H2020

TOOL FACTSHEET

Tool name
Seascape visualisation

Tool type
Interactive visual simulations of seascapes in virtual reality

Short description of the tool
Virtual reality and visualisation tools enable the exploration, interpretation, design and dialogue about aquaculture developments in seascapes with different types of stakeholder. They are used:

- to explore socio-economic and environment, developing options of development, aiding decisions about locations and siting, raising public awareness, scientific experimentation on public preferences and attitudes;
- at strategic, local, and site specific geographic levels;
- at symbolic and photorealistic levels of detail;
- as static or navigable models;
- in an interactive mode, enabling features to be changed, or only for viewing.

Details of the use of 3D modelling in planning are provided in Miller *et al*. (2016), and the requirements for creating a virtual reality model in Wang *et al*. (2015).

In general, the tools are used in three ways, the specifics of which depend upon the purpose:

i) **Interpretation at strategic or locational levels**. 3D models are compiled of the area of interest, with associated ancillary information (e.g. designations, transport, land and sea use), overlays of which can be switched on and off, and viewed from user specific locations, or routes through the landscape, and underwater. The infrastructure for the use of such models depends upon the purpose, but can enable group discussion or individual users. The purposes can be to explore strategic scenarios for uses of land and sea, or raising awareness of elected representatives or public audiences of issues relating to aquaculture.

ii) **Seascape creation.** To enable users to create spatial models of the location of aquaculture developments in the area of interest. A 3D model developed to represent both the land and the seafloor, the detail of which focuses on the seaward side of the coastline, on issues associated with landscape and seascape and not other biophysical constraints. The user interface enables icons of different types of feature (aquaculture, renewable energy) to be added or relocated within the model area. By such of such interactive tools, and colour coded icons, stakeholders and public can identify where they would prefer aquaculture to be directed or locations to be avoided.

iii) **Aquaculture simulation.** To raise awareness and understanding of the components of an aquaculture development, a demonstration model was obtained of such a development (from the Norwegian University of Science and Technology). It is implemented using virtual reality headsets. The model enables the user to move through the development in a boat, inspect the fish cages and moorings, and move amongst the animated fish in the cages. Other features included are feeding lines and a feeding station.

The outputs are recorded as one or more of the following:

i) geographical locations of the features added to, or relocated within the model;

ii) visual imagery with a broad area of coverage, for use at a strategic level, and for communications;

iii) visual imagery of the location of interest and its vicinity, and multiple uses of land and sea for use in reporting options under different scenarios, and for communications;

iv) visual imagery of specific features or individual sites, for use in describing the specific developments;

v) responses to survey questions (electronic or paper).

The outputs may be used in formal assessments of the potential environment impact of an aquaculture development, and in public consultations and engagement at which the concept or specific proposal is introduced to public audiences. New guidelines on such uses are being developed, in Scotland, UK, by Scottish Natural Heritage (2017).

Source (where/ link)

Several sources of software and hardware are used, listed below.

Hardware and infrastructure -

- Virtual Landscape Theatre: James Hutton Institute
- Virtual Reality headsets: Oculus Rift.

Software -

- Interactive visualisation software (commercial source): Presagis
- Interactive visualisation software (bespoke software): coded in VRML, played in Octaga Panorama
- Google Earth

Data –

- Digital Terrain Model (e.g. for Scotland, OS Terrain 5, 5m x 5m raster)
- Aerial imagery (commercial vendors, e.g. Getmapping, Bluesky).
- Environmental designations (marine and terrestrial) (Scotland's Environment Web)

Licence cost or other type of costs (e.g. maintenance)

Hardware –

- No licencing requirements for the virtual reality theatre hardware and infrastructure.
- No licencing requirements for the virtual reality individual headset hardware and infrastructure.

Software –

- 3D modelling design and compilation, e.g. Visual Nature Studio £1,500; Autodesk Maya free for academic use.
- Interactive visual simulation software, Presagis maintenance and functionality for marine environments: c. £3,500 (annual maintenance).
- Interactive visual simulation software, bespoke for project use: no licensing required.
- Google Earth: no licensing required.

Data -

- Costs or licencing requirements depend upon the data used within the models. A minimum requirement is a suitable Digital Terrain Model of the area, and data for geo-specific textures (e.g. aerial imagery). Costs vary by country and institutional arrangements. Spatial data for public sector bodies in Scotland are provided through the One Scotland Mapping Agreement, which includes costs for data on terrain, aerial imagery and other topographic and planimetric data. Data of environmental or regulatory relevance (e.g. designations, aquaculture sites, certain types of land use) are available, free-to-use, from Scotland's Environment Web as part of Scottish Government policy on Open Data.

General requirements (technical and input data)

Hardware and infrastructure:

- Group forum to discuss strategic, locational or site level developments, and the creation of interactive layouts of aquaculture developments, use the Virtual Landscape Theatre. This enables audiences of up to 18 people per engagement session. Details of the technical requirements are available at: www.hutton.ac.uk/learning/exhibits/vlt/technical-details
- Individual user of virtual reality tools, requiring headsets. For Aquaspace these are Oculus Rift.

Software:

- Development of the 3D models, enabling the handling of surface terrain, or seafloor spatial data, surfaces textures, ancillary context data and 3D models of individual features. e.g. Autodesk Maya; Visual Nature Studio.
- Presentation and interactive use of virtual reality models, Octaga Panorama player, Presagis (Vega Prime).

Data:

- Terrain - Digital Terrain Model of area of interest, at a spatial resolution compatible with the use planned (e.g. 50 m x 50 m raster for strategic, overview; 5 m x 5 m raster for location options; 1 m x 1 m for site specific discussion or representation of site design).
- Seafloor - Bathymetry data from INIS Hydro (www.inis-hydro.eu), 1 m x 1 m horizontal resolution.
- Representation of textures of land surface or seafloor to provide context for interpretation of the area or features. Options used are satellite imagery presented as true or false colour (c. 25m x 25m), high resolution true colour aerial imagery, and artificial textures for seafloor surfaces.
- Areal features representing planning responsibilities, designations or classifications of relevance to landscapes (e.g. in Scotland - National Scenic Areas and Landscape Character Assessment).
- Features of interest designed as feature specific or generic inserted into the model. Examples of such features are individual fish cages in an aquaculture development, feeding barge, feeding lines, onshore buildings and transport infrastructure, and other structures of relevance for use in public discussions (e.g. renewable energy facility, leisure craft, site buildings of cultural significance, vegetation).

Management dimension for which the tool could be used

☒ Policy / Management

☒ Environmental

☐ Economic / Market

☐ Other sectors

Main functionality

☒ Site identification

☒ Modelling

☐ Mapping

☒ Stakeholder engagement

☐ Economic analysis

☒ Ecosystem services assessment

☒ Scenario analysis

☐ Other: (Please specify)

Fields of application (i.e. issue to be solved)

Stakeholder engagement, for raising public awareness of aquaculture and the provision of evidence relating to opportunities for multiple uses of sea lochs is an output of the research activities.

An interactive 3D model for creating seascapes can be used to enable options for aquaculture, renewable energy and tourism related activities to be selected and located within the study area. The development of options for locating aquaculture developments, enables the exploration of choices made by members of the public with respect to the uses of coastal waters, and the reasons for their choices.

The identification of preferred options for siting aquaculture developments, to gain insight to the perceptions of public audiences with respect to seascapes, and thus of the cultural services such areas provide. An interactive model enables participants to explore an area of interest, view existing structures, and scenarios of alternative uses of coastal waters by energy, aquaculture and leisure sectors, and record preferences on siting. Public preferences can then be tested with respect to landscape characteristics, in an experimental mode (Ode *et al*., 2009; e.g. scale of topographic backdrop, perceived naturalness, coherence of the view in which aquaculture sites are located).

Circumstances in which it can be implemented (strength and opportunities)

Pre-development consultations on prospective developments of aquaculture. The aims are to enable pre-development consultations about options for aquaculture, consistent with principles of public participation in planning, as per the Aarhus Convention (United Nations Economic Commission for Europe, 1998) and European Landscape Convention (Council of Europe, 2000). Such consultations would include visioning exercises to identify opportunities for aquaculture development from the perspective of local communities, and stakeholders in the private and public sector.

Raising public awareness of aquaculture and the characteristics of developments, using visualisations and movement through 3D models to inform people of context and issues relating to aquaculture, and aiding the interpretation of the seascapes in which they are located.

Note that many of the forms of engagement which involve the use of such tools there will be a requirement for ethical clearance to be obtained, and best practice in research ethics regarding the involvement of public participants in research activities (e.g. European Commission, 2009, 2017).

Limitations

Constraints on the analysis are:

1. Data - no Digital Terrain Model available of a suitable quality (i.e. accuracy, horizontal and vertical resolution); no data for providing textures at a suitable spatial resolution for coherent visual imagery; no data on contextual information (e.g. designated areas, other developments of similar types, other environmental, economic or social factors);
2. Audiences - engaging relevant stakeholders requires their motivation and availability, and requires the events or forums to be accessible;
3. Forums or venues – lack of suitable institutional structures or opportunities for engagement within a planning process (e.g. generation of the main issues report in pre-plan development phase; formal consultation periods, and thus some management actions to be considered); lack of a suitable public venue for an engagement event which is accessible by the communities affected or in the vicinity of the proposed development.

Technical skills needed to operate the tool

Technical skills are required in the design and development of the virtual reality models. Predominantly, these are computer literacy, 3D design capabilities, and knowledge of relevant 3D modelling tools and the conversion of 3D models into formats suitable for use in the virtual reality hardware and software frameworks.

Computer literacy and technical knowledge of the infrastructure is required for use of the Virtual Landscape Theatre as a virtual reality environment. However, to facilitate public participation, no technical skills are required by attendees, as users of the virtual reality tools, with respect to their functionality (e.g. introduce new features, drag and drop features within the 3D environment, navigating through the 3D environment).

Interpersonal skills are required to facilitate events in which the tools are used, with audiences from policy, practice and public. Such skills could include formal training in event facilitation.

Background knowledge needed to implement the tool

Correct implementation of the virtual reality tools requires access to sources of knowledge of the topic (i.e. aquaculture technologies, certain management processes) to ensure appropriate information and content is built into the models, and for guiding their use with audiences comprising public or stakeholders. The planning stage of such engagement events requires the identification and agreement of the context and context such that the narrative associated with the event is appropriate (e.g. neutral and unbiased).

No specific technical knowledge is required with respect to the use of the virtual reality tools.

How can the tool contribute to the EAA

Please select the EAA steps that the tool can contribute:

1. ☐ Scoping
2. ☒ The identification of issues and opportunities
3. ☒ Prioritisation of issues
4. ☐ Objectives
5. ☐ Management actions
6. ☒ Monitoring

How can the tool contribute to the MSP

Please select the MSP steps that the tool can contribute:

1. ☐ Define goals and objectives
2. ☐ Gather data and define current conditions
3. ☒ Identify issues, constraints, and future conditions
4. ☒ Develop alternative management actions
5. ☒ Evaluate alternative management actions
6. ☐ Monitor and evaluate management actions
7. ☒ Refine goals, objectives and management actions

AquaSpace case studies in which it has been implemented

Case study name:

Argyll and Bute, UK

Reference and link to case studies report:

www.aquaspace-h2020.eu

Other bibliographic references

Council of Europe, 2000. European Landscape Convention, Council of Europe, pp94.

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Miller, D., Morrice, J., McKeen, M., Donaldson-Selby, G., Wang, C. and Munoz-Rojas, J. 2016. Use of digital and 3D technology in planning: research report. FInal Report for Scottish Government. pp109.

Ode, A., Fry, G., Tveit, M., Messager, P. and Miller, D.R. 2009. Indicators of perceived naturalness as drivers of landscape preference. *Journal of Environmental Management,* 90, 375-383.

Scottish Natural Heritage 2017. Visualisations for aquaculture, Draft guidance. Scottish Natural Heritage, pp 16.

Wang, C., Miller, D.R., Brown, I., Jaing, Y. and Castellazzi, M. 2015. Visualisation techniques to support public interpretation of future climate change and land-use choices: a case study from N-E Scotland. *International Journal of Digital Earth*, Published online 17/11/2015.

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