



THE PROBLEM:

Most proprietary off-the-shelf GIS software packages provide visibility analysis tools, but these are generally slow, making real-time animation of viewsheds impossible and detailed analysis of whole landscapes using high resolution DEMs impractical. In addition, most proprietary viewshed tools provide the user with binary outputs (simply showing whether an object is visible or not) based on interpolating line-of-sight across a terrain surface for a single or multiple points using fixed terrain offsets. They do not provide detailed analysis of just how much of an object or set of objects is visible and how much of the observers 360-degree field of view is occupied by these object(s). Exact calculations of visual impact are therefore limited.

THE SOLUTION:

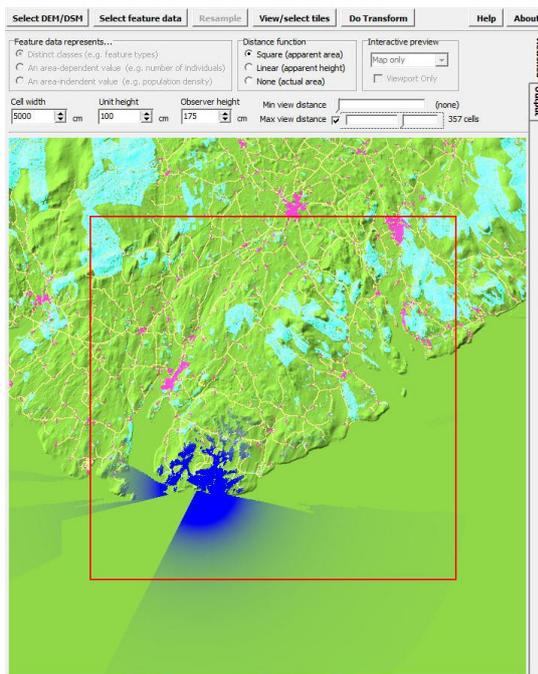
The ***Viewshed Explorer*** is a simple, easy to use and highly efficient viewshed algorithm and desk top tool for interrogating viewsheds in real-time and batch processing of exhaustive cumulative viewshed analyses using high resolution digital surface models. The tool takes both distance decay effects and the exact proportion of an object or feature that is visible above the intervening terrain surface into account in realising accurate and detailed landscape visualisation and impact assessments.

HOW IT WORKS:

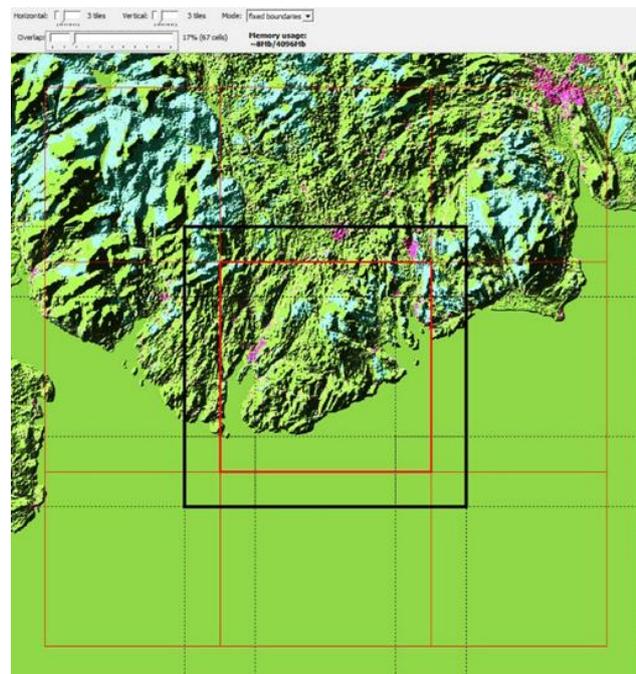
The algorithm employed here is very similar to the R2 ray casting algorithm described by Franklin & Ray (1994). Such ray casting algorithms have been implemented in computer gaming software since the early 1990s but have now been largely usurped by polygon-based approaches supported by modern graphics hardware. Nonetheless, ray-casting techniques can be of enormous practical benefit for terrain based visibility analyses linked to GIS as implemented here with the ***Viewshed Explorer*** (see [user guide](#) for further information).

THE INTERFACE:

The algorithm has been embedded within a user-friendly GUI and can be run either from the desktop on a single PC or across the network on multiple machines to further speed up processing times for very large areas. A tiling-tool has been added to facilitate this process. The interface allows users to input a large DEM as a floating-point raster and a feature layer containing separate feature classes. Observer height and maximum/minimum search radius can also be set. Distance decay effects can be calculated as $1/d$ or $1/d^2$ giving the relative height and surface area of a feature cell, respectively (where d = distance from the observer).



Main tool interface



Tiling tool

A short video illustrating the use of the *Viewshed Explorer* interface is available [here](#).

POTENTIAL USES:

There are many potential and possible applications of the *Viewshed Explorer* software. Coupled with a high resolution digital terrain or surface model, the software can be used to either interrogate the visibility across the landscape interactively and in real-time, or calculate the cumulative visibility of a given set of objects or features across the whole terrain surface. This can be extremely useful in modelling visual impact (e.g. from wind turbines), in predicting the visibility of observation posts or radar installations, or in producing landscape assessments.

EXISTING APPLICATIONS AND USERS:

The **Viewshed Explorer** software has already been used in several projects by various organisations. The tool was originally developed for use in modelling the absence of modern human artefacts in the landscape as part of a contract awarded to the Wildland Research Institute and University of Leeds by Scottish Natural Heritage (SNH) to develop a [methodology for mapping wildness](#) in Scotland's national parks. The tool has subsequently been used to help [map wildness across the whole of Scotland](#) in support of the Scottish Government's National Planning Framework 3 and Scottish Planning Policy. The **Viewshed Explorer** has also been used by the US National Park Service (USNPS) to help [modelling wilderness character](#) within selected national parks. WRi and partners regularly use the tool in contract work and research.

SALES AND LICENSING:

The **Viewshed Explorer** is available for purchase and use under licence. For further details, please contact us by [email](#).

PUBLICATIONS:

Several publications describing or based on the **Viewshed Explorer** tool are available. A sample are listed here.

Carver, S., Comber, L., Fritz, S., McMorran, R., Taylor, S., & Washtell, J. (2008). [Wildness Study in the Cairngorms National Park](#). University of Leeds.

Washtell, J., Carver, S., & Arrell, K. (2009). [A viewshed based classification of landscapes using geomorphometrics](#). In Proc. Geomorphometry Conf. (pp. 44-49).

Comber, A., Carver, S., Fritz, S., McMorran, R., Washtell, J., & Fisher, P. (2010). [Different methods, different wilds: Evaluating alternative mappings of wildness using fuzzy MCE and Dempster-Shafer MCE](#). Computers, Environment and Urban Systems, 34(2), 142-152.

Carver, S., Comber, A., McMorran, R., & Nutter, S. (2012). [A GIS model for mapping spatial patterns and distribution of wild land in Scotland](#). Landscape and Urban Planning, 104(3), 395-409.

Carver, S., & Washtell, J. (2012). [Real-time visibility analysis and rapid viewshed calculation using a voxel-based modelling approach](#). In Proceedings of the Twentieth Annual GIS Research UK Conference, Lancaster, United Kingdom.

Carver, S., & Markieta, M. (2012). [No high ground: Visualising Scotland's renewable energy landscapes using rapid viewshed assessment tools](#). In Proceedings of the GIS research UK 20th annual conference.

Carver, S., Tricker, J., & Landres, P. (2013). [Keeping it wild: Mapping wilderness character in the United States](#). Journal of environmental management, 131, 239-255.