Environmental Sensitivity Mapping (ESM)
supporting environmental assessment processes in Ireland

USER MANUAL

1. INTRODUCTION

The ESM Webtool is designed to facilitate multiple data interaction. Its purpose is to enable geographical exploration of environmental considerations onshore, and to combine relevant environmental datasets to produce **environmental sensitivity** maps in **support of Strategic Environmental Assessment** (SEA).

This user manual is intended to facilitate its application and provide guidance on the preparation of sensitivity maps while highlighting some critical considerations.

2. FUNCTIONALITY

Specific **locations** can be searched in the **search engine** at the top of the Web viewer. The ESM Webtool will automatically zoom in to the searched location.
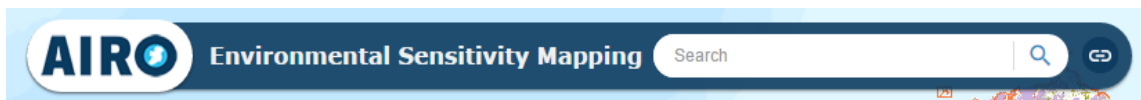
A number of **basic tools** can be found at the bottom of the Web viewer as illustrated and explained below.

Layer list   Legend   Widget   Chart   Street view   Swipe   Add shapefile


Select the **Layer List** icon to obtain a list of the **available spatial datasets**. To visualise any of these just tick on the relevant environmental theme and then tick on the relevant spatial dataset/s. The dataset/s will be displayed on the viewer.

Multiple datasets can be visualised at once. However, note that wide coverage datasets such as bedrock geology may obscure the display of other datasets. In such cases, turn on/off relevant datasets one by one (or use the Swipe tool – see below for details).

You can use the drop down menu to the right to zoom in to a given environmental theme (i.e. to the datasets contained within it), adjust its transparency or move it up or down the list to display on top/below other theme/s.
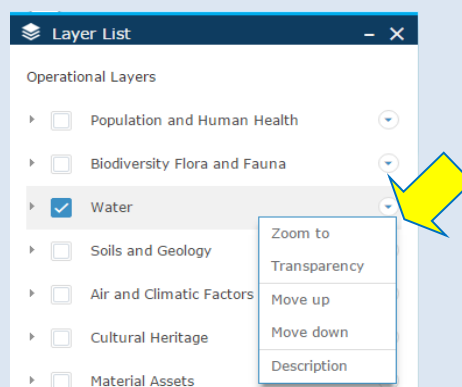
To obtain metadata, including a description of the spatial dataset, use the drop down menu to the right of the dataset name and click on "Description".
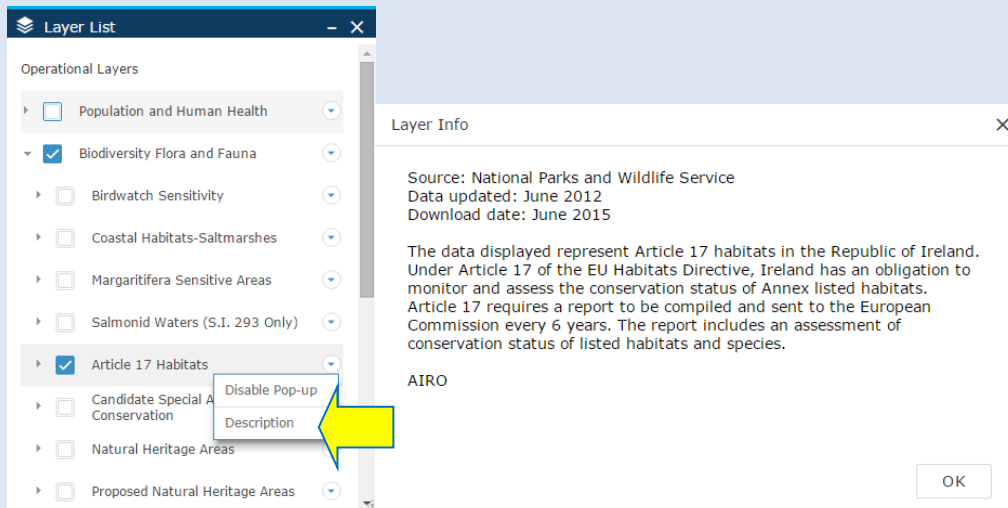
The **Legend** icon will launch a window providing the **legend of the selected spatial datasets** (i.e. categorisation and symbology of those currently displayed on the map).

This icon opens the **ESM Widget** window where you can define the geographical extent and the variables to be combined **to generate an environmental sensitivity map**. See further detail in Section 3 below.

The **Chart** option enables **visualising the population profile** for the selected **area** in the form of a chart.

Google Street View allows **3D and 360° visualisation of streets and their surrounding landscape/environment**. Click on the icon and drag the little man onto the map to see the street view for that location. You can pan around and also visualise the location in aerial and bird's eye view forms.
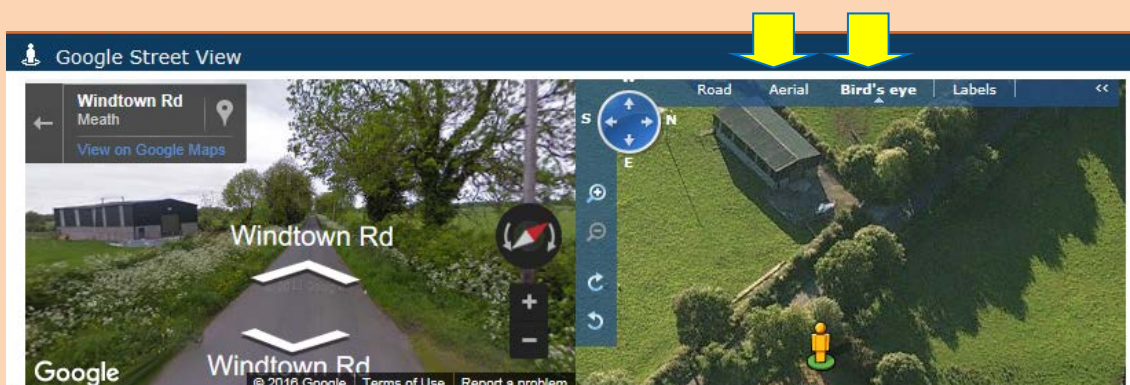
The **Swipe tool** enables **swiping a selected dataset to visualise the underlying dataset/s**. It opens a menu with the themes turned on in the Layer List from which the dataset to swipe can be defined. Scroll the associated bar to swipe.

Use the **Add Shapefile** option to **upload an external shapefile**. The shapefile will be displayed in the viewer. The shapefile must be zipped for uploading and contain no more than 1,000 features.

3. APPLYING THE WIDGET

The sensitivity maps are based on the principle that the more environmentally susceptible factors co-occur at a given location, the more sensitive that area may be to change/s. For example, the overlap of multiple ecological designations (such as candidate Special Areas of Conservation and proposed Natural Heritage Areas) with extreme vulnerability aquifers and high soil permeability would highlight significantly sensitive environmental areas in terms of both biodiversity and water, thereby providing early warning of potential land-use conflicts. The identification of such co-occurrence of environmental sensitivities can also contribute to cumulative effects assessments. The datasets are aggregated on the basis of scientific scores that reflect their quality, risk or protection status, agreed a priori through stakeholder consultation (see the Annex).

Plan/programme-specific environmental sensitivity maps can be created as follows:

The **ESM widget** will launch a new window where environmental datasets to be brought into the sensitivity mapping are to be selected.

Step 1. **Select the study area**. This may be a region, county or water catchment depending of the geographical extent of the plan/programme being assessed. Pull down the menu option to obtain a list of administrative areas and catchments and select the relevant one. The sensitivity mapping will be undertaken for this selected area only with a 10Km buffer zone (or cushion) around it. This is to examine the potential for any transboundary sensitivities that may also be affected by the plan/programme.
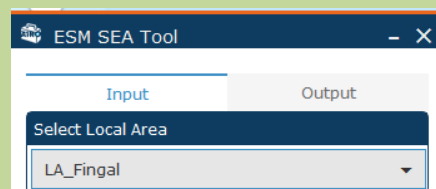
Step 2. Next **select the SEA theme** by clicking on the + icon. This will display the datasets available for that theme - tick on those that are relevant to the assessment of the plan/programme. These criteria should be selected in rational manner, linking them to issues and considerations identified during scoping. You can add additional environmental themes

and associated relevant datasets as appropriate. You can remove a theme by clicking on the x icon. Note that the model will not run if a theme is selected but not any datasets within it.
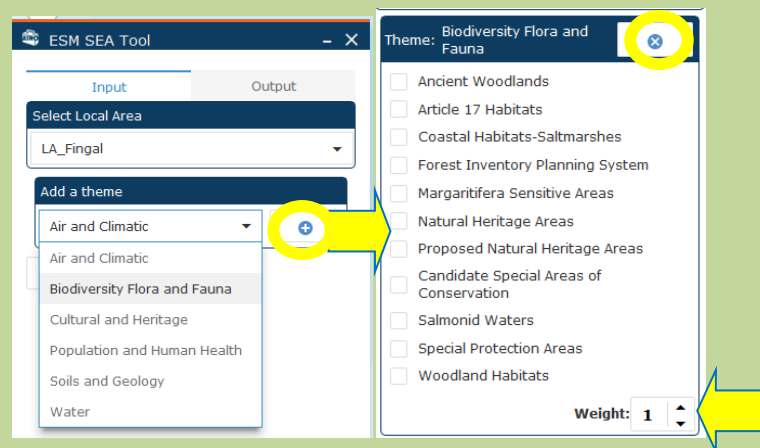
Step 3. **Define weights** for each environmental theme added to the sensitivity mapping. These user-defined weights are to be used to emphasise the relative importance of a given environmental theme (and the associated dataset/s selected for the assessment). 1 denotes neutral weight, while a weight of 2 indicates that the selected theme is relatively more important due to its overall significance or to the likelihood of it being significantly affected by the plan/programme under assessment. Ideally, the assignment of weights and, therefore, the magnification of the sensitivity of a given environmental theme is to be defined and agreed through stakeholder consultation during SEA scoping.

WARNING: **Environmental themes and factors represented by the ESM Webtool datasets must be selected and combined in a sensible way, incorporating only considerations that are relevant to the plan/programme under assessment and applying rational relative weights.**

When selecting environmental datasets and applying weights, bear in mind that:

A. The more spatial datasets are selected, the higher the likelihood of sensitivity in the study area. It is the user's responsibility to coherently select relevant spatial datasets and weights for the creation of meaningful sensitivity maps that are relevant to and appropriate for the assessment of the plan/programme.

B. Particular care should be given to double counting issues by selecting datasets that are directly related. For example, selecting Ancient woodlands, Annex I habitats and Woodland habitats would overemphasise the sensitivity of certain woodlands. Similarly, selecting Aquifer vulnerability, WFD Groundwater status and Groundwater source protection areas would overstate the sensitivity of this natural resource. If this may be the intention of the assessment, it should be clearly stated so, or taken into consideration when interpreting the output map/s.

C. Weights are only to be used to emphasise the relative significance of an environmental aspect. Applying a weight of 2 to more than two SEA themes would magnify and possibly overstate the overall sensitivity of the study area. Where all considered themes are equally important in the assessment, a weight of 1 should be applied to them all.

When relevant SEA themes, associated datasets and weights are defined, press Go at the bottom of the Widget window. The Help option will direct you to this User Manual and to a video demonstration.

The system will automatically generate a sensitivity map and bring you to the Output tab of the window. You can **return to the Input tab if you want to perform a new assessment** with different datasets and weights.
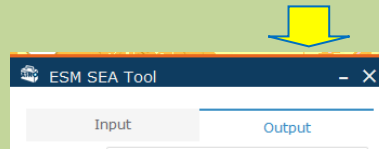
This Output tab includes a legend with the **categorisation of sensitivity**. These categories are based on the number of environmental sensitivities overlapping at one location where 0 is no occurrence, 1 to 3 is occurrence of one high environmental sensitivity (or three low sensitivity datasets), 4 to 6 indicates two high or one high and 2 moderate overlapping sensitivities, and so on.

Step 4. **Prepare for printing** by turning on the relevant administrative boundaries and adjusting the transparency of the sensitivity dataset (now included in the Legend as "ESM Result"). For guidance on visualising dataset and adjusting transparency refer to page 1.

For printing purposes, change the map title (e.g. to reflect the name of the plan/programme or indicate "SEA supporting environmental sensitivity mapping"), select the format (e.g. PDF or JPG) and define the author/s of the map. Authorship should be defined in order to defend the rational for using the selected variables/weights and the resulting mapped output.
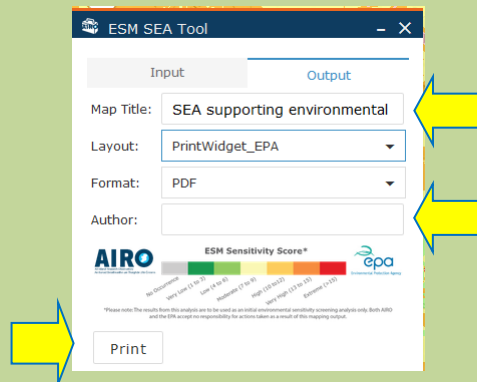
Press **print** to obtain a layout map. This includes the mapped output of the sensitivity analysis, the sensitivity categorisation legend, and a clear indication of the selected datasets and applied weights for clarity and transparency. The output map appears at the bottom of the window - select it to open it in a webpage and save it to your computer.

If you generate multiple sensitivity maps (by going back to the Input tab and changing the selected datasets and weights), the print option will generate multiple outputs accordingly, and these will be listed in the window. These will be removed/deleted automatically once you come out of the session (save them to your computer for future access/use).
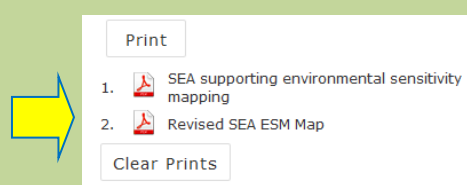
4. LIMITATIONS OF THE WEBTOOL

The ESM Webtool and Widget are to be used to **support and inform SEA processes**. The following aspects need to be considered during their application:

- The **quality of the ESM outputs** (i.e. sensitivity maps) is **dependent upon the quality of the data** entered into the assessment. The ESM Webtool is fully reliant on existing and publicly available spatial datasets from third party sources. As a result, data gaps (e.g. current omission of Record of Protected Structures or scenic landscapes in the ESM Webtool due to data availability and access constraints), and any scale and quality/completeness issues associated with the already included datasets can affect the comprehensiveness and detail of the sensitivity analysis. AIRO takes no responsibility for any errors/inconsistencies/gaps in the included datasets.

- **Data** included in the ESM **are static**, **representing** data available in **a given point in time** (the last data update took place in December 2016). So certain datasets (i.e. those that are regularly updated such as ecological designations) could be out-dated when applying the Webtool and Widget, affecting the validity of the outputs. The metadata associated to each dataset indicates when the last update took place, and this should be taken into consideration when interpreting the results. Future iterations of the ESM project may be able to incorporate dynamic/live standardised map services in order to automatically update datasets as these become available.

- The **availability of more data for certain SEA themes** (e.g. large number of water-related spatial datasets due to the Water Framework Directive requirements) could result in an unintended imbalance of environmental sensitivity towards a given theme if all datasets were to be selected. As this has implications for the assessment outputs, a sensible number of criteria should be selected to avoid unintended bias (unless a particular environmental consideration is specifically intended to be emphasised).

- The **inter-relation of certain environmental factors** (e.g. water-dependant habitats and species), as well as the **inter-connection between natural features** (river networks or wildlife corridors) requires consideration of **catchment-based analysis** – as opposed to the application of administrative boundaries. Due consideration should therefore be given to examining sensitivity at the catchment level, as appropriate, with particular focus on contributing upstream elements (e.g. streams feeding into a designated water body).

- **Scientific scores** determine the intrinsic vulnerability of each environmental dataset and are the basis by which datasets are aggregated for the sensitivity analysis. Scientific scores range from 1 (low - e.g. coniferous forests, unrestricted coal areas) to 3 (high - e.g. Special Areas of Conservation, groundwater source protection areas) and have been defined for each dataset in consultation with stakeholders. See the Annex for detailed information on scientific scores. These should be taken into consideration when interpreting the ESM outputs.

- **Weights applied** to the SEA themes **affect the ESM outputs**. Significance weights can be determined by the end-user or by a stakeholder group. In all cases, significance

weights are subjective but not arbitrary (i.e. they should be based on evidence). For an effective assessment, a range of relevant experts should be consulted to determine appropriate weights for specific themes, and the effect that weights have in the relative sensitivity outputs examined.

- The **sensitivity maps have a resolution of 100m x 100m**. This resolution has been adopted as it provides sufficient detail for regional and county level assessments. All vector datasets have been converted to 100m x 100m resolution rasters and in doing so, detail is lost at the local level. Therefore, mapped outputs are not to be examined/scrutinised by zooming in tight to local areas, as the 100m x 100m resolution does not enable fully representative considerations/issues at that level.

Given the above considerations, the **ESM outputs should be treated as indicative** rather than definite. The **sensitivity maps are a direct product of selected criteria and applied weights**. The **maps aim to highlight the relative environmental sensitivity of different areas** and are to be used to provide early warning, advise on the potential for land-use conflicts and, in this way, promote evidence-based planning. They should not be used to identify no-go areas or provide green light to development. In fact, they can also be understood as assets to a region given the range of ecosystem services they provide.

Processing time: it can take up to 3 minutes for the Widget to run and produce the sensitivity map depending on the size of study area and the number of variables selected. Please be patient.

ANNEX: SCIENTIFIC SCORES ASSIGNED TO THE ESM WIDGET DATASETS

The scientific scores associated to the environmental datasets included in the ESM Widget were identified and agreed at two stakeholder workshops involving national SEA experts, consultants, local authority planners and heritage officers, and government representatives.

The scientific scores are embedded into the Widget raster files and cannot be modified. They are classified as follows: 1 = Low; 2 = Moderate; and 3 = High.

The scores are assigned on the basis of: a) their quality status and representativeness as indicators of environmental quality (e.g. extreme vulnerability aquifers obtain a scientific score of 3 while low vulnerability aquifers are classified as 1); b) their legislative protection or conservation priority (e.g. Special Areas of Conservation are given a score of 3 while proposed Natural Heritage Areas are scored as 2); and their risk (e.g. flood risk areas are considered to have a score of 3 while the rest of lands are be given a score of 1).

The following table presents the scientific scores assigned to each datasets included in the ESM Widget.

Sensitivity Scores 1=Low, 2=Moderate, 3=High	1	2	3	Basis
Population and Human Health				
WFD RPA Groundwater drinking water			X	Statutory: Protection priority
WFD RPA Surface water drinking water (Lakes)			X	Statutory: Protection priority
WFD RPA Surface water drinking water (Rivers)			X	Statutory: Protection priority
Biodiversity, Flora and Fauna				
Ancient woodlands • **Ancient Woodland** • **Possible Ancient Woodland** • **Long-established Woodland (LEW I)** • **Long-established Woodland (LEW II)**		X X	X X	Value judgment: Protection priority
Annex I Habitats			X	Statutory: Legal protection and indicator of environmental quality
Coastal habitats (Saltmarshes)		X		Statutory: Protection priority and environmental quality
Forest Inventory and Planning System • **Deciduous** • **Coniferous**	X	X		Value judgment: Environmental quality
Margaritifera sensitive areas • **Catchments of SAC populations listed in S.I. 296 of 2009** • **Catchments of other extant populations** • **Catchments with previous records of Margaritifera but current status unknown**		X	X X	Statutory: Legal protection and indicator of environmental quality
Natural Heritage Areas			X	Statutory: Legal protection
Proposed Natural Heritage Areas		X		Statutory: Protection priority
Salmonid rivers (S.I. 293 only)			X	Statutory: Legal protection
Special Areas of Conservation			X	Statutory: Legal protection
Special Protection Areas			X	Statutory: Legal protection
Woodland habitats		X		Value judgment: Environmental quality

Water				
Aquifer vulnerability				
• **High/Extreme/ Rock near surface**			X	Value judgment: Environmental quality
• **Moderate**		X		
• **Low/Water**	X			
Aquifer categorisation				
• **Pure limestones that are designated as karst aquifers**			X	Value judgment: Environmental quality
• **Pure limestones that are not designated as karstic aquifers, impure limestones and Precambrian marbles**		X		
• **Non-carbonate rocks**	X			
Biological Q values				Statutory: Protection priority
Groundwater source protection areas			X	Statutory: Protection priority
RPA Nutrient sensitive areas (Lakes)			X	Statutory: Protection priority
RPA Nutrient sensitive areas (Rivers)			X	Statutory: Protection priority
RPA Recreational waters (Lakes)			X	Statutory: Protection priority
RPA Recreational waters (Coastal/Rivers)			X	Statutory: Protection priority
RPA Water dependant habitats (SAC)			X	Statutory: Protection priority
RPA Water dependant habitats (SPA)			X	Statutory: Protection priority
Wetlands		X		Statutory: Environmental quality
WFD Groundwater status				Statutory: Environmental quality
• **Good**	X			
• **Poor**		X		
WFD Lake status				Statutory: Environmental quality
• **High**		X		
• **Pass/Good/Moderate**	X			
• **Poor/Bad**		X		
WFD River status				Statutory: Environmental quality
• **High**		X		
• **Pass/Good/Moderate**	X			
• **Poor/Bad**		X		
Soils and Geology				
Geoparks and Geosites			X	Statutory: International importance
Outcrops		X		Value judgment: Protection priority
Peat bogs		X		Statutory: Protection priority
Well drained soils		X		Value judgment: Environmental quality
Poorly drained soils		X		Value judgment: Environmental quality
Air and Climatic Factors				
Air zones				Value judgment: Environmental quality. Omitted as a sensitivity criteria
• **Dublin/Cork/Cities**	X			
• **Rural areas**	X			
Coal restricted areas				Value judgment: Environmental quality. Omitted as a sensitivity criteria
• **Restricted**	X			
• **Unrestricted**				
Historical flood extents			X	Statutory: Risk status
Cultural Heritage				
National Inventory of Architectural Heritage (NIAH)		X		Statutory: protection priority
Record of Monuments and Places (RMP)			X	Statutory: Legal protection