stakeholders in the BSR. The impact of the project will be facilitated and assessed in transnational case studies, where integrated solutions are required. The local scale will consist of case study areas in the South-West Baltic, the Latvian territorial and EEZ waters including open part of the Baltic Sea and the Gulf of Riga, and across the region, a pan-Baltic case study will be performed.

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Report Summary

This deliverable presents Baltic Explorer, a collaborative GIS and spatial decision support system (SDSS) for the maritime spatial planning (MSP), that was designed, built, and studied in the BONUS BASMATI Work Package 5. Section 1 summarises the general concept, key functionalities, use tests and free release of the Baltic Explorer, and Section 2 describes and guides the usage of the system. Previous deliverables and published or forthcoming scientific articles provide more information about the creation and assessment of the Baltic Explorer.

Baltic Explorer is available at http://balticexplorer.eu and its source code at https://github.com/FGI-GEOINFO/Baltic-Explorer.

Key functionalities of the Baltic Explorer:

- User-friendly map interface
- Multi-device usability
- Multi-user access model
- Workspaces for group work
- Up-to-date spatial maritime data from a large number of providers
- Create, edit and add vector features

Use tests of the Baltic Explorer:

1. MSP workshop, Umeå, Sweden
2. PhD course, Turku, Finland
3. MSP workshop, Riga. Latvia
4. MSP course, University of Turku, Finland
5. MSP course, University of Gothenburg, Sweden
6. MSP workshop, Aalborg University Copenhagen, Denmark

1   Baltic Explorer in general

Baltic Explorer is available at http://balticexplorer.eu and its source code at https://github.com/FGI-GEOINFO/Baltic-Explorer.

1.1   Introduction

Baltic Explorer is a collaborative web map application and spatial decision support system (SDSS) designed particularly for the maritime spatial planning (MSP) for the Baltic Sea (Figure 1). The Baltic Explorer combines easy-to-use spatial tools with easy-to-access data from spatial data infrastructures of several maritime actors. Users collaborate on multiple devices in the same map-based workspace, where each user can see changes made by the others. Results from the collaboration are stored in a database for future use. The system is designed to enable all participants to engage in work with the system, regardless of their skills and expertise.
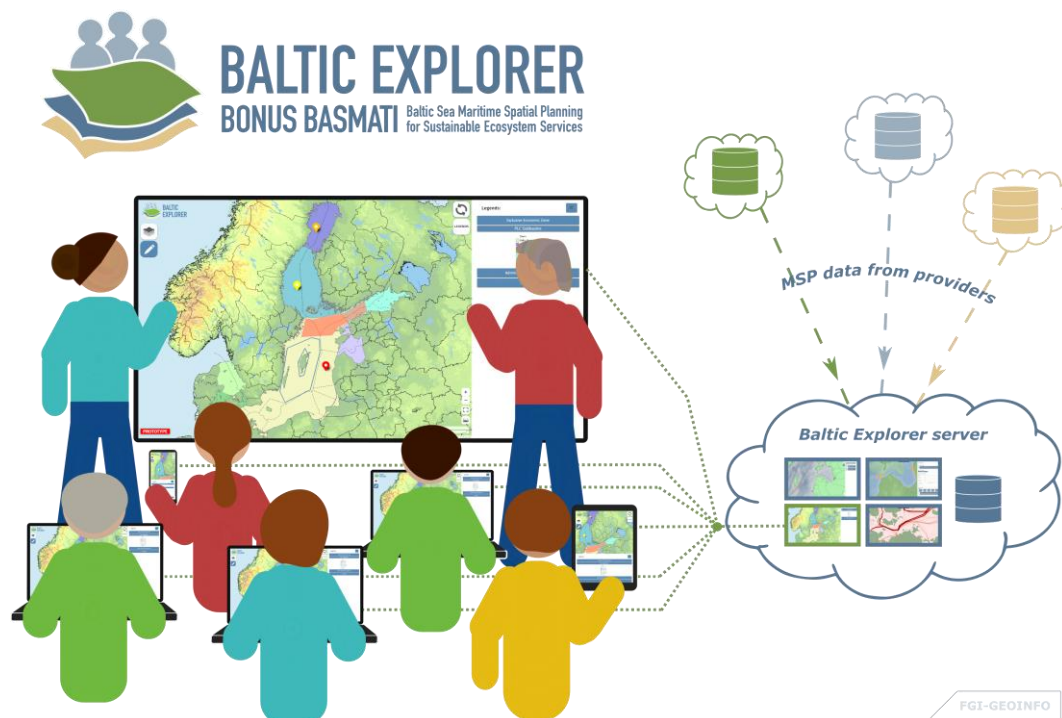

Figure 1
Baltic Explorer enables collaboration on complicated spatial tasks of maritime spatial planning through common workspaces accessed simultaneously through multiple devices.

1.2   Key functionalities

- **A user-friendly map interface** with intuitive navigation tools makes viewing and browsing of spatial information easy for all users (for user requirements, see Koski et al., 2017).
- **Cross-platform use** on computers, smartphones, tablets and touch-displays supports active participation, and makes it easy for the participant to provide input in a variety of planning situations (see Koski et al., 2020).
- **The multi-user access model** allows the opportunity to assign different roles to participants. The moderator can, for example, add or remove editing rights, which can make the tool flexible for multiple situations. Clear roles support successful participation in

the planning task at hand (see Rönneberg et al. 2019).

- **Workspaces** enable multi-user collaboration in workshops and online meetings. Users can work simultaneously on individual views and see the larger view in a shared workspace, making it easy to create and share perspectives (see Koski et al., 2019).
- **Wide access to up-to-date spatial data** from the Baltic Sea Region through existing spatial data infrastructures provide the backbone for visualising the current maritime actions, identifying conflicting values and proposals for MSP (for data requirements, see Schiele et al., 2018).
- **A possibility to create, edit and add vector features.** Users can utilise drawing tools or add own vector layers to the workspace to present their perspective on the topic. They can also overlay data to view possible overlaps between current and future activities or add comments to share their views (see Koski et al., 2019).

1.3   Use tests

Baltic Explorer was designed for studying the use of spatial collaboration tools in stakeholder workshops. By using the Baltic Explorer in planning workshops and university courses, knowledge has been gained on how collaboration, more specifically interaction and decision-making processes, can be facilitated with a spatial decision support system, when working with complex spatial problems in MSP. Particularly, the stakeholder feedback provides essential information for further advances on the usability of spatial decision support systems within MSP.

Five use tests were conducted on the Baltic Explorer during the BONUS BASMATI project (Table 1). Overall, the tests revealed positive attitude and expectations towards digital collaborative SDSS, such as Baltic Explorer. Understanding about usefulness of the system and its functionalities was achieved, which will be reported in scientific journal publications in near future. However, it was found that participation in real test situations on a prototype system may not be widely accepted due to the extra time consumption required in addition to the usual planning work.

Table 1

Use tests on the Baltic Explorer during the BONUS BASMATI project.

Place	MSP event	Organiser	Date	Participants	Project focus
Umeå, Sweden	MSP workshop "Better maritime planning – towards a shared future, together"	FIAXSE	26.3.2019	MSP planners and stakeholders	Usefulness of BE in MSP
Turku, Finland	PhD course "Maritime Spatial Planning processes in Baltic Sea countries"	University of Turku	6.-8.4.2019	Doctoral students	Usefulness of BE in MSP
Riga, Latvia	MSP workshop	Latvian Institute of Aquatic Ecology and the Latvian Ministry of Environmental Protection and Regional Development	20.2.2020	Ministry, regional authority and NGO personnel	Analysis functionality of the Latvian Case Study; Usefulness of BE in MSP
Online 1	University course "Maritime and Coastal Spatial Planning"	University of Turku	April 2020	Master's students	Online use; usefulness of BE in MSP

Online 2	University course "Integrative governance of marine and coastal space: conditions, principles and toolbox"	University of Gothenburg	April-June 2020	Master's students	Online use; usefulness of BE in MSP
Online 3	MSP workshop "Coastal and marine cultural heritage in the Baltic Sea – tourism, recreation and sustainability challenges"	Aalborg University Copenhagen	17.8.2020	Local NGO representatives and citizens with an interest in MSP	Online use; usefulness of BE in MSP

1.4   Source code and future views

Baltic Explorer has been released as free and open source software (FOSS) under the AGPL license at the end of the BONUS BASMATI project at https://github.com/FGI-GEOINFO/Baltic-Explorer. The source code enables any organisation or individual to host their own instances of Baltic Explorer. The system can also be hosted for other geographical areas than the Baltic Sea by changing the configurations for the coordinate reference system and adding a background map suitable for the desired marine region. Additional data from spatial data infrastructures from the new region will then be effortless to add to the system through its administration interface.

Open source code will enable other developers to use the code of the system as a base for future development of similar systems. Together with the knowledge provided from the conducted user tests, development efforts can rapidly improve the current system, and modify it according to future needs of collaborative SDSS in MSP.

2   Description for usage

This description is also available in the User Guide of the Baltic Explorer, accessible in the Main panel (see Figure 5) at http://balticexplorer.eu.

2.1   Technical requirements and limitations

The Baltic Explorer runs on web browsers that support JavaScript and functions best with the Chrome and Firefox browsers that implement standard web practices.

The user interface supports a variety of screen sizes, including currently common mobile phone, tablet, laptop, desktop and large touch screens. However, when using a touchscreen some features requiring hover (cursor over) are inaccessible.

2.2   Central concepts

2.2.1   Workspaces

The Baltic Explorer features multi-user workspaces where users can collaborate in groups. When users draw or add new data to a workspace and once these changes have been saved and stored to the Baltic Explorer server, other users in the workspace can see the changes that have been made. Users who are already inside the workspace will see the changes when they use the *"Sync"* button (see below Section 2.2.5 "Synchronization").

2.2.2   Overlays

Baltic Explorer features overlay data layers from various sources that can be visualised on the map. These layers are not stored within the system. Instead, Baltic Explorer provides quick access links to Web Map Service (WMS) layers that access the overlay data from the providers' servers. Displayed overlays are specific for workspaces, which means that all users share the state of overlays on the map.

2.2.3   Features

Features are vector objects (markers, lines and polygons) that can be drawn on the map. Baltic Explorer enables features to be drawn, edited, imported and exported. Features may represent different real-world objects according to the user's needs. Features are stored in Feature layers.

2.2.4   Feature layers

Feature layers store features and help users to categorise and organise them. The default display style of features drawn to each feature layer can be customised to help distinguish between different themes of data on the map. Each user has their own feature layers. However, the workspace owner can edit other users' feature layers and move features between layers.

2.2.5   Synchronization

Users can synchronize (sync) their workspace view, which will refresh the workspace. All newly added and edited features by other users will be added to the view. Changes to overlays by other users will also be updated. Note that displayed overlays are workspace-specific and shared by all users.

2.3   Users and user roles

Baltic Explorer can be used anonymously or logged-in (for signing up to a user account, see Section 2.4.1 "Home page"). Logged-in and anonymous users can access and edit workspaces for which the workspace owner grants these rights to them. Only signed-up users can become workspace owners and have their own feature layers.

2.3.1   Workspace owner

When a user is logged in and creates a new workspace the user becomes a workspace owner. Workspace owners have full access to all parts of their workspaces. They can also edit features and feature layers that other users create in their workspace. This allows the owner to, for example,

move features from any layer to another, delete any feature or layer, and rename features. The workspace owner decides who can see, access and edit their workspace.

2.3.2   Editor

When editing rights within a workspace are set to "Only editors can edit", only users who have been given the editor status in the workspace have the right to draw features and make changes to the workspace, such as change overlays. The workspace owner can assign new editors to a workspace from the workspace settings.

2.3.3   Anonymous user

Anonymous users can enter public workspaces and edit workspaces that are set to "Anyone can edit". In any workspace, an anonymous user can edit only one feature layer called "Anonymous user" that is same for all anonymous users. Multiple simultaneous changes on the layer by different anonymous users cannot be saved. Instead of using anonymous access to workspaces, it is encouraged that users sign up for a user account in the Baltic Explorer.

2.4   Guidance for using Baltic Explorer

2.4.1   Home page

From the home page users can access existing workspaces, create new workspaces, log in and out of their user accounts, and sign up for a user account (Figure 2).
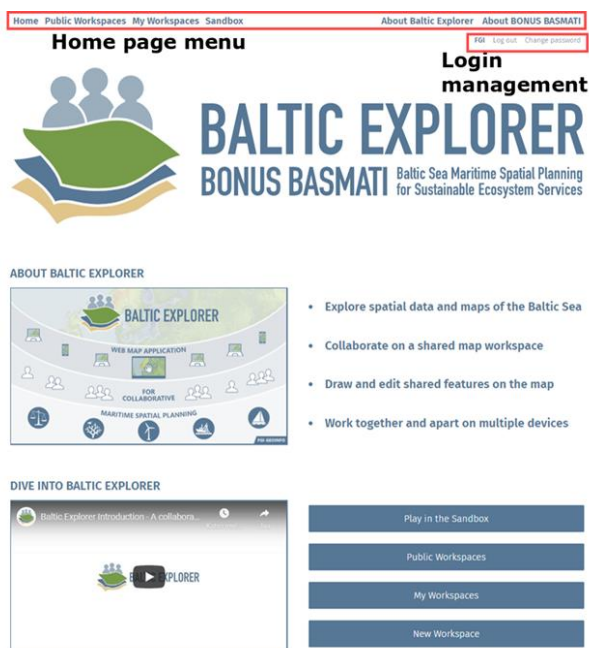

Figure 2
Home page of the Baltic Explorer, from which "Public Workspaces", "My workspaces", the "Sandbox" and a new workspace are accessed. Signing up and logging in are also available from the home page (top).

User login

Log in to an account from the *"Log in"* button in the login management. The login management can be found in the top right corner of the home page. For more information about creating a new

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account, see next paragraph.

Creating user account

New users are encouraged to create an account before accessing workspaces. A user account will enable the user to create their own workspaces and act as an identifiable editor in other users' workspaces. To create an account, press the *"Sign up"* button in the login management at the top right corner of the home page. Enter a username and a password and confirm the password.

NB! In the prototype, it is not possible to retrieve a lost or forgotten username or password. Take good care of your account credentials.

Accessing workspaces

Existing workspaces are accessed by pressing *"Public workspaces"* or *"My workspaces"* buttons (Figure 3). This will list every workspace in their respective category. Public workspaces can be viewed by anyone. My workspaces are workspaces for which the user is an owner or a granted editor. The home page also contains a quick link to the *"Sandbox"* workspace of the Baltic Explorer that can be used to try out the system. In the Sandbox, anyone can add and edit features, including anonymous users.
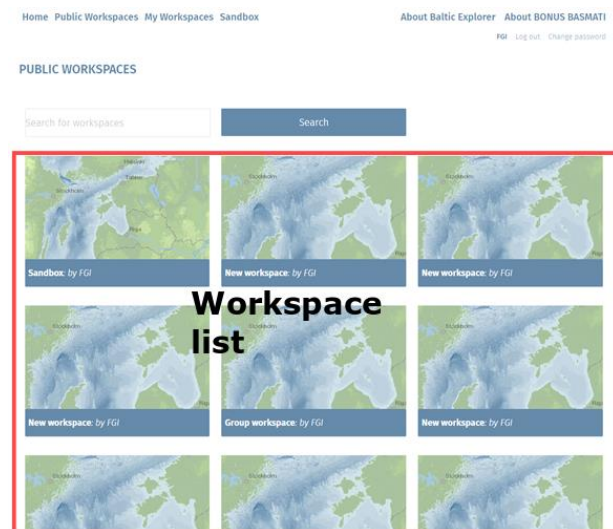

Figure 3
Workspace selection pages list map previews of workspaces (here "Public workspaces").

Creating a new workspace

Only logged-in users can create new workspaces. Create a new workspaces from the *"New workspace"* button on the home page. Creating a new workspace will direct the user straight to the map interface of the new workspace. The workspace management panel (see section 4.6 "Workspace management") will be opened when a workspace is first created, and the workspace is immediately ready to be used.

2.4.2   Map interface

Baltic Explorer workspaces have map-based user interfaces (UI; Figure 4). Users can pan and zoom the map using mouse or by tapping and dragging on touchscreen. Zoom buttons are available on the map (bottom right).

The Baltic Explorer map-based UI consists of buttons and panels. Buttons related to editing are on the left and buttons related to synchronization are on the right. Panels show information about the workspace. Panels are opened on the right side of the map or, with small screens, below the map.

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Dark-colored backgrounds in panels indicate that the workspace can be edited. A *"Save"* button is prompted when changes have been made (top right). Light-colored backgrounds in panels indicate that the workspace is not being edited.

The left side menu has the *"Main panel"* button, the *"Data menu"* button and the *"Edit features"* button. The *"Main panel"* button opens the main panel. When pressing the *"Edit features"* button, Baltic Explorer will enter the editing mode, and buttons will appear for *"Draw features"* and *"Manager feature layers"* (see below "Drawing and Editing features").

The top-right menu has the *"Sync"* button, and when there is something to save, the "Save" button, as well as a *"Legend"* panel button when overlays are added to the map. Synchronizing is required to see changes saved by other users. The *"Legend"* panel button will open a panel that displays the legends of all overlays that have been added to the map.

When users perform certain actions in the Baltic Explorer the system may provide some information in an info bar in the middle of the top edge of the UI. The info bar will disappear on its own after a few seconds. It can also be closed by pressing the cross on the right side of the bar. The lower-right corner of the map features the *"Zoom"* control buttons, the *"Measure tool"*, a scale bar and credits for content that is displayed in the map view.
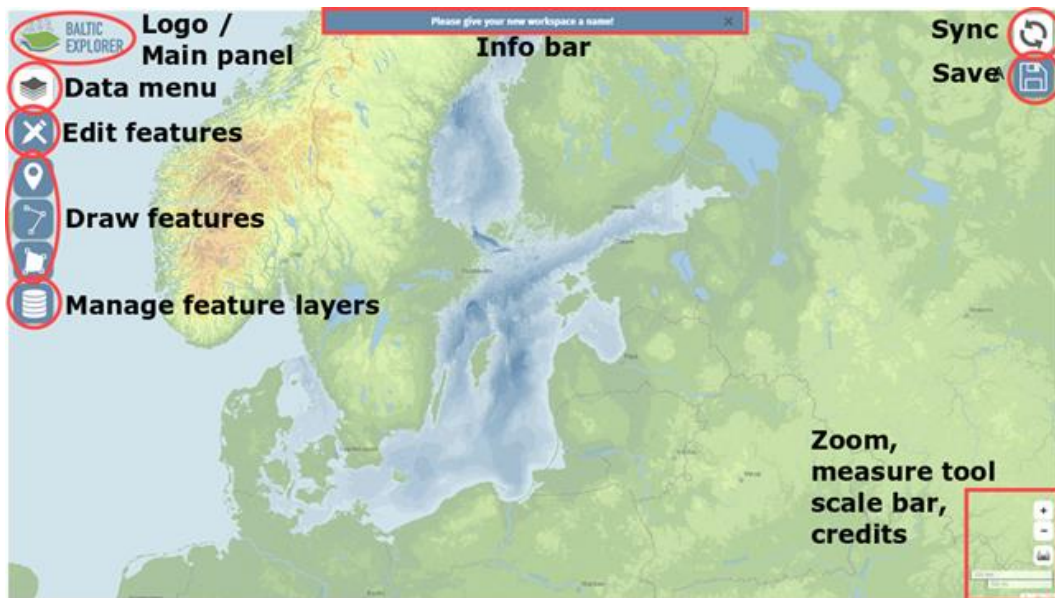

Figure 4
The Baltic Explorer map-based user interface in workspaces.

Main panel

When opening the main panel by pressing the *"Main panel"* button (top left), the user will first see the info panel (Figure 5). The info panel provides basic information about Baltic Explorer, and enables users to access the user guide, home page, summary of the workspace and, for the owner, workspace management.
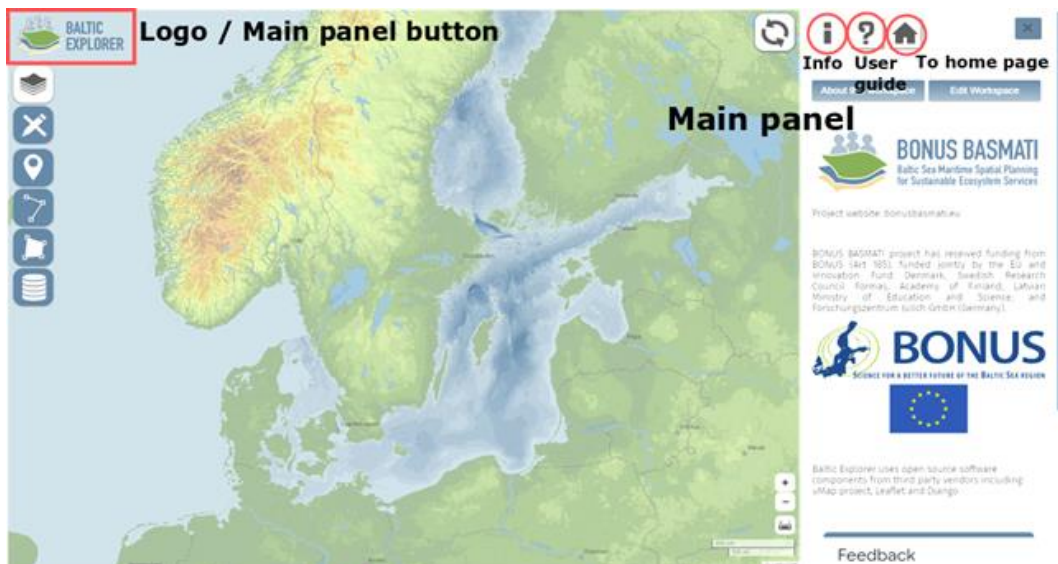
Figure 5

The "Main panel" offers general information of the Baltic Explorer and workspace management for the owner of the workspace.

Workspace management

Workspace management can be accessed by pressing the *"Main panel"* button and then from the main panel the *"Edit workspace"* button. Workspace management is available only to workspace owners (Figure 6). From the "Workspace settings" panel, the workspace owner can edit the name and description of the workspace, edit the default map view by limiting the map bounds, control UI elements, restrict access and editing of the workspace, and add editor users to the workspace.

Through *"Advanced actions"* button the owner can delete or clone the workspace. Cloning the workspace will create an exact replica of the current workspace and open it. The owner can also delete, download and import vector data. Downloading the data can be done in the following standard formats: GeoJSON, GPX, KML, and in the Baltic Explorer full map format, which clones the workspace to a file. The full map file can be uploaded to replace the edited workspace. Importing data can be done in the following standard formats: GeoJSON, CSV, GPX, KML, OSM, GeoRSS and in the Baltic Explorer full map format.

Figure 6

Owner of the workspace can edit workspace settings, such as workspace name and visibility of the workspace to others.

The owner can edit all the workspace settings: visibility, editing and editors (Figure 7). Visibility: public, hidden (default) or private, controls who can see the workspace. Editing: everyone, editors (default) or owner, controls which user groups can edit the workspace. Editors list: owner (default), controls which users are editors of the workspace. To add an editor the owner can start to type the name of the editor and select the editor from the appearing list below. The workspace must be saved to apply the changes. The workspace will appear for the selected users in the "My Workspaces" page list.

Figure 7
Setting a workspace public but only editable by editors allows everyone to see the workspace but only selected users to edit its contents.

Browsing and controlling data in the data panel

The "Data" panel, accessed by pressing the *"Data panel"* button (top left) lists features that have been drawn or imported to the map as well as the overlays that have been added (Figure 8). In addition, users can access the "Background maps" panel where they can change background map of the workspace.

Features are organised to feature layers to which they belong. The feature layers can be hidden and zoomed to from the "Data" panel. Users can also edit or delete feature layers that are assigned to the user. Workspace owners can edit and delete any feature or layer. In addition, users can press the features to zoom to them, or if created by them access the feature edit panel from the pencil symbol.

In the data panel, users can also turn on and off overlays that are on the map. Users can change the opacity and view the legend of overlays by pressing on the overlay buttons in the panel. The order of the overlays can be changed by dragging the overlay above or below another overlay. From the "Data" panel users can also access the "Overlay management" panel.
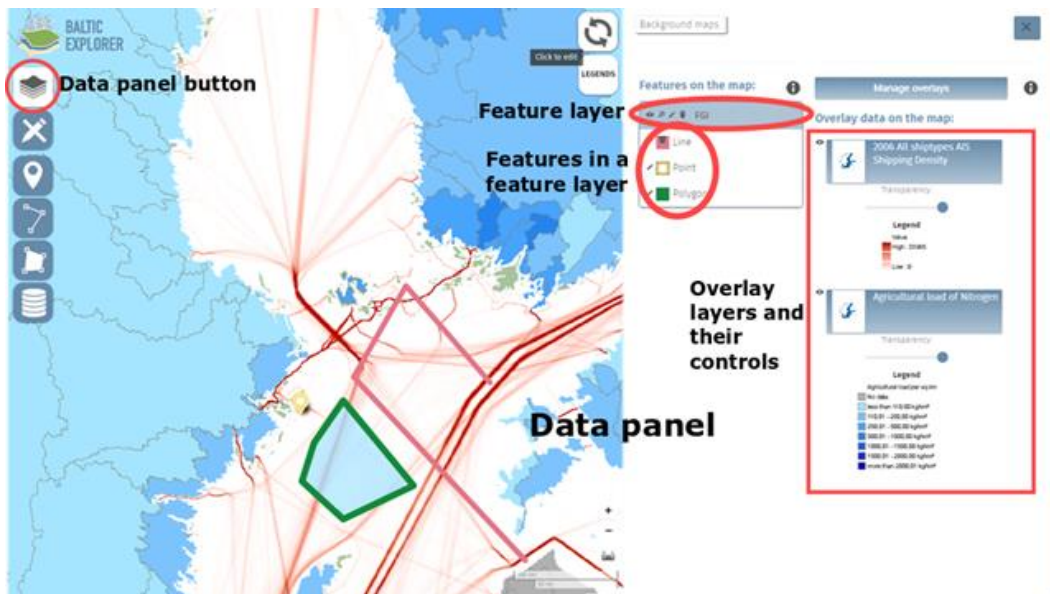
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Figure 8

Background maps, features on the map and overlay management are accessed from the "Data" panel.

Managing overlays

The "Overlay management" panel lists all the overlays that are available in the Baltic Explorer (Figure 9). Overlay management panel is opened by pressing the "Data panel" button (top left) and then pressing the "Manage overlays" button from the data panel. The data in the overlay panel is categorised according to data providers. Each provider has defined their own categorisation, and the data is further organised according to these categories. To help users find datasets among more than thousand overlays, there is a search function that will search data from all overlay data in the Baltic Explorer.

Overlays are selected to be visualised on the map by pressing on an overlay. This will move the overlay to the top of the overlay panel and also show it on the data panel. Pressing the overlay that is on the top of the overlay panel will remove the overlay from the map view, the "Data" panel and the "Overlay" panel. The removed overlay will return to its category in the "Overlay" panel.
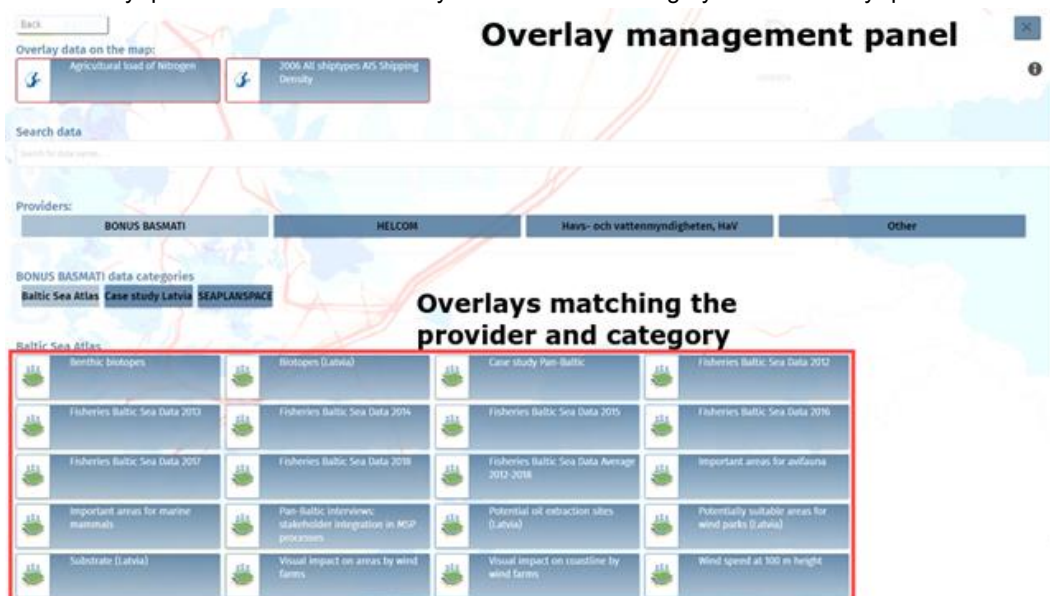

Figure 9

Overlay management panel categorises more than a thousand overlays ready to be selected for displaying on the map.

Drawing and editing features

Users who are granted editor rights in a workspace can draw markers, lines and polygons on the map. Pressing the *"Enable or disable editing"* button (pencil) will open the drawing menu and from there the desired feature type can be selected. The pointer will change into a crosshair symbol when drawing features on the map. Place the marker or starting node of a line or polygon by pressing the desired location on the map. Lines and polygons may have any number of nodes (white boxes along the line). A new node is drawn by pressing on the map again. To finish drawing a polyline or a polygon, press a second time on the last node.

When drawing a feature is finished, the feature editing panel opens automatically. From here, users can select a layer for the feature, give the feature a name and description, enter comments about the feature and change its style (Figure 10).
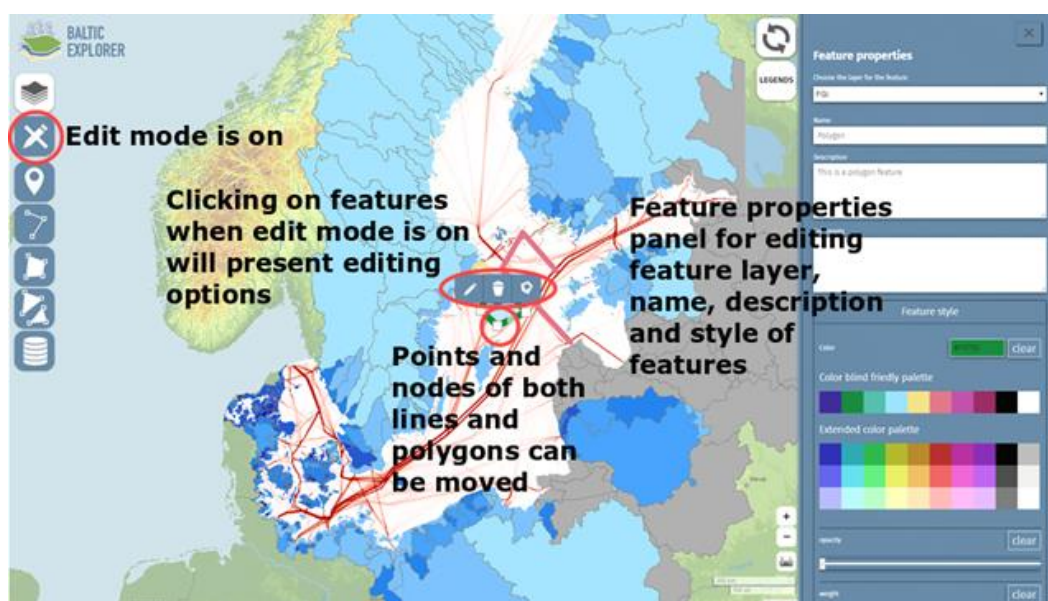

Figure 10
Drawn and edited features can be shared to others by saving the workspace. Pressing the "Sync" button will include what others have created and edited.

The following markup can be used for formatting text:

```
*simple star for italic*
**double star for bold**
# one hash for main heading
## two hashes for second heading
### three hashes for third heading
Simple link: [[http://example.com]]
Link with text: [[http://example.com|text of the link]]
Image: {{http://image.url.com}}
Image with custom width (in px): {{http://image.url.com|width}}
--- for an horizontal rule
```

Advanced feature editing includes moving a feature on the map and changing the shape of a feature. This functionality is easiest to perform with mouse input but can be also made with touch input although accuracy and speed will likely suffer.

To move or reshape feature, enter edit mode by pressing *"Enable or disable editing"* button (pencil). To move a marker on the map press on the marker and drag it to a new position. To move a line on

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the map press on the line, press the *"Toggle edit mode"* button, press long on the line and drag the line to a new position. To move a polygon press on the polygon, press the *"Toggle edit mode"* button, press long on the polygon and drag the polygon to a new position. To move an individual node on either a line or a polygon, press on a node (white box) and drag it to a new position.

To add a new node inside a line or a polygon, press on a potential node (transparent white box). To continue a line, press the first or last node on a line, press the *"Continue line"* button and press on the map to add a new node. To delete a node on a line or a polygon, press the feature, press a node, press the *"Delete this vertex"* button. To add a new line to a line, press the *"Add a line to current multi"* button. To split a line, press on the line, press the *"Toggle edit mode"*, press a node (white box) and press the *"Split line"* button. To add a new polygon into a polygon feature, press the polygon, press the *"Add a new polygon to this multi"* button and draw the polygon on the map. To add a hole to a polygon, press the polygon, press the *"Toggle edit mode"* button, press the *"Start a hole here"* button, add nodes, press on the last node to create the hole.

Managing feature layers

The "Feature layer management" panel enables users to hide, add, edit and remove feature layers (Figure 11). Order of the layers can be changed by dragging the feature layer above or below another feature layer.
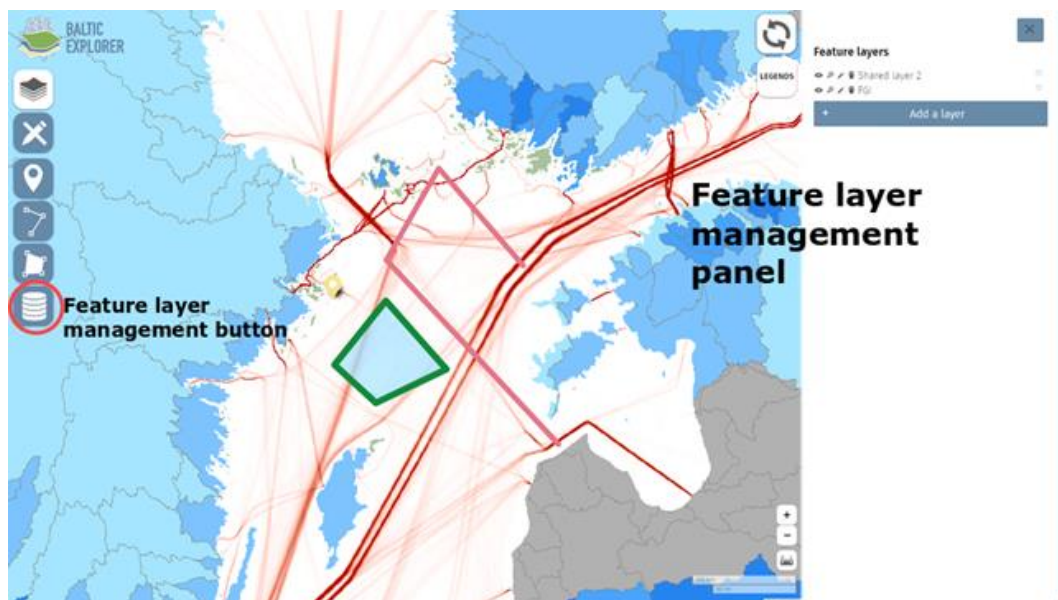

Figure 11
The "Feature layer management" panel enables users to hide, add, edit and remove feature layers.

New feature layers are named after the user who creates them. "Description" enables users to describe their layers differently and enables distinction between feature layers with the same name. "Description" is displayed with the name of the layer when drawing new features, as well as in the "Data" and "Feature layer management" panels. Feature layers can be given default styles that will apply to all new features drawn to that layer (Figure 12).
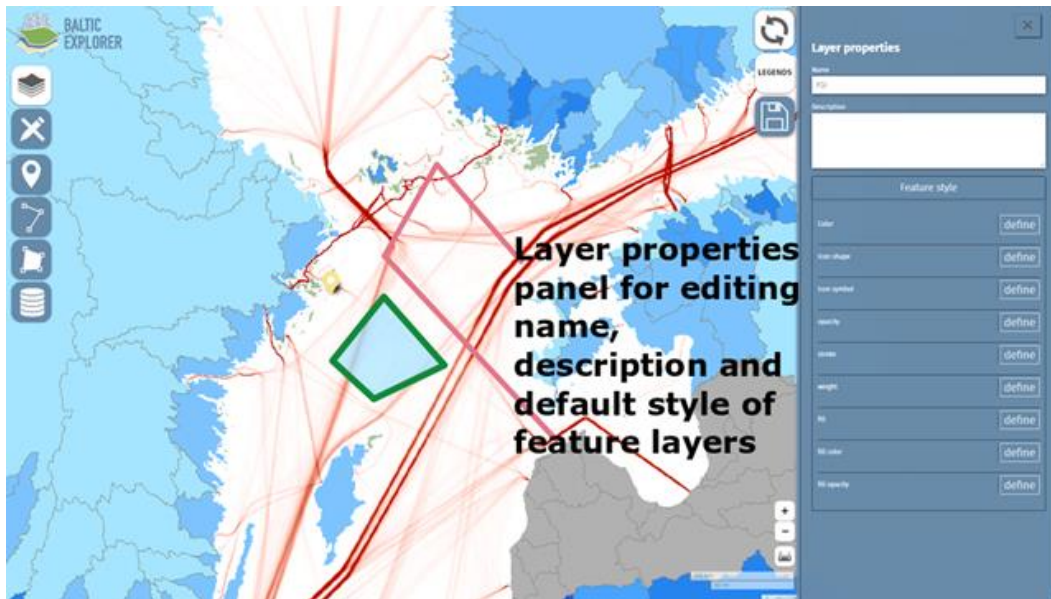
Figure 12
The panel for editing feature layer properties allows users to customize their layer.

The workspace owner can give a feature layer any name and therefore create or rename layers to make them editable by other users (Figure 12). To give rights to a layer for another user, the owner can rename the layer with the user's username by pressing the pencil button next to the feature layer and then giving the layer a new name.

Saving and synchronising a workspace

A workspace is a shared environment that can host multiple users who add and edit features simultaneously. Pressing the *"Sync"* button will refresh the user's workspace and show all the features created and edited since the last synchronisation by any user. Pressing the *"Save"* button will save and share any features created or edited by the user to the workspace for other users to see and possibly edit (after the others have synced their workspace view). If the save button is not pressed and the user leaves the workspace, the changes will not be saved. The user is prompted to confirm for not saving the workspace.

The workspace view of a user can be different depending on when the user has last synced their workspace view (Figure 13). It is advised to take the habit of saving and syncing after each addition or edit. It is also advised to add and edit features in small increments. For example, if a user must edit 30 features on the map, saving and syncing after each edit is advised for two reasons. First, this will keep all other users updated on what the user is doing and second, this will keep the editing user updated about what others have done. However, if the situation requires, a user can withhold saving or syncing the workspace until they are ready to share their additions and changes.
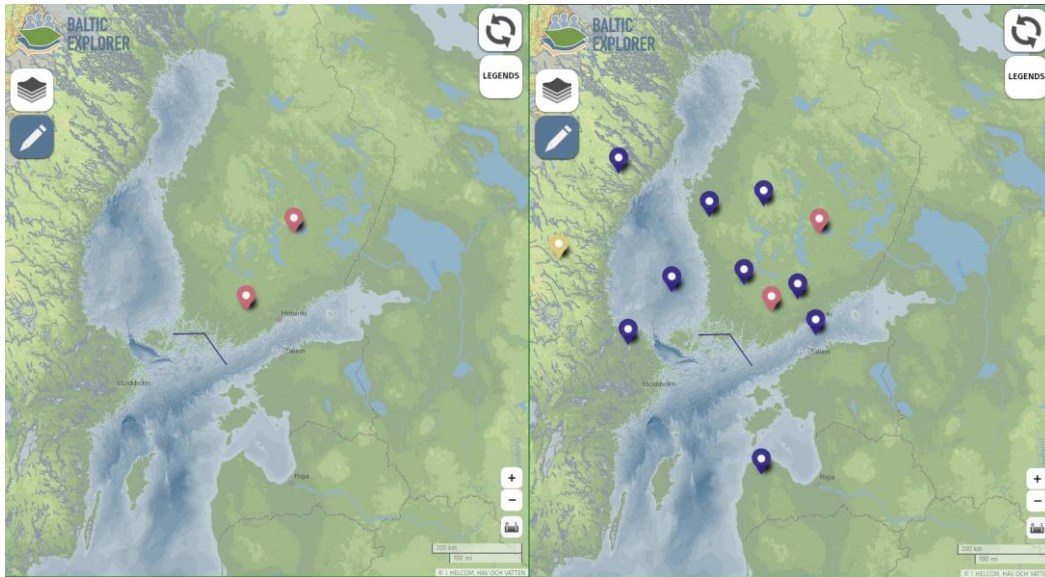
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Figure 13
The same workspace where the first user has not synced their view while the second user has been keeping their view updated.

Measure tool

Baltic Explorer features a measure tool that enables users to measure distances on the map, length of a line feature and area of a polygon (Figures 14 and 15). Select the measure tool and the desired unit (kilometres, miles, nautical miles). Press on the map to start measuring, or hover (place cursor over) a feature on the map to display its length or area. Measured distances can go through multiple nodes that change the angle of the measured line. Make a new node by pressing on the map after creating the initial starting point. Stop measuring by pressing on the last node a second time. Measurements are not stored in the Baltic Explorer.
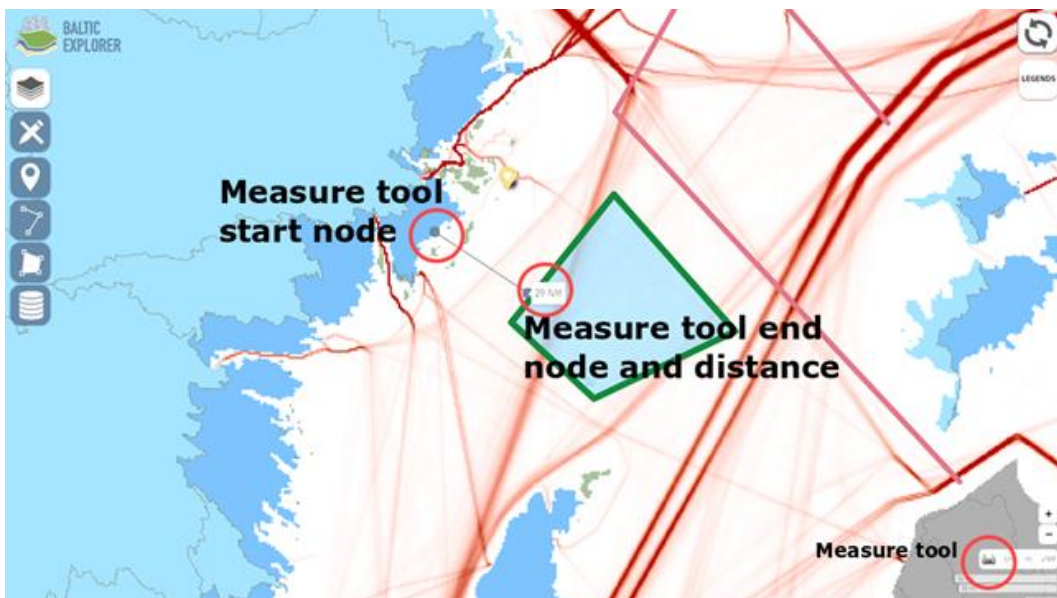

Figure 14
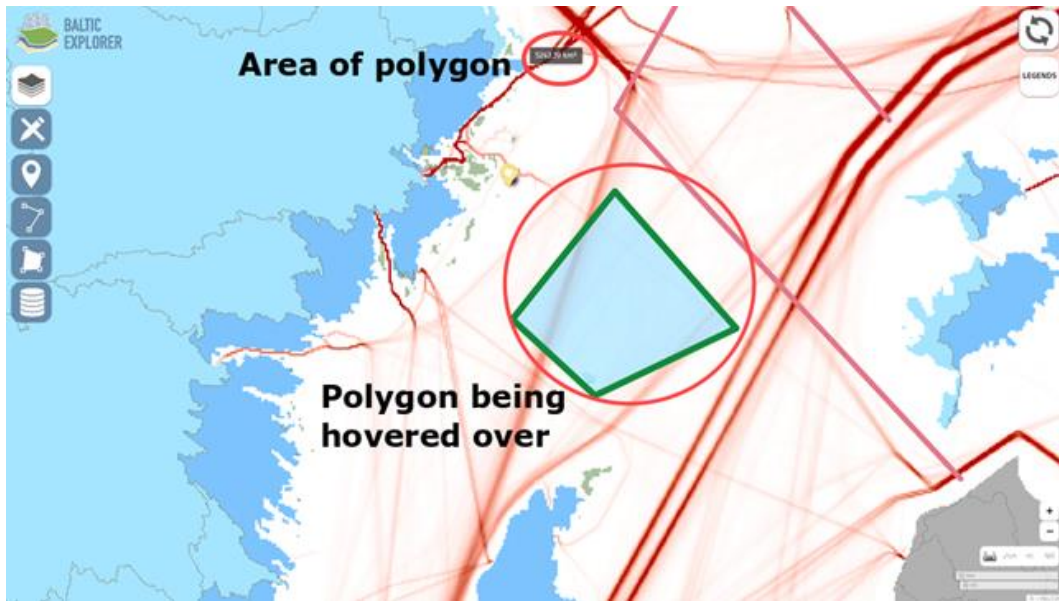*"Measure tool" button is on the bottom right.*

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Figure 15
Measuring area of a polygon feature. Act similarly for the length of a line feature.

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References

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