Outdoor Recreation Valuation (ORVal) User Guide

Version 2.0

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Business School

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1. Introduction

- The ORVal Tool is web application developed by the Land, Environment, Economics and Policy (LEEP) Institute at the University of Exeter with support from DEFRA. It can be accessed at: http://leep.exeter.ac.uk/orval.

- ORVal's primary purpose is to provide information that might be useful to government, businesses and communities in understanding the benefits that are derived from accessible greenspace in England and Wales.

- ORVal is map-based and allows users to explore the distribution of greenspace across England and Wales, plotting out the locations of recreation sites, be those beaches, recreation areas like parks and nature reserves, paths through the countryside or along river banks.

- ORVal also allows users to learn something about the nature of those different sites; it provides a large variety of additional layers that users can display on the map. Those layers provide information on the land cover, land uses, water margins, special designations and points of interest to be found in or near each recreation site.

- ORVal's key functions:

    (1) It allows users to explore the visitation and welfare values that are generated by **currently accessible greenspaces**. Welfare values can be viewed at individual site level or aggregated by regions.

    (2) It allows users to estimate how visitation and welfare values might change if the **characteristics of a recreational greenspace were changed**.

    (3) It allows users to draw new recreation sites on the map, define their characteristics and estimate the visitation and welfare values that might be generated by **creating that new greenspace** in that particular location

- **ORVal's estimates of visitation and welfare values are derived from a statistical model of recreational demand** (see Box 1).

- The recreational demand model is a person-level model; that is to say it provides estimates of the recreational behaviour of a person with particular characteristics living in a particular location. The model can be used to predict which greenspaces an individual might visit over the course of a year and how much welfare value they get from each of the greenspaces available for them to visit.

- The visitation and welfare values displayed in ORVal are obtained by aggregating individual values over all residents of England and Wales (see Boxes 2 and 3).

Box 1: The Recreation Demand Model

The Recreation Demand Model that underpins the ORVal Tool is a statistical model that can be used to predict the number of visits that are made by adult residents of England and Wales to different greenspaces (see Box 2). The model adjusts its predictions according to a number of factors, most particularly the socioeconomic characteristics of people, the day of the week, the month of the year, the attributes of a greenspace and the availability and qualities of alternative greenspaces.

The model is estimated from data collected in the Monitor of Engagement with the Natural Environment (MENE) survey. The MENE survey provides information on the recreational behaviour of a large, representative sample of adults (over 16 years of age) resident in England. Over the course of a week, each respondent records when they visited greenspaces and for one randomly-selected visit the exact location of that visit.

The fundamental assumption of the model is that the choices observed in the MENE data are somehow welfare-maximising. By 'welfare' we are referring to the sense of well-being or utility that an individual feels from their experiences. So when an individual is observed to have taken a trip to enjoy greenspace, we assume that the welfare of taking a trip at that time exceeds the welfare of doing something entirely different (say watching the TV or going shopping). Likewise when an individual is observed to have chosen a visit to one particular recreational site, we assume that the welfare derived from that visit exceeds the welfare that would be enjoyed from visiting an alternative site. Our model seeks to use that information to build a function which describes the welfare an individual gets from making different recreational choices. Indeed, it is this welfare function that is used in ORVal to estimate the welfare values generated by different greenspaces (see Box 3).

In the model, a large number of variables are used to capture important arguments in the welfare function. For example, the welfare that a person gets from taking a trip is modelled as depending on a person's socioeconomic characteristics, the location in which they live, the day of the week and the month of the year. In a similar vein, the welfare derived from visiting a particular greenspace is modelled as a trade-off between the benefits of enjoying time at that site and the costs incurred in getting there. In the model, those on-site benefits depend on the size, land covers, water margins, designations and points of interest that characterise a particular greenspace. Likewise, the costs of getting to the site are calculated as the sum of a 25p per km travel cost (based on estimates of the average variable costs of car travel) and the costs of travel time (based on Department for Transport estimates).

While the data provides lots of information from which to estimate the welfare benefits of visiting greenspace our model is still statistical. Ultimately, we are able to use the model to make probabilistic predictions; How likely is it that a person with particular characteristics living in a particular location will choose to take a visit to greenspace on some particular day? How likely it is it that on that day a person will choose to visit each of the multitude of accessible greenspaces available to them, given the characteristics of each of those greenspaces and the costs of travelling to them?

2. The ORVal Map Interface

- The screen that users arrive at upon navigating to the ORVal site is shown below.
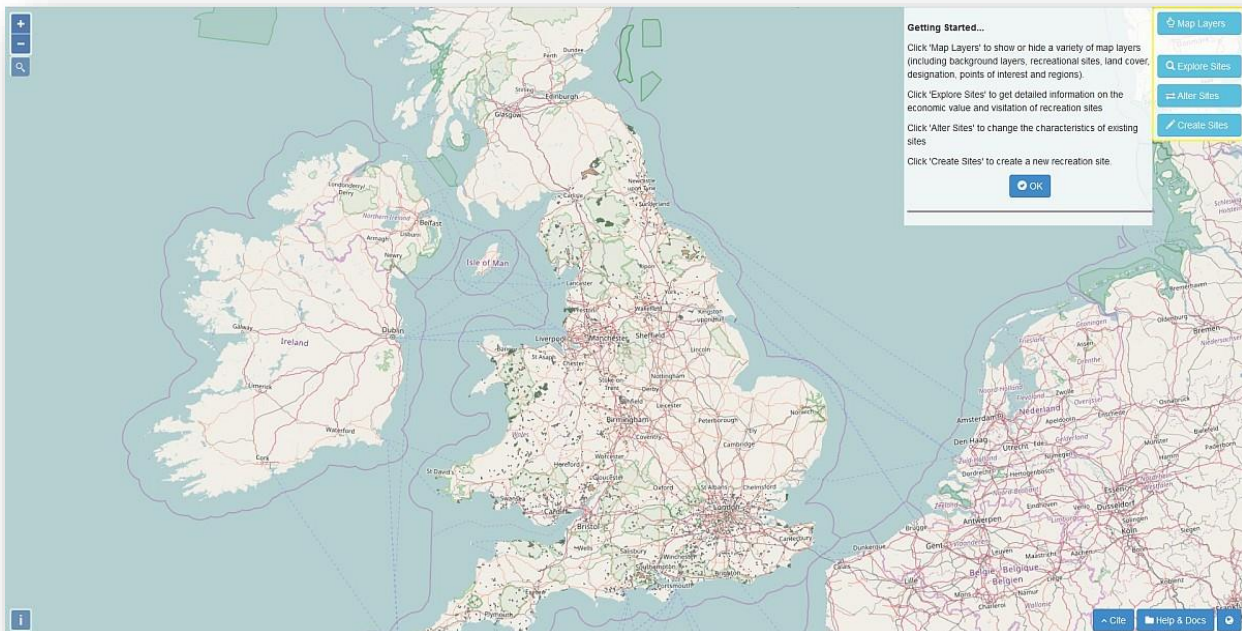
- The default ORVal screen presents the locations of accessible greenspaces across England and Wales[1], presented on a background map provided by OpenStreetMap.

- Users interact with ORVal through this map-based interface and through a series of menus and wizards.

- The process of navigating around the ORVal map follows protocols familiar to users of map-based web applications.

    o **Zoom** in or out using either the ⊞ or ⊟ buttons on the left of the screen or by using the mouse's scroll wheel.

    o **Search** and zoom to a location using the 🔍 button and typing a city/town, address or coordinates. The search function uses the OpenStreetMap Nominatim search engine.

    o **Pan** across the map by grabbing (clicking and holding the left mouse button) then moving the mouse to pull the map in the direction you wish to move.

- The greenspaces identified on the ORVal map take three different forms:

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[1] The map was constructed through the collation of an array of spatial data sources details of which can be found in the project report "ORVal Data Report" (http://leep.exeter.ac.uk/orval/pdf-reports/orval_data_report.pdf).

o **Areas** (accessible greenspace contained within well-defined boundaries over which visitors usually have freedom to wander)

o **Paths** (walkable routes that pass through greenspaces but confine visitors to defined routes of passage) [2]
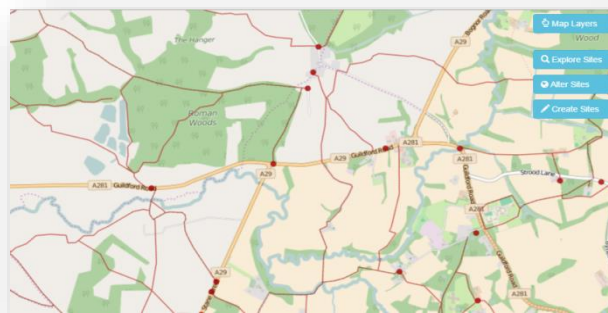
o **Beaches**

- The core functions of ORVal are accessed through the four buttons at the top right of the screen. These allow users access to;

  o Display different layers of map data (**Map Layers**)

  o Explore estimates of the visitation and welfare value generated from recreational use of different greenspaces (**Explore**)

  o Investigate how altering the land cover at existing recreation sites will change visitation and welfare values (**Alter**)

  o Investigate how much additional visitation and value would be generated by creating a new recreation site in a particular location (**Create**).

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[2] The distinction between areas and paths is somewhat blurred. Nature reserves, for example, which have well-defined extents but often restrict visitors to a limited paths network.

Box 2: Estimating Visitation

The Recreation Demand Model can be used to estimate and predict visits to greenspaces. In particular, the model allows us to predict how likely it is that an individual will take a trip to a particular greenspace on a particular day. That likelihood differs according to the socioeconomic characteristics of the person, the attributes and proximity of the greenspace and the attributes and proximity of alternative recreational greenspaces.

To generate estimates of the annual number of visits to a particular greenspace we draw on data from the 2011 UK census. For each Lower Super Output Area (LSOA) in the census in England and Wales, that data records the number of adults in each of the socioeconomic groups used in the model. Visitation predictions for a particular greenspace are reached through the following set of calculations:

- For each socioeconomic group in an LSOA, we use our model to calculate the probability of taking a trip to the focus greenspace on a particular day at a particular time of year.

- Adding those probabilities up for each individual from each socioeconomic group in an LSOA provides an estimate of the expected number of visits from that LSOA to that greenspace on that day.

- Given visitation varies across months and days of the week, we reach an annual visitation figure from an LSOA by summing expected visitation numbers calculated for each different day of the year.

- Finally we repeat those calculations for each of the 32,844 LSOAs in England and 1,909 LSOAs in Wales and sum the results to arrive at a final prediction of the annual number of visits to a particular greenspace.

Estimating visitation rates for a new recreation site simply entails performing those calculations for the new site. Likewise, In order to estimate changes in visitation that arise from altering the attributes of a particular greenspace, we compare visitation levels estimated before and after the change in attributes.

In addition to predictions of annual visitation, the ORVal model also returns two other interesting predictions regarding trips to a site;

- <u>Visits by mode of transport</u>: predictions of how many of the visits to a site are made by motorised transport ('by car') or by other modes ('not by car') where the latter is assumed by the model to be walking.

- <u>New visits</u>: predictions of the number of 'new' visits generated by the site. Here the model is examining the substitution possibilities open to people visiting a particular site. Clearly, some of those visits will be by people who would go to an alternative greenspace if that particular site were not available. On the other hand, some of the trips will be made by people who would otherwise simply not have made a trip to an outdoor greenspace. The new visits reported by the tool are estimates of how many of the visits to a particular site are greenspace trips that would not have occurred without that site.

3. Map Layers

- ORVal draws on a large number of spatial datasets. By Clicking on the ⚲ Map Layers button users can change the map interface; choosing what is displayed and layering on additional spatial datasets.

- Six different types of map layer are made available through ORVal; Backgrounds, Recreation Sites, Land Covers, Designations, Regions, Value Maps.
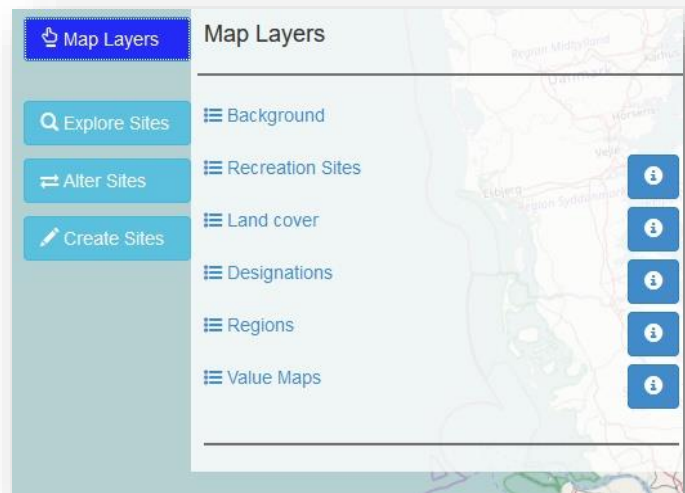
- The key for a Map layer can be turned on or off by pressing the information button ⓘ next to that layer.

3.1 Background

- ORVal currently offers OpenStreetMap as the **Background** map layer.

- The opacity of the background can be altered by adjusting the slider across the range from 0 (fully transparent) to 1.0 (fully opaque).

3.2 Recreation Sites

- Expanding the **Recreation Sites** list allows users to choose which types of Recreation Sites are displayed on the Map.

- By default all recreation sites (areas, paths, and beaches) are displayed.

- To avoid over-cluttering, note that the paths and beach layers only becomes visible once the user has zoomed in to a sufficiently small area of the map.
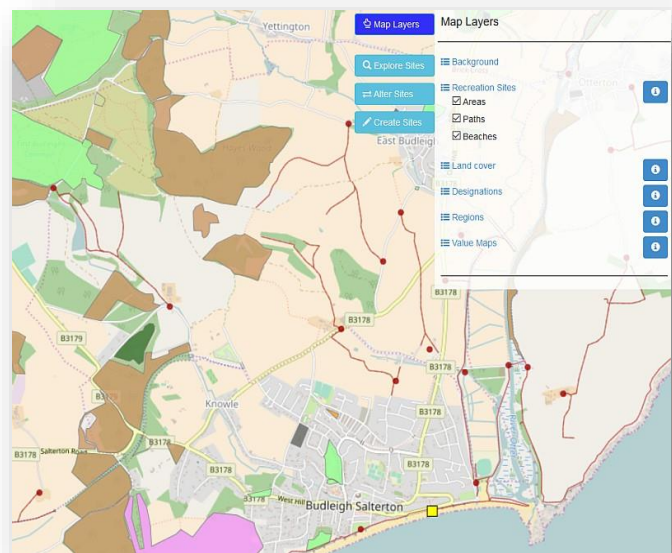
- By pressing the information button ⓘ next to the Recreation Sites list, users can display the Recreation Sites key. For display purposes, recreation areas are classified into one of 7 categories reflecting the key land cover or land use of an area. The colour-codes used are shown in the key.

- Paths are shown as red lines on the ORVal map.

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- Since path networks may be very extensive we assume that the recreation experience enjoyed by visiting a path network can be attributed to the point at which a visitor accesses that path network. Path access point are shown as red circles on the ORVal map[3].
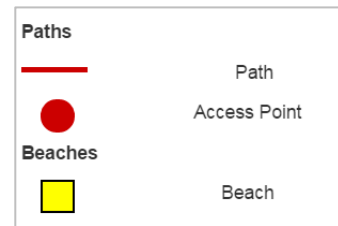
- Beach locations are shown on the ORVal map as yellow squares.

3.3   Land Cover

- In ORVal, the characteristics of a recreation area are described (in part) by its Land Cover.

- Land Covers can be displayed through the **Land Cover** list in the Map Layers Menu.

- Land Cover are displayed as colour-coded dots located on a 25m grid over recreation sites.

- For paths, land covers are identified for the area in a 25m region each side of the path.

- The land cover key can be displayed by pressing the information button next to the land cover list. Fifteen different forms of land cover, land use and water margins are identified in ORVal, as follows;

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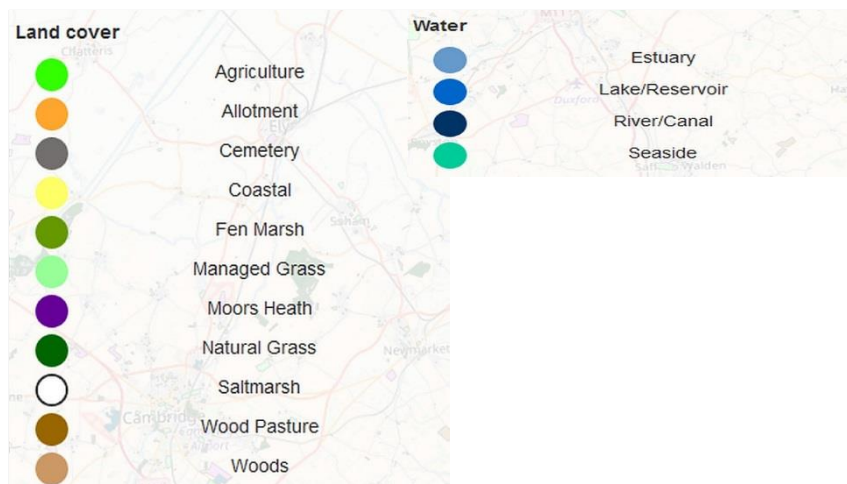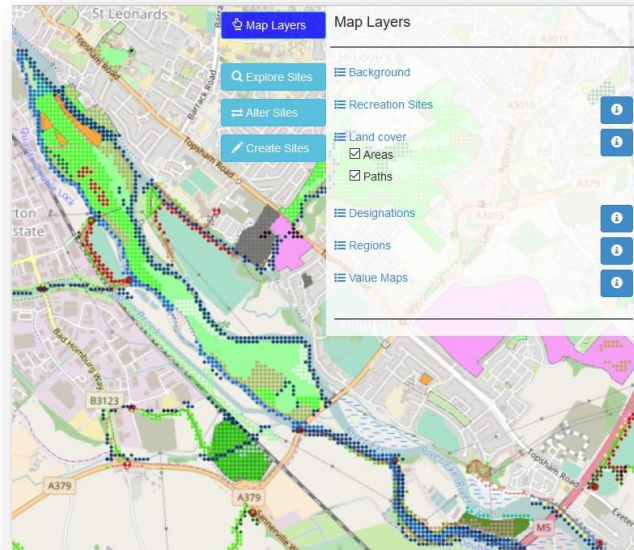
[3] Note that access points are identified by a spatial algorithm that looks for 'dangling ends' of paths within 50m of the road network. In some cases numerous access points to the same path network are found within close proximity to each other. In those cases, the group of access points is approximated by an access point located at the centroid of the group. For this reason some access points on the map are approximations and may not fall exactly on the paths network.

3.4   Designations

- Recreation Sites are also described by the extent of land on that site under special designation or ownership.

- Designations can be displayed through the **Designation** list in the Map Layers Menu.

- The designation key can be displayed by pressing the information button next to the designations list.
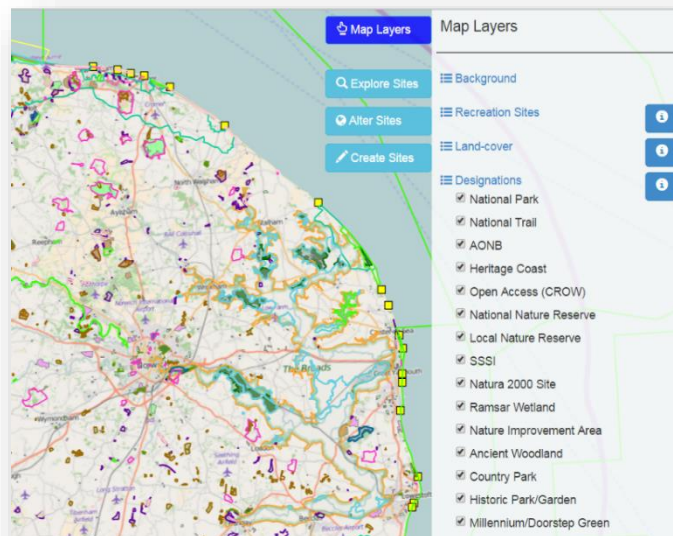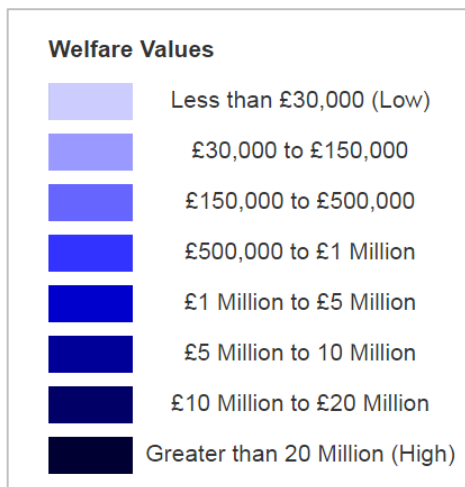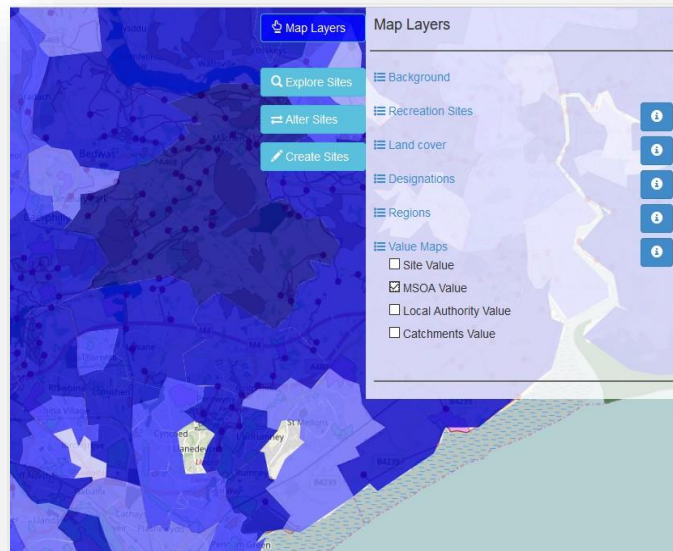

3.5   Regions

- The **Regions** layer allow the user to overlay a variety of spatial boundaries.

- The user can select:

  o **Middle layer Super Output Area** (MSOA) taken from the 2011 UK census.

  o **Local Authority Areas**, taken from the Ordinance Survey's Boundary Line package.

  o **Catchment Areas** taken from the National Flood Risk Assessment (NaFRA) for England.
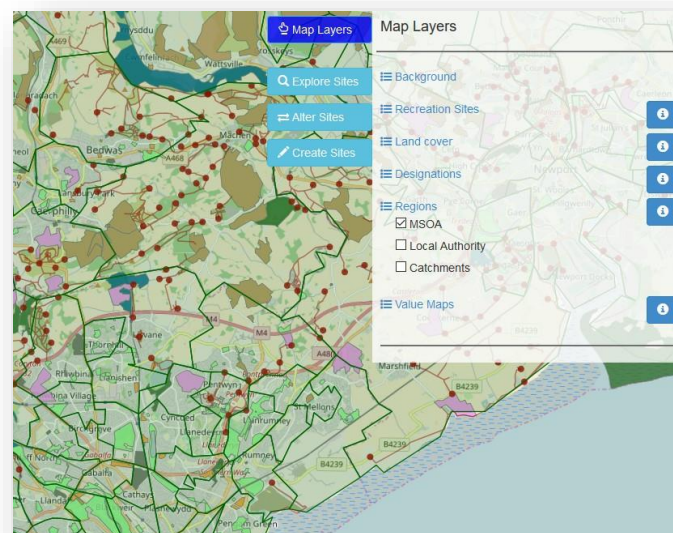
3.6   Value Maps

- The **Value Maps** layer allow
  users to visualise the welfare
  values generated by accessible
  greenspace.

- Welfare values are calculated
  for each recreational site using
  the Recreation Demand Model.
  The welfare value of a site is a
  monetary estimate of the extra
  welfare enjoyed by adult
  residents of England and Wales
  from being able to access that
  site (see Box 3).

- The Value Maps allow users to view welfare values either for each site or aggregated by
  regions (Middle Super Output Areas, Local Authority Areas or Catchment Areas). To be clear,
  aggregated values represent the sum of values generated by the sites that fall within the
  boundaries of a region.

Welfare Values

	Less than £30,000 (Low)
	£30,000 to £150,000
	£150,000 to £500,000
	£500,000 to £1 Million
	£1 Million to £5 Million
	£5 Million to 10 Million
	£10 Million to £20 Million
	Greater than 20 Million (High)

- Welfare values on the Value maps are colour
  coded with darker blues representing higher
  values.

- The range of values represented by the colours
  can be viewed by pressing the information button
  next to the Value Maps list. Regions coloured
  white contain no recreational sites.

- Note that the value ranges represented by the
  colours differ across the different levels of
  aggregation.

Box 3: Estimating Welfare Values

The Recreation Demand Model can be used to estimate welfare values for greenspaces. By 'welfare value' we mean a figure describing the monetary equivalent of the welfare enjoyed by individuals as a result of having access to a greenspace. In economics this welfare value is often alternatively called an 'economic value' or a 'willingness to pay'. Welfare values are useful for decision-makers in applying cost-benefit analysis to appraise projects that impact on greenspace.

Our calculation of welfare values is enabled by the fact that the recreation demand model provides an estimate of the recreation welfare function (see Box 1). That function identifies how much welfare an individual enjoys as a result of beneficial attributes of a greenspace (e.g. the extent of woodland, the presence of a children's playground). Likewise, it identifies how much welfare is lost from each extra pound of cost incurred in travelling to a greenspace. The latter amount is crucial in calculating welfare values. It tells us the amount of welfare a person considers is equivalent to having one extra pound. In other words, it provides an exchange rate that we can use to convert estimates of changes in welfare into equivalent amounts of money.

Welfare values for an existing site are estimated by calculating how much each individual's welfare would fall if they were no longer able to access that site and then converting that welfare quantity into an equivalent monetary amount. Those welfare values can then be aggregated over the adult population of England and Wales for an entire year using the same sequence of steps as used to aggregate estimates of visitation (see Box 2).

Estimating welfare values for a new site follows the same logic. First we calculate, the welfare gain enjoyed by adding this new site to the set of greenspaces available for individuals to visit. Then we convert that to a money equivalent and aggregate to give an annual figure for the whole population. Likewise, the welfare value of a change in greenspace attributes is calculated by aggregating monetised estimates of the welfare changes expected from that change in attributes.

Note that the greenspace welfare values presented in ORVal are estimated under the assumption that the accessibility and attributes of all other greenspaces do not change. Recall that the value of a recreation site is taken to be the monetised welfare loss experienced by individuals if they could no longer visit that greenspace. Of course, that welfare loss will be mitigated the more alternative recreation sites there are that an individual could visit instead. In other words, the level of welfare loss depends crucially on the availability of substitute sites. If we are considering the welfare value provided by a set of recreation sites, then two measures suggest themselves;

- Either add up the welfare value provided by each greenspace assuming that the other sites remain as possible substitutes, a quantity we describe as summing marginal values.

- Or, calculate the welfare value of removing all of the greenspaces simultaneously.

The latter must exceed the former since removing all the greenspaces simultaneously reduces the availability of substitute sites. While the recreation demand model could be used to calculate welfare values that assume simultaneous removal of greenspaces, ORVal currently presents only the relatively conservative estimates derived from summing marginal values.

4.   Explore Sites

- The Explore functionality allows users to examine the model's estimates of the usage and welfare value generated from the recreational use of the different greenspaces (see Boxes 2 and 3).

4.1   The Explore Panel

- Pressing the [Q Explore Sites] button brings up the **Explore Panel**, allowing users to choose the level of aggregation at which they wish to view information on the greenspaces.

- Seven options are available; users may view information either presented for individual **Sites** or aggregated within Regions (**MSOA**, **Local Authority**, **Catchment**, **National Parks** or **National Trails)** or aggregated across the whole of England or Wales (**National**).

- Selecting one of the options in the explore panel, allows users to begin selecting features on the map and viewing information on those features.
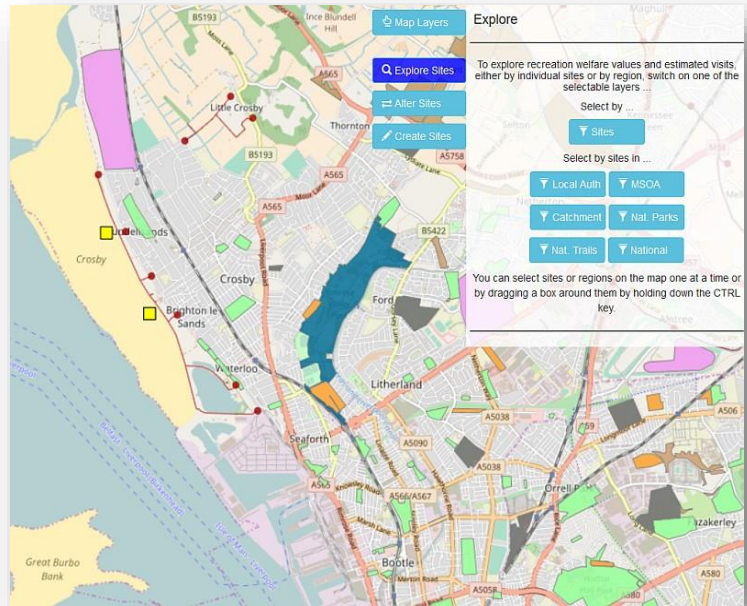
4.2   The Current Site Information Panel

- Information is displayed to the left of the screen in the **Current Site Information Panel**.


- Clicking on a feature on the map will populate the Current Site Information Panel, displaying the name and ID of the selected feature and a series of lists containing feature data.

- When a feature on the map is clicked it will be highlighted and the ID number will also appear on the map.

- That data in the Current Site Information Panel is organised into **Simple** and **Detailed** tabs. Information on estimates of visitation, new visits and welfare values can be viewed either in aggregate (in the simple tab) or broken down by socioeconomic segments or mode of transport used (in the detailed tab). The detailed tab also shows land cover details, designations and points of interest.

- Expanding a list reveals the information for the selected feature.
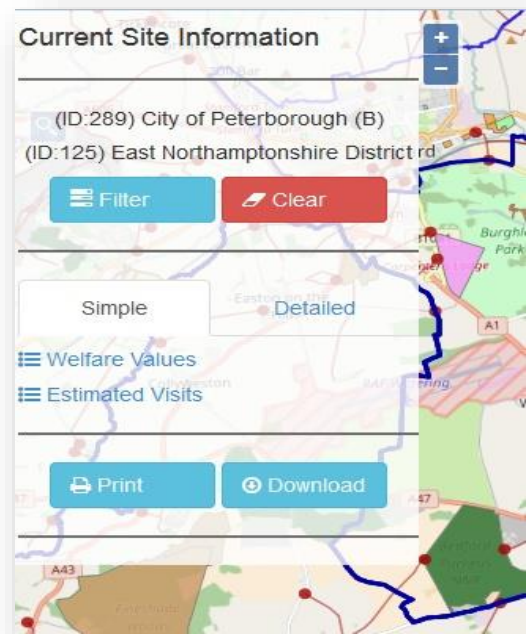
4.3 Multiple Selection

- Multiple sites or regions can be selected. One option is to simply click another site or region, the details will be displayed in the Current Site Information Panel on the left of the screen identified by that features unique ID number.

- Alternatively, select multiple features by holding down the CTRL key to drag a rectangular box. The drag box selection works together with the single click selection to allow seamless change between the two selection methods.
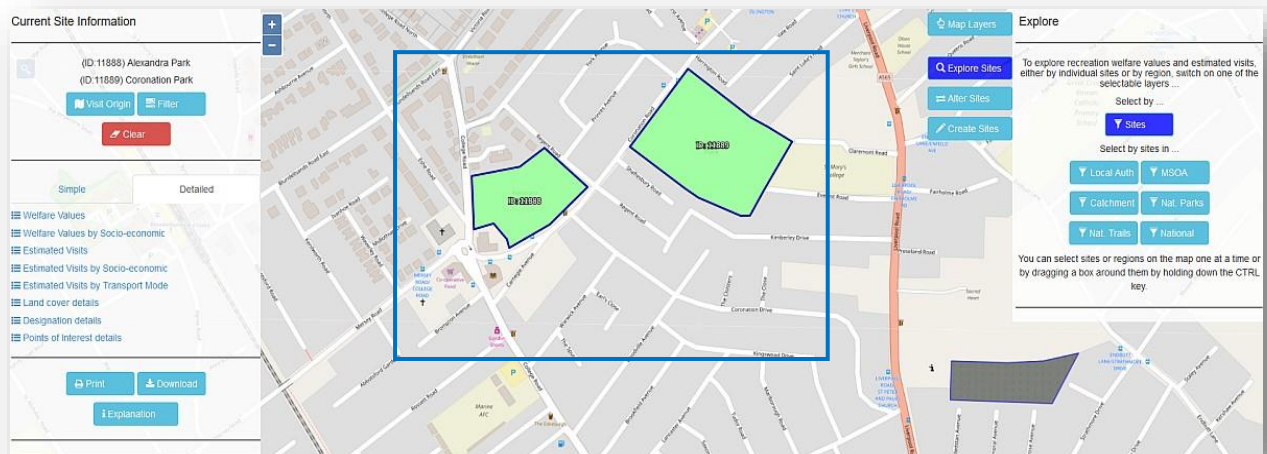

- Users can clear down the selections they have made in the Current Site Information Panel by pressing the [Clear] button.

- Users can download a permanent record of the results by pressing the [Download] button or view a print friendly version of the results by pressing the [Print] button. An explanation of the data provided in the csv file can be obtained by clicking the explanation button.

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4.4   Filtering Results

- When exploring data in Sites mode, users have the ability to select multiple sites. Likewise, when exploring data in Region mode (i.e. by choosing Local Authority, MSOA, Catchment, National Park, National Trails or National in the Explore Panel) then users are selecting all the sites in the selected regions.

- As an example, a user could select a local authority and then use the Filter functionality to look at the visits and welfare values generated by the greenspaces that border rivers and lakes. Alternatively, a user might select a number of MSOAs and then use the Filter functionality to narrow the information to those sites that contain woodland and have SSSI designation.
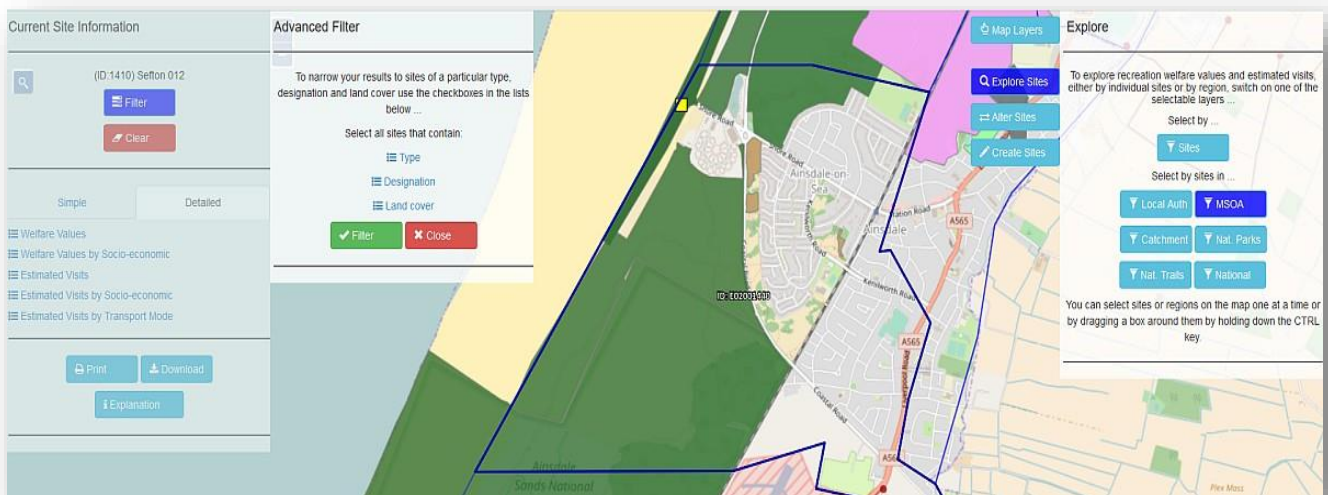
- To access the Filter Dialogue, first select one or more regions or sites then press the [Filter] button in the Current Site Information Panel.

- The Advanced Filter Panel will appear, presenting three lists of site characteristics that can be used to filter the selection.
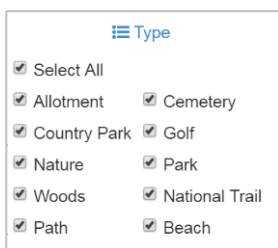

- The Type List allows users to narrow their selection to particular types of greenspace.
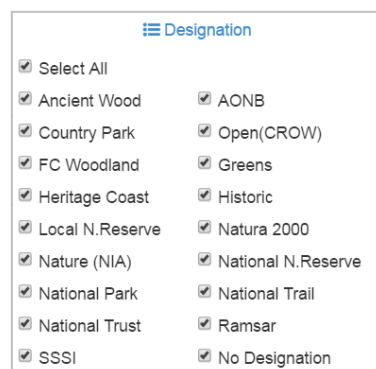
- The Designation List allows users to narrow their selection to greenspaces under special designations.

- Notice the 'No Designation' category that ensures users can restrict their selection to greenspaces which do not have any special designations.

- The Land Cover List allows users to narrow their selection to greenspaces that contain certain land covers, land uses or water margins.

- IMPORTANT: When filtering on multiple criteria (by ticking a number of different items from the filtering lists) ORVal joins from different lists with an 'AND' and from within lists with an 'OR'. For example, if a user ticked 'Nature' (Type) and 'National Park' (Designation) and 'Saltmarsh', 'Estuary', 'Fen Marsh' (Land covers) then the filter would select greenspaces that are classified as Nature AND designated as National Parks AND contain some land covered in Saltmarsh OR Estuary OR Fen Marsh.

- Once the desired greenspace characteristics have been selected in the Filtering dialogue users can press the [✔ Filter] button to continue or the [✖ Close] button to go back and start again.

- On pressing the [✔ Filter] button, the Filter Dialogue Panel will display a summary of the attributes on which the user is filtering.
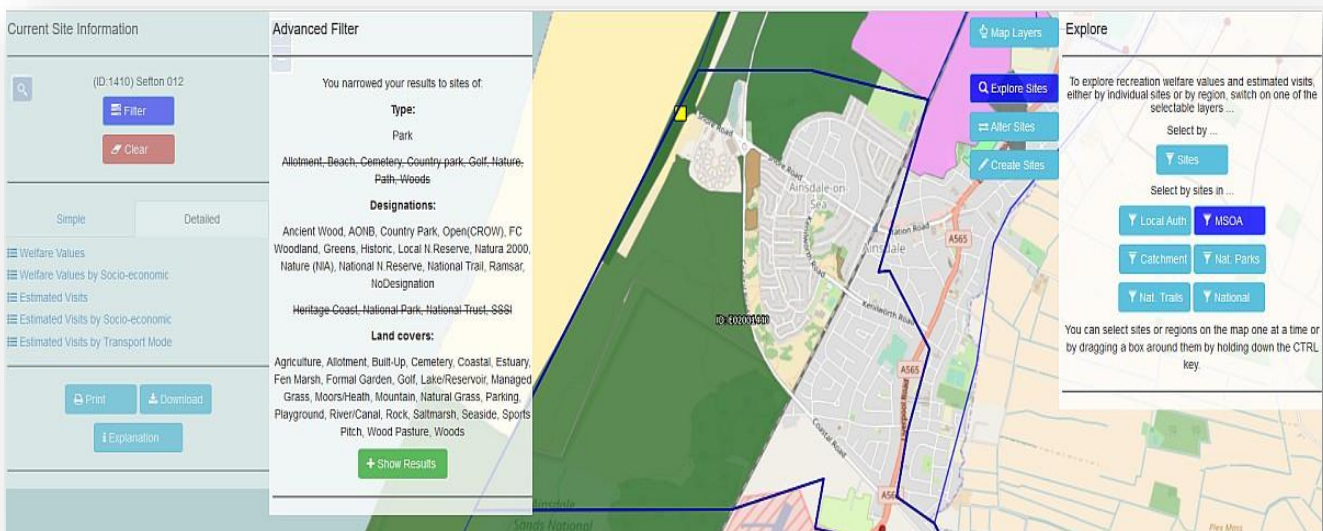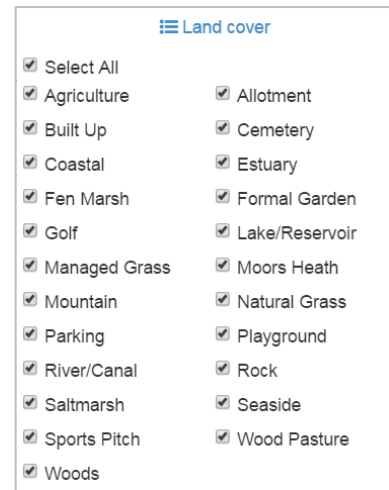
- Pressing the [+ Show Results] button allows the user to view data for their narrowed selection.

- As usual that data is presented in the Current Site Information Panel.
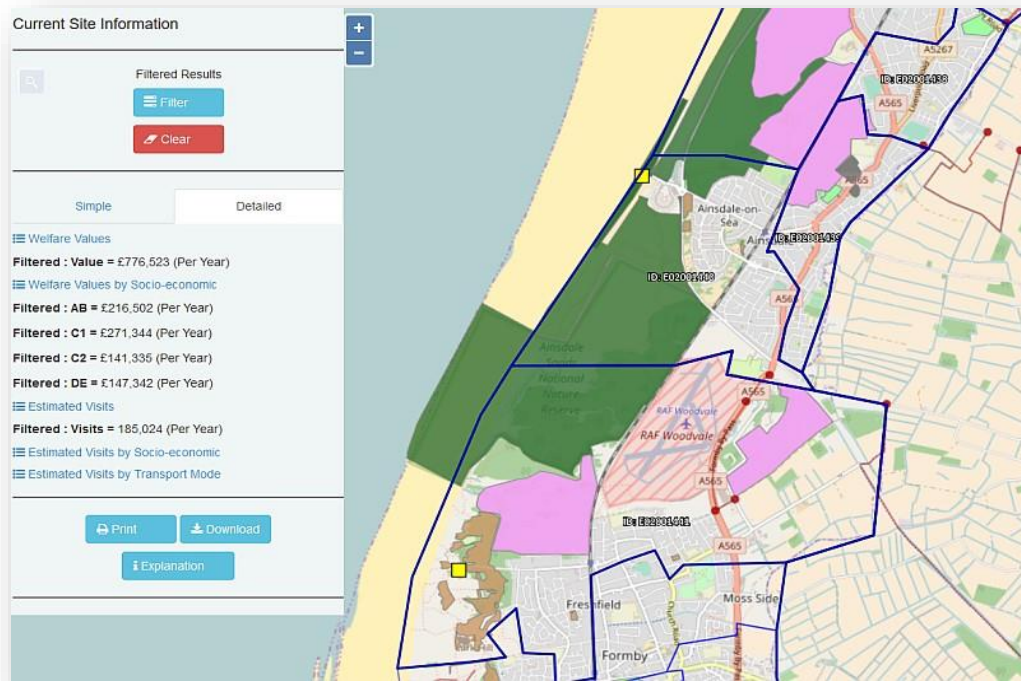
- Note that the figures presented in that panel represent the sums of welfare values and visits for those greenspaces in the original selection of sites or regions that meet the users filtering criteria. For example, the data might show the total value and visits to greenspaces within a local authority that have woodland.

- Again, users can download a permanent record of the results of their query by pressing the ⬇ Download button or view a print friendly version of the results by pressing the 🖨 Print button.

4.5 Visit Origin

- The visit origin function allows for the visualisation of where the visits to a particular site originate from.

- Clicking the visit origin button opens the visit origin panel.

- The visit origin panel allows the users to change the sophistication of the travel cost calculation method and to set the minimum number of visits required from an LSOA to be displayed in the visualisation.

- Setting the travel cost calculation to Crude Approx. means the model uses straight line distances between the LSOA's and the sites in the calculations. Setting it to Good Approx. uses the road network, and setting it Exact uses the road and path networks in the calculation.
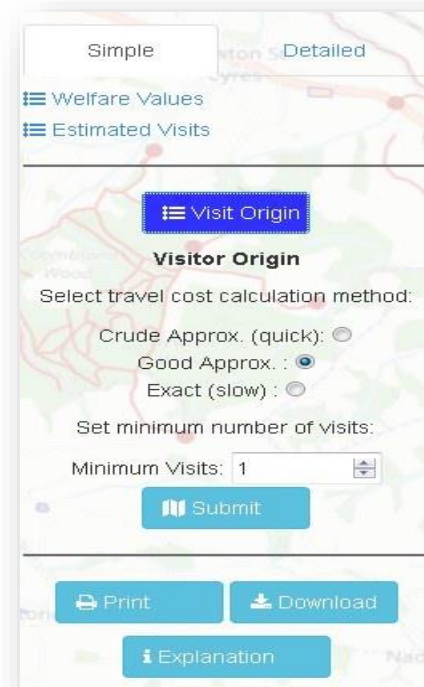
- The choice of a more sophisticated travel costs calculation method results in a longer wait for the user before the results are returned.

- The minimum visits number can be used to restrict the visit origin to LSOA's that provide over a certain number of visits to the site. For example, a minimum visits of 10 will fetch data for every LSOA that has 10 or more visits to the selected site.

- Clicking the submit button will run the visit origin function. It loads small circles on to the map, these circles are located at the centre of LSOAs that the model predicts visitors to the site would come from. The size of the circle corresponds to the number of visitors so that the larger the circle the more visitors.

- Hovering the mouse over each circle reveals a box which contains the number of visits associated with that LSOA for the selected site.

- Note that the visit origin function only works for a single site.

- Users can clear the visit origin visualisation from the map by pressing the Clear button.
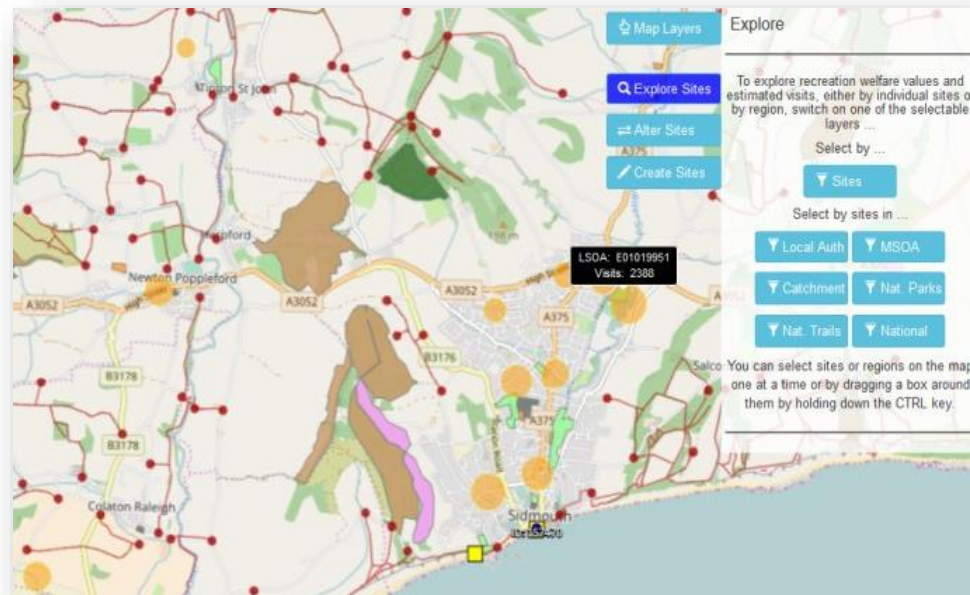
5. Alter Sites

- The **Alter Sites** functionality allows users to investigate how altering the land cover or the area of existing recreation sites will change usage and welfare values.

5.1 The Alter Panel

- Pressing the [Alter Sites] button brings up the **Alter Site Characteristics Panel**.

- To begin, press the [Sites] button which enables the selection of sites on the map and brings up the Current Site Information panel.

- Select the site whose attributes are to be altered. Its name and ID number will appear in the Current Site Information panel.

5.2 Travel Cost Method

- Setting the travel cost calculation to Crude Approx. means the model uses straight line distances. Setting it to Good Approx. uses the road network, and setting it Exact uses the road and path networks in the calculation.

- The choice of a more sophisticated travel costs calculation method results in a longer wait for the user before the results are returned.

5.3 Site Area

- The area of existing sites can be altered using the area box. This automatically shows the existing area size in hectares and can be altered to show how changes in site area might impact on usage and welfare value.

- Altering the area is only available for recreational areas not paths or beaches, when a path or beach is selected whilst in 'alter' the area alter box will not show.

5.4 Site Land Covers

- To alter the site's land cover, expand the land cover list by pressing :≡ Land cover. This will bring up a list of: Managed, Natural, Water and Other.

- The land covers for the selected site, in its present state, are displayed.

- To experiment with how changes in land cover might impact on usage and welfare value, alter land covers by clicking in the boxes next to the various land covers and changing the percentage amounts.

- The land cover for Managed and Natural must together add up to 100%. The water margins and other categories can be changed as required.

- Once the new land covers have been entered press the ✔ Update button to confirm that the new land cover extents add up to 100%. If they do not, then make alterations until they do.

5.5 Site Water Margins

- The Water Margins tab shows the water margins for the selected site, in its present state.

- The water margins can also be changes to show how they might impact on visitation and welfare value, alter water margins by clicking in the boxes next to the various water margins and changing the amounts which are in metres.

5.6 Other

- The Other tab shows the other characteristics which users are able to alter: Presence of a playground, river water quality, and, for beaches, bathing water quality.

- These characteristics are shown for the selected site, in its present state and can be altered by the user.

5.7   Results
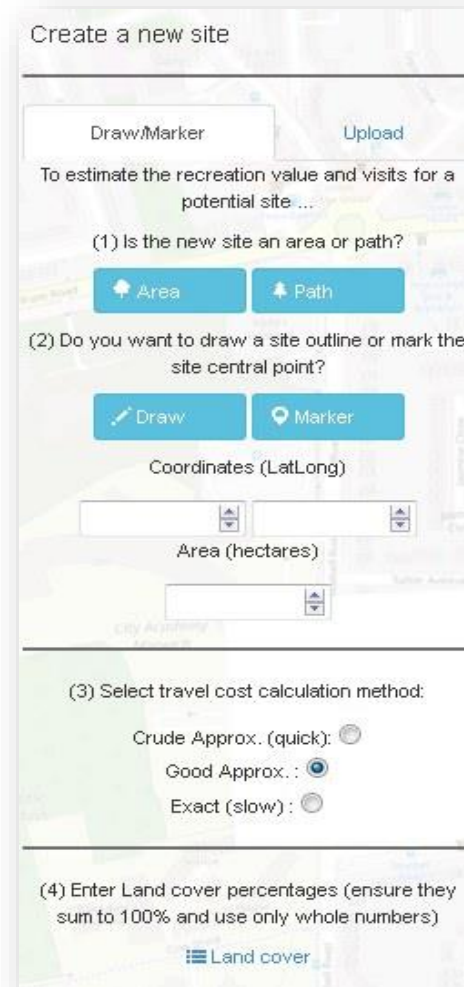
- Press the ✔Submit button to calculate predictions of how welfare values and visitations might change due to the change in attributes.

- Once the calculations are complete the Information Panel will be automatically updated with details of the predicted changes in welfare values and visits resulting from changing the sites attributes.

- Note that the quantities that are displayed in the Map Information Panel are recorded in terms of changes from the welfare values and visit predictions for the selected site with its current attributes.

- Users can download a permanent record of the results of their query by pressing the ⬇Download button or view a print friendly version of the results by pressing the 🖨Print button.

6. Create Sites

- The **Create Sites** functionality allows users to investigate how much additional usage and value would be generated by creating a new recreation site in a particular location.

6.1 The Create Site Panel

- Pressing the [✎ Create Sites] button brings up the **Create New Site Panel**.

- The procedure for creating a new recreation site proceeds through four steps.

- In the first step, users select whether the new site is a [📍 Park] or a [🌲 Path].

- In the second step, users choose how to represent the new site on the map.

  - By selecting the [✎ Draw] button, the greenspace can be drawn directly on the map.

    - If creating an area then the draw feature allows users to outline the boundary of that area, clicking at a location on the map to add a vertex and clicking twice on the final vertex to complete the area outline.

- If creating a path then the draw feature allows the user to draw the route on the map, clicking at a location on the map to add a vertex and clicking twice on the final point to complete the path.

- On finishing by clicking twice, the new greenspace extent turns from a dashed line to a yellow line and the area (area feature) or length (path feature) of the new greenspace is displayed in the Create New Site panel.

- The location of the new greenspace is also displayed in units of latitude and longitude in the Create New Site panel.

- Alternatively, selecting the [Marker] button, allows the user to represent the greenspace in the very simplest manner possible;

  - Clicking on the map places a yellow marker on the map. If the user is creating a new area then this will be taken to represent the centre of that greenspace. If the user is creating a new path then this is taken to be the access point.

  - When creating sites in marker mode, the user must manually insert the extent of the new greenspace, either entering an area in hectares for an area greenspace or a length in kilometres for a path greenspace.

- In the third step users can set the travel cost calculation as described in section 5.2.

- In the fourth and final step, users define the land cover, water margins and other characteristics of the new greenspace by expanding the [Land cover] list in the Create New Site Panel as described in section 5.4, 5.5 and 5.6.

6.2   Heat Map

- For those who want an indication of the best potential location for a new recreation site there is a heatmap function at the bottom of the create site panel. The heat map function returns the welfare value and visits for a grid of 25 possible sites locations around the point specified by the user in the second step above (the draw or marker on the map).

- Clicking the blue heatmap button opens the heatmap panel. The user is required to enter a number which determines the distance between points of the grid. We recommend values between 1,000 (1km between potential new recreation site locations) and 10,000 (10km between locations).
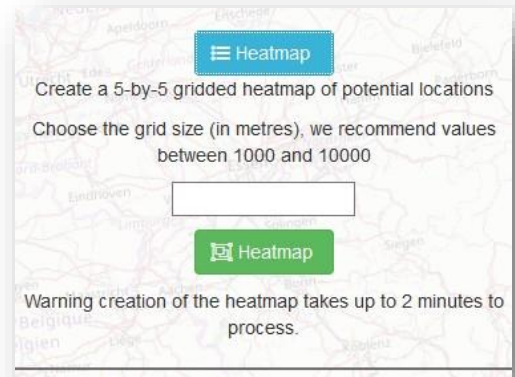
- Once all steps for the create site (see above in section 6.1) and the grid size number have been entered the green heatmap button can be pressed.

- Circles will then appear on the map one-by-one. The size of circle corresponds to the predicted welfare value so that the larger the circle the higher the welfare value from that potential site location.

- The user can cancel the heatmap whilst it is being generated by clicking the 'stop heatmap' button at the bottom of the page.
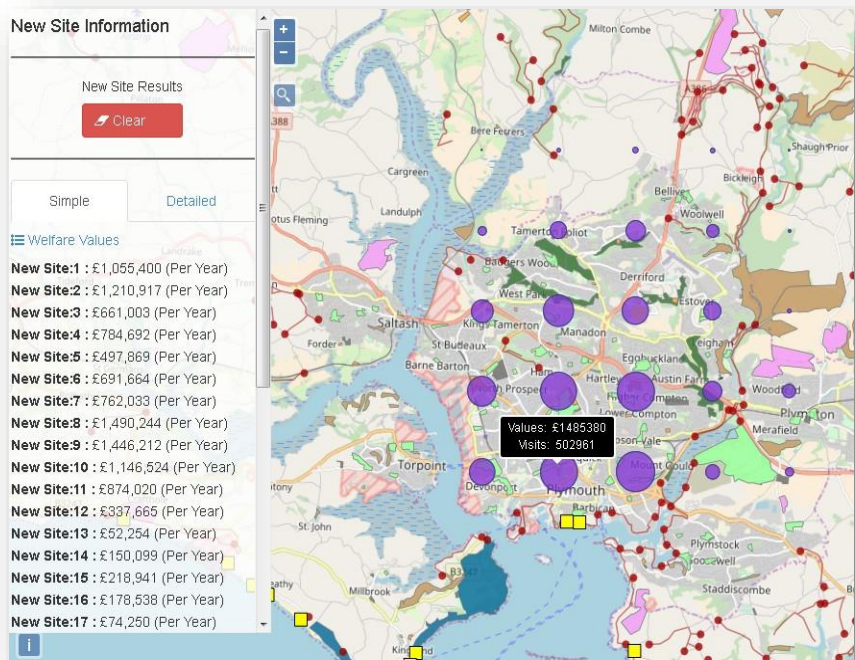
- Hovering the mouse over each circle reveals a box which contains the number of visits and welfare value associated with that site location.

6.3   Batch Upload

- For users who want to create a lot of new sites there is a batch upload tab in the create sites menu. Rather than individually drawing or marking sites on a map, using the batch upload enables multiple sites to be created simultaneously.

- To use the batch upload function a csv file needs to be prepared which follows exactly the format of the template csv file. In particular, each new site is a row of the csv file with 26 columns.

- Once the csv file has been prepared it can be uploaded.

- To upload a csv file, click the browse button and navigate to your csv file. You will receive a message which summarises the file and tells you how many new sites will be created. If this number is as expected click submit to create the new sites.

6.4   Results for Creating a New Site

- Once the calculations are complete for either the (6.1) draw/marker create site, (6.2) heatmap or (6.3) batch upload the results will be automatically written to the New Site Results Panel to the left of the screen with details of the predicted changes in welfare values and visits resulting from creation of the new site(s).

- Users can download a permanent record of the results of their query by pressing the ⬇ Download button or view a print friendly version of the results by pressing the 🖨 Print button.

7. Help and Docs

- The help and documentation for ORVal is located at: http://leep.exeter.ac.uk/orval/documents. It contains all reports on ORVal, including this user guide, a spatial data set report, describing all the data used as part of this project and an advanced technical report on the econometric model used in ORVal.

- The help and documentation also contains case studies which use the ORVal tool and all datasets made available for download as part of this project.