

# **MESO Viewer: An On-line Visualisation of the impact of Anthropogenic Pressures on Marine Ecosystem Service Optimisation**

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## **User Guide and Tutorial**



**The Marine Biological Association**  
Established 1884, incorporated by Royal Charter



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# Contents

1. [Introduction](#)
2. [Capabilities of the toolkit](#)
  - a) Current Capabilities
  - b) Future Developments
3. Display of Pressure Impacts
4. Interaction with underlying Bayesian Belief Network
5. Spreadsheet structure
6. [Help and Support](#)



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# 1. Introduction

MESO Viewer is a Proof of Concept tool developed by AVS Developments in conjunction with Marine Biology Association, on behalf of the Joint Nature Conservation Committee.

The tool uses a Gaussian Linear Bayesian Belief Network to model the interactions between Anthropogenic Pressures, and a range of sub littoral habitats commonly found within UK waters. The tool provides a structured mapping between four distinct functioning layers within the habitat, as follows:

- Anthropogenic pressures
- Bio assemblages
- Output processes
- Ecosystem services

The outputs of the Viewer comprise two elements:

- Pressure impact assessment
- Underlying Belief network viewer



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## 2. Capabilities of the toolkit

MESO Viewer comprises 2 major components in order to inform and support decision making on the impact of anthropogenic pressures on UK sub-littoral habitats:

- a) Impact Assessment Viewer
- b) Bayesian Belief Network Viewer

At the initial version, the tool is a Proof of Concept and it is envisaged that the tool has considerable scope for further development. These developments are described briefly below in order to assist the user in understanding its full use case:

- c) Geographical based interaction
- d) Temporal interaction including modelling of biomass





# Impact Assessment Viewer

The impact assessment viewer is divided into four functional blocks as depicted in the graphic below:.

1. Pressure selectors

2. Impact on bio-assemblages

3. Impact on output processes

4. Impact on ecosystem services



Help feature –  
Opens final report  
and  
this User Manual

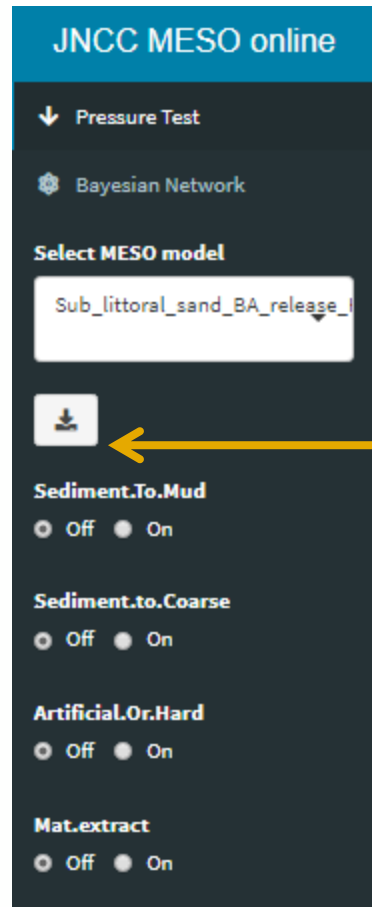


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# Selection features

To navigate through the tool, the user can select options from the left hand side toolbar. This toolbar is visible on both pages.



The toolbar can be minimised by pressing the box in the top bar

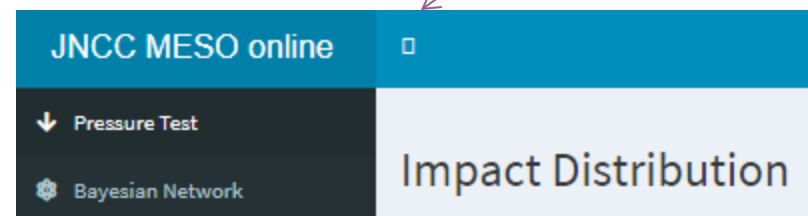
Page selector

Model selector: selects a different model

Download button (see latter section)

Pressure buttons (see next page)

Pressing this icon hides (and shows) the left hand side bar



# Pressure Buttons

**Sediment.To.Mud**

☐ Off ☒ On

**Sediment.to.Coarse**

☐ Off ☒ On

**Artificial.Or.Hard**

☐ Off ☒ On

**Mat.extract**

☐ Off ☒ On

**Abrasion**

☐ Off ☒ On

**Penetration**

☐ Off ☒ On

**Wave.exp.change**

☐ Off ☒ On

**Susp.Sed.change**

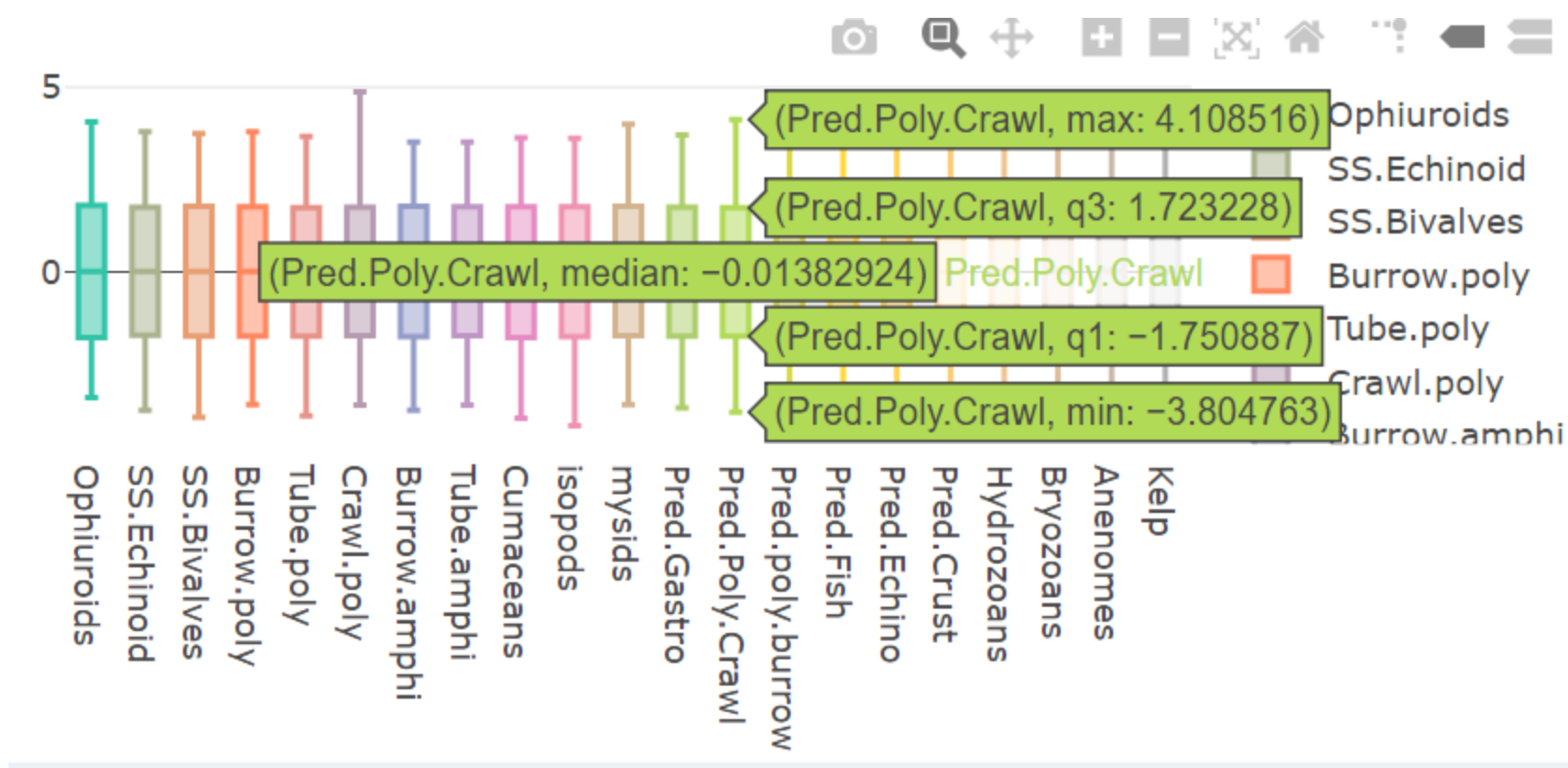
☐ Off ☒ On

Pressures are as defined by the MarESA pressure assessment. Further information can be found in the final report, available as a download from the tool.

The buttons will automatically calculate the impact of a combination of multiple pressures upon the habitat.

# Hover over functionality

Hovering over any of the box plots show the range of impact in terms of the mean (i.e. the direction of travel) and range calculated as mean  $\pm$  1 quartile as the box and the min and max as the whiskers above and below the box.

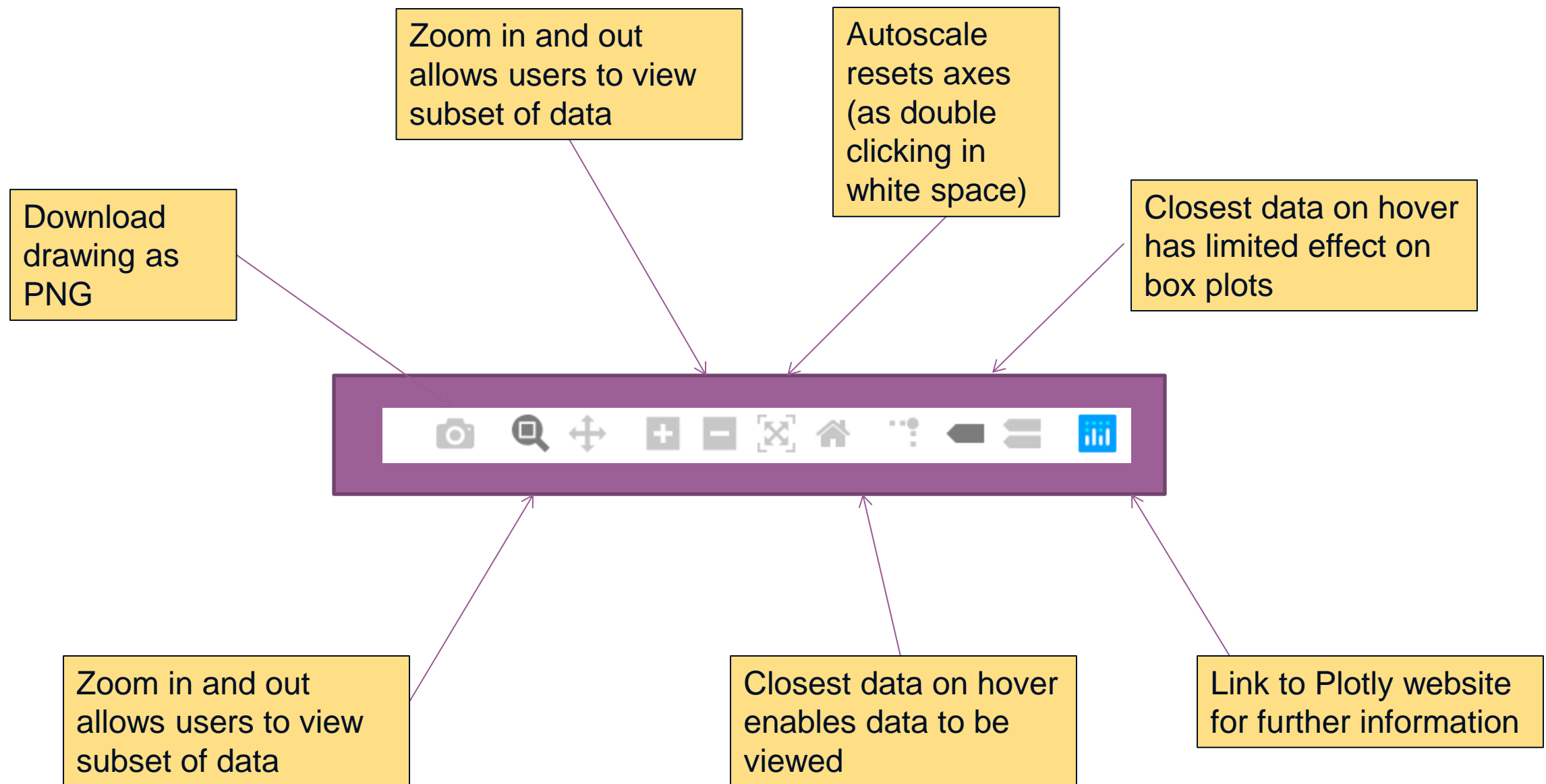


Hovering over any of the box plots show the range of impact in terms of the mean (i.e. the direction of travel) and range calculated as mean  $\pm$  1 quartile as the box and the min and max as the whiskers above and below the box.



# Facilities within the box & whisker plots

The box and whisker plots using the 'Plotly' library. This is a comprehensive open source graphing library. The menu bar in the top right of the graph provides a set of facilities as follows, available when the cursor hovers over the top right area of each graph:



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# Future uses of the Toolkit

The potential uses of the toolkit include:

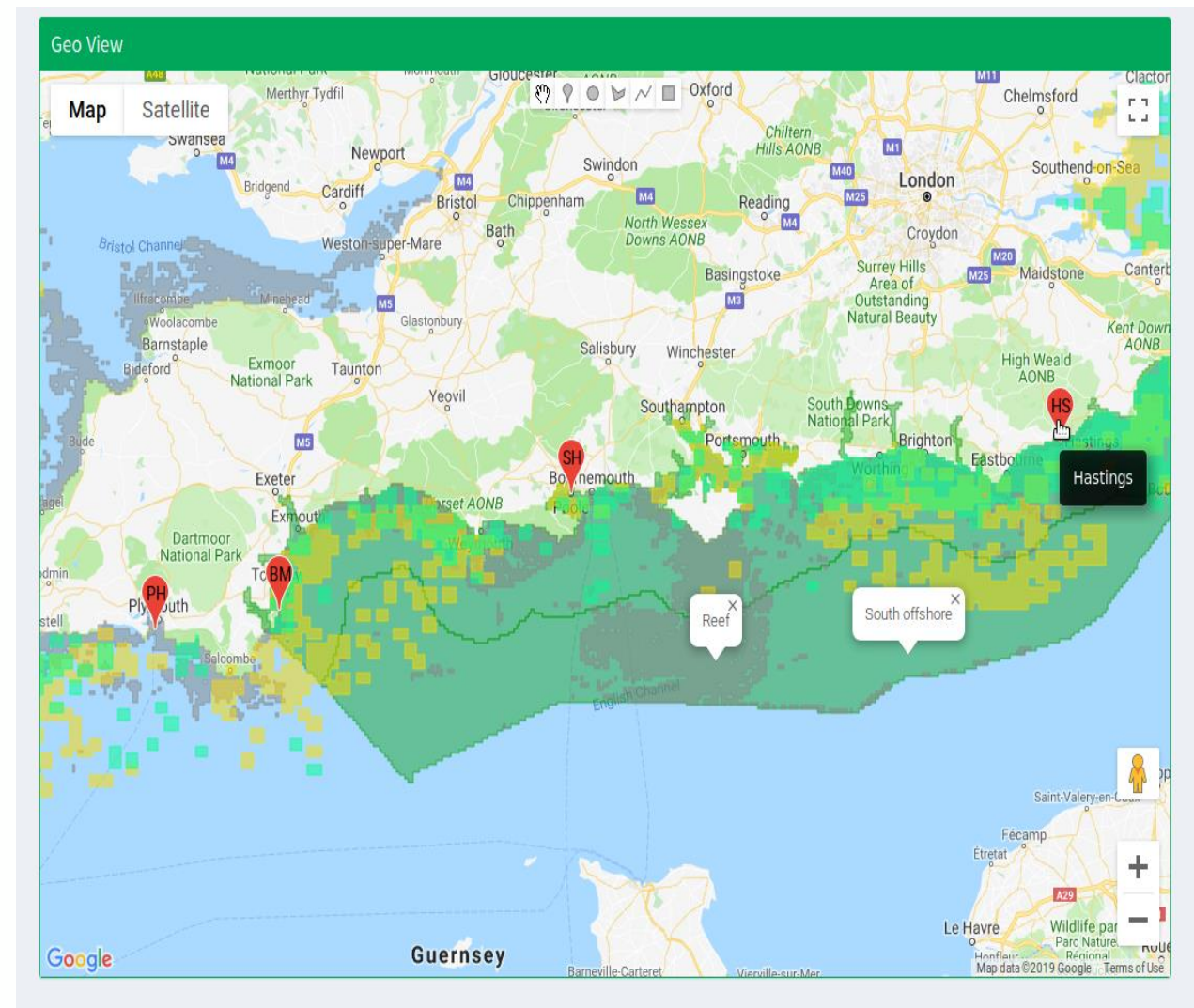
1. Understanding the current condition of habitat based upon knowledge of historic activity.
2. Understanding the future risks in continuing or extending current levels of activity.
3. Understanding the future risks in altering existing activity, including consideration of options for new installations as well as decommissioning of existing facilities.



# Future enhancements: Geographical Information System Overview

The GIS layer viewer could provide the following generic facilities:

- Overlay of habitat related information (including sensitive habitats), substrate and energy levels
- Overlay of existing and proposed activity including fishing, renewable energy sources, pipelines and installations.
- Overlay of geographical conservation areas including MCZs, SPAs, SCIs, etc.
- Ability to define custom areas and extract information from the three overlays above, for instance when considering planning applications.



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# Future enhancements: Improved Scenario Analytics

In order to provide increased useability for planners, conservationists and analysts, a suite of tools are envisaged which allow for:

- Time series analysis to include the modelling of recovery;
- Prior condition consideration, including current levels of biomass and allowance for impacted population levels;
- Proportionality of response: enabling users to interact with the model to gain insight into the relative contributions of individual nodes and their response on ecosystem services
- Linkage with geographical information sets as described on the previous page.



# Validation & Calibration

At Proof of Concept stage, the model has been built upon the Marine Biology Association's assessment of sensitivity and resistance of functional groups to pressures. This is, in turn, fully referenced back to source literature.

However, the assessments are a single expert judgement which need to be validated through a peer review process. This would be followed by a synthesis of views which can then be applied to the weightings within the models in order to evolve a more considered evaluation of sensitivity and variability.

For a complete calibration, the models need to be referenced against empirical data wherever possible, whilst not underestimating the complexity and completeness of gathering comprehensive data sets across all referenced habitats.





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# Parameterisation

Currently the model is parameterised as relative contributions of effect on nodes within the network. There is no absolute reference points available to which these relative effects can be calibrated.

The current pressure levels are based against the MarESA pressure benchmark scores. The effect on bio-assemblage is based upon resistance component of the sensitivity analysis.

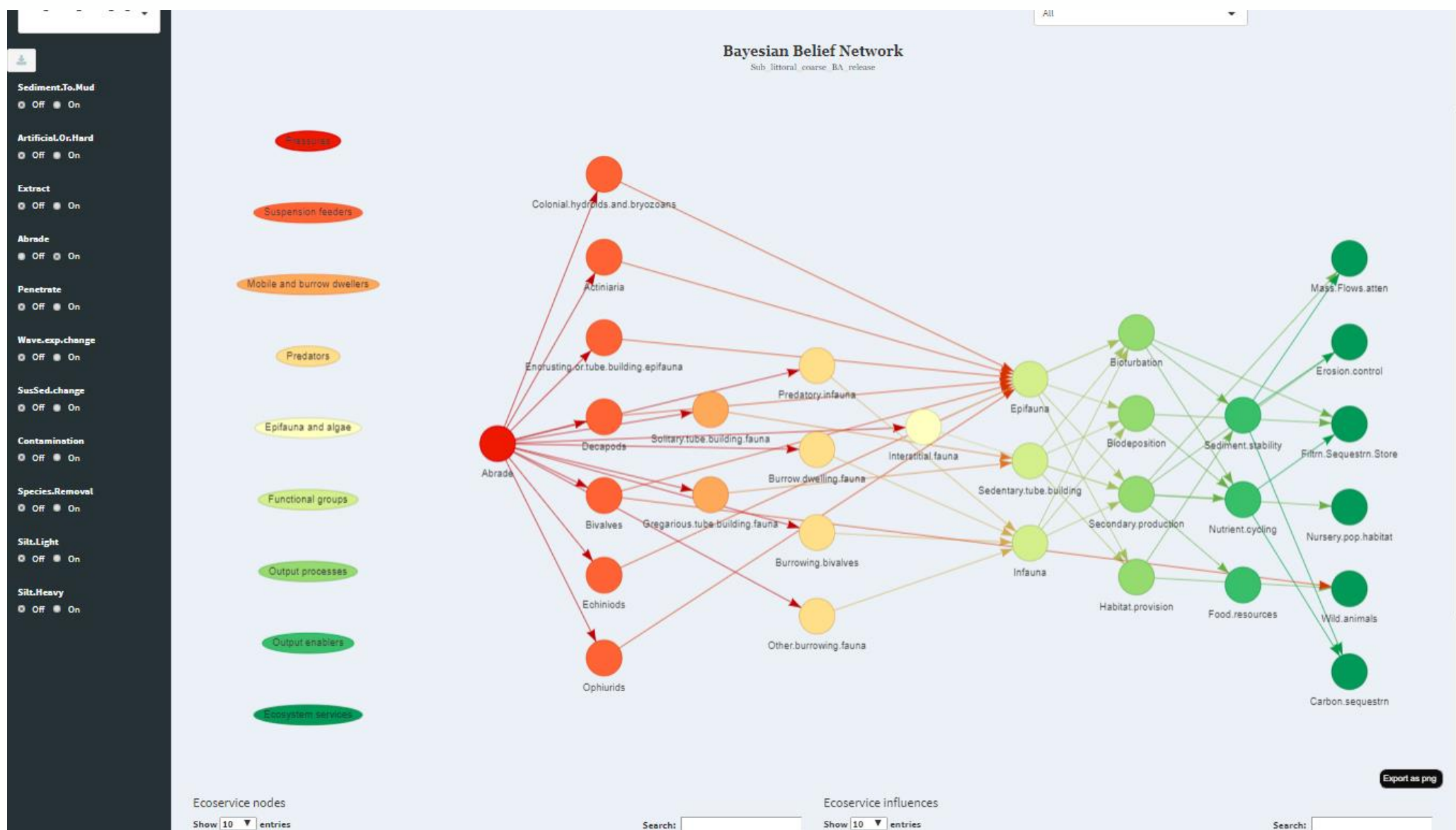
In turn, the impact on output processes are considered as relative contribution to each output processes, based upon expert judgement and this approach is also used to assess relative performance of ecosystem services based upon change in output processes.

In the future, a more traceable and quantitative approach would require the performance metrics of each node to be defined and agreed, in a manner which allows them to be populated with empirical data.



# Bayesian Belief Network Viewer

The viewer has the same left hand sidebar as the Impacts Viewer and so changes in applied pressures can be seen on both views. The BBN Viewer ONLY shows the elements of the graph for which pressures have been applied.



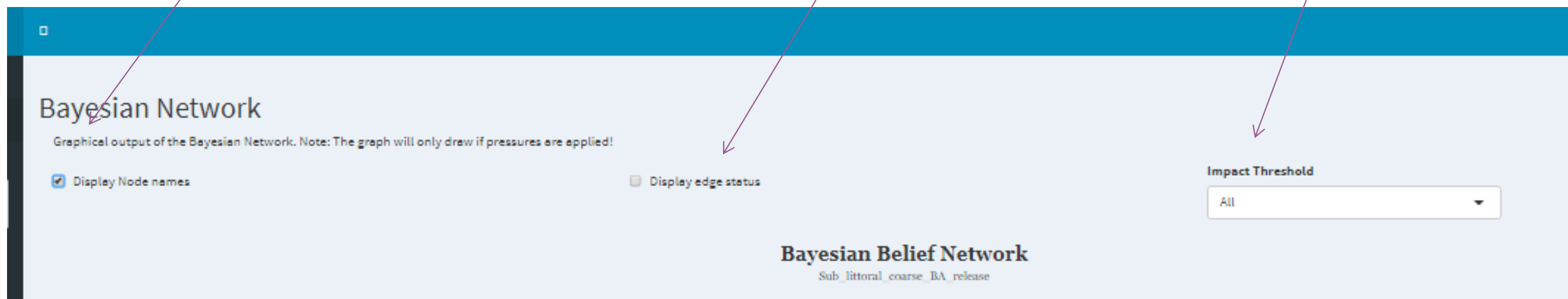
# User selection features

Large models can be viewed using pan and zoom using a mouse by clicking in white space to zoom and using the mouse wheel to zoom. Additionally extra facilities are provided as illustrated below:

Toggles between the abbreviated codes for a given node vs full names

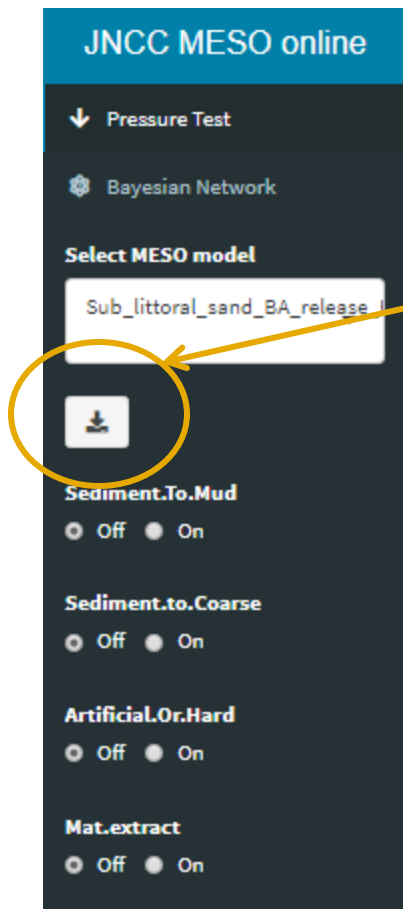
Toggle edge label descriptors

Set the sensitivity threshold (inverse of resistance score) to limit number of edges being displayed



# Download feature

A download feature allows for all settings and the box plots to be downloaded. At the present time, the Bayesian Belief Network cannot be downloaded, but a fix is being sought for this issue.



Selecting the download feature cause a 'pop up window' to be displayed prompting the user for a filename and a title. The title will be appended to the graphical outputs.

will generate four files enclosed in one zipped document (named in accordance with the given filename. The four files will be:

- A png file for the pressure to bio-assemblage box plot;
- A pbg file for output processes box plot;
- A png file for the ecosystem services box plot.
- An excel spreadsheet containing the node table, edges table, pressure status and sensitivity weightings.

The resulting zip file should be available in the user's downloads folder upon completion.

The bayesian network view can be downloaded by pressing the 'png' button in the lower right hand corner..

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# Training & Updates

- Helpdesk support and advice
  - Bug fixing and technical investigation
  - E-mail to [support@avsdev.uk](mailto:support@avsdev.uk) or telephone 01202-883234 during office hours.
- Short term Updates
  - Toolkit will be hosted by AVS Developments for 6 months from April 2019
  - Updates will be rolled out as required during this time