

## The Map tool

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## The Map tool

Using maps to visualise the location of sites can be a powerful method for both analysing data and detecting errors. BioLink recognises this importance and includes a built-in mapping tool. This tool displays site-based information on user-definable maps. Information can be for a single site, a named place selected from the on-line gazetteer, or for all sites for a taxon or set of taxa.

## The Map tool window

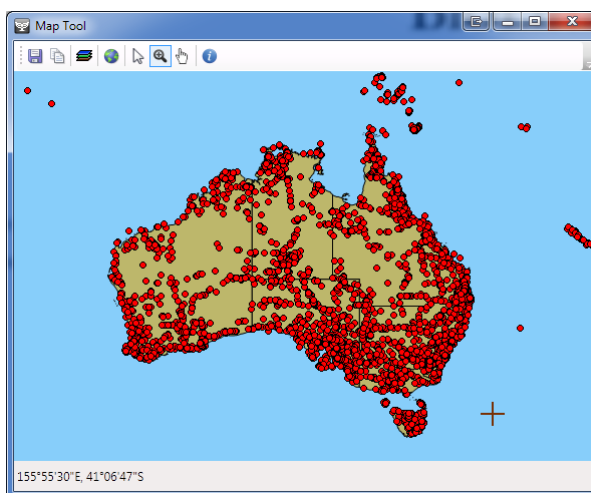
The main map window displays a user-selected map that can range in scale from global to local. This map can be composed of layers, each layer containing different but related information. For example, coastlines can be on one layer while country boundaries are on another. This allows great flexibility by combining different layers to increase or decrease the complexity of individual maps. Within each layer, the colour and style of individual

items can be modified. The entire map can be zoomed, panned, copied to the clipboard, saved to disk and printed.

The main purpose of the Map tool is to display the location of sites. This can involve a single site or a collection of sites (for example, for a taxon). Once displayed, information about the site can be directly accessed using the mouse or can be displayed on a panel next to the map. The mouse can also be used to indicate the approximate coordinates of items on the map.

## ***Launching the Map tool***

The Map tool can be opened in a number of ways: from the main menu, from the Taxon Explorer, from the Site Detail window and from eGaz. In addition, the map tool is used to display the results of Predictive Distribution Modelling, and can also be launched of query and report results (if they contain site information). The information displayed by the map will depend on the method used to open it. For example, if opened from the Taxon Explorer, all geocoded sites for all material for the selected taxon and all of its children will be displayed. Note that map layers will always be displayed, independent of the method used to open the Assistant.



### ***Launching from the main menu***

Launching the Map tool from the main menu opens the map without any supplementary information. To open the Assistant, select the **Show Map** command under the **View** menu.

### ***Launching from the Taxon Explorer***

When opening the Map tool from the Taxon Explorer all geocoded sites for the selected taxon or taxa (at any level in the classification) are displayed. If the selected taxon has children (for example, a genus containing species) all geocoded sites for the selected taxon and all of its children will be displayed.

To launch the Map tool, open the Taxon Explorer, select a taxon, click the right mouse button and select **Distribution Map...** from the context menu.

### ***Launching from the Site Detail window***

If opened from the Site Detail window, the Map tool shows the location of the site (if geocoded). This can be of value when the geographic location of a site is uncertain or to check the accuracy of the geocoding.

To open the Map tool, find the desired site in the Site Explorer and open the Site Detail window for the site (see Site Explorer or Site Detail Window for details). Select the **Position** tab on the Site Detail window. In the lower left corner is a small “mini-map” showing the approximate location of the site. Double clicking on the mini map will open the Map tool and display the selected site.

### ***Launching from eGaz***

When called from eGaz (the “electronic” gazetteer) the location of the named place selected in the main eGaz window will be displayed together with any offset information. This can speed geocoding and reduce errors.

To open the Map tool, start eGaz (see eGaz for details) and press the **Show Map** button near the bottom of the window.

## **Changing the way maps look**

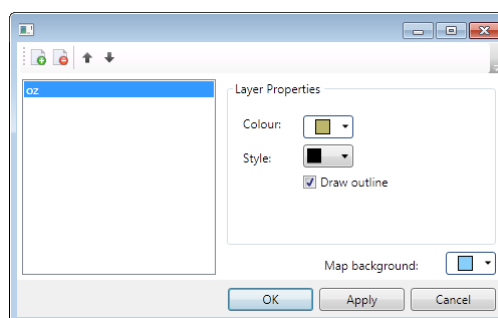
The map can be zoomed and panned using the mouse pointer and toolbar buttons. To zoom, select the **Zoom In** toolbar button, and use the left mouse button to draw a rectangle on the map. The area inside the rectangle will fill the window when the left mouse button is released. To zoom out, select the **Zoom Out** button and click on the map. The map will be reduced in size each time the mouse is clicked. If the map has been zoomed, the **Pan**

button can be used to move the map. Click the **Pan** button, place the mouse pointer over the map, hold down the left mouse button and move the mouse. The map will move (pan) as the mouse moves. To view the entire map, press the **Full Extent** button. This will fill the map window with the entire map. For details on changing the map being displayed, its colours and styles, see *Map Layers* below.

Details concerning selected items on maps can be contained in the shape file of each layer. To display these details, press the **Information** toolbar button. This opens a panel with a list of details for the selected item. If no items are selected, the list will be empty. To select an item, make sure the **Pointer** toolbar button is pressed and click an item on the map. The Information panel will be updated with details for the selected item. In some cases, items on different layers can be simultaneously selected. The layer number (starting with 0 for the uppermost layer) is displayed in the Information panel. In this way, the information for each layer can be distinguished.

## Map layers

The 'maps' displayed by the Map tool are composed of layers, each layer containing different but related information. A layer can represent a line or polygon (such as a coast line or state boundary), a series of lines or polygons (such as contour lines) or points (such as a taxon distribution). Any number of layers can be displayed at any given time. In most cases at least two layers will be used, a user-defined boundary layer and a BioLink-created point layer. The use of layers allows great flexibility by combining different layers to increase or decrease the complexity of individual maps.



Layer files must be formatted as ESRI shape files. This is the format used by ESRI's *ArcView* and *ArcInfo* GIS packages. Files in this format are available for a large range of areas and at a number of scales. BioLink comes with a variety of sample layers for Canada, New Zealand, the US and the world. These include layers for coastlines, states/provinces, counties, cities, lakes, rivers, and contour lines (not all types are available for all areas). These are located in the BioLink\Map Layers directory on the BioLink CD. Additional layers can be found on a number of Web sites and translators are available to convert files in other formats into the shape file format. The ESRI web site at <http://www.esri.com/> is a good place to start as is Blue Marble Geographics (<http://www.blumarblegeo.com>). The ESRI site contains many free layers as well as information concerning commercially available information while Blue Marble Geographics has a number of useful GIS tools (especially the Geographic Explorer) along with a number of free maps.

### Map Layers window

The layers displayed by the Map tool are added and removed using the Map Layers window. This window also allows the formatting and style of many layer objects to be controlled.

The Map Layers window is opened using the **Layers** command on the **Map** menu or by clicking the **Layers** button on the toolbar (the second button from the right). Map files must be in either ESRI Shape file format or be a georeferenced bitmap or TIFF (non-georeferenced files can also be displayed but their placement will default to 0°00"N 0°00"W with a scale of 1.0). For details of the ESRI Shape file format and availability of maps that use it, see *ESRI Shape Files* below. For details concerning georeferencing bitmaps and TIFFs, see *Displaying Raster-based Files* below.

### Adding a map layer

To add a map file, press the first toolbar button on the Layers window (the icon of the page) or click the right mouse button and select the **Add New Layer** command. This will open a File Open dialog that will allow the selection of a file. Once located and selected, press the **Open** button. This will add the file to the list in the Layers window. Pressing the **OK** or **Apply** button will update the Map tool and display the new map.

### Removing a map layer

To remove a map layer, select its name in the list and press the second toolbar button (with the X icon) or click the right mouse button and select the **Remove Layer** command. This will remove the selected layer from the list and ultimately the Map tool window (when **OK** or **Apply** are pressed).

### Saving a map layer

To save a map layer to disk select the required layer in the list and press the third toolbar button (with the disk icon) or click the right mouse button and select the **Save As** command. This will open a Save As dialog box where a file name and path can be specified. Pressing the **Save** button will save the layer to disk.

### ***Map layers and display order***

The Map tool can display any number of map layers at any one time. These separate layers are superimposed over the top of each other and items on lower layers will often be hidden by items on upper layers. To change the display order of layers, select a layer and use the **Up** and **Down Arrow** toolbar buttons to move it relative to other layers. Alternately, drag and drop can be used to move layers relative to each other. The layers will be displayed in the order they are found in the list, with layers in the top of the list being displayed above layers lower in the list.

The style used for each layer will also impact on the way it is displayed. For example, a layer based on a bitmap or TIFF file will generally hide items below it while layers based on polylines or points will generally not hide items below it. Layers containing polygons will hide items if its style is set to a solid fill but will not hide items if its style is set to an outline format. This should be kept in mind when ordering layers and setting their colours and styles.

For example, the predictive distribution modelling produces a bitmap. If this bitmap is placed over a polygon-based layer containing the outline of a country it will hide the country under it. At the same time, if the polygon-based country layer is placed over the bitmap and its style is set to a solid fill, it will hide part of the bitmap. To solve this problem, place the solid bitmap as the lower layer with the country layer as the upper layer, and set the style of the polygon-based country layer to an open fill. This will result in the solid outline of the country (the polygon) to be displayed over the bitmap, and the bitmap will be visible 'through' the open polygon of the country.

Experimentation with colour and style settings for the various types of items found in layers will often be necessary to achieve the desired result.

### ***Changing the way a layer is displayed***

Items in the Feature group are used to control the way a layer is displayed. The box near the **Colour** button displays the currently selected colour used to fill layer objects. Pressing the **Colour** button will open a colour selection window that can be used to change this colour. The Style combo box is used to change the type of fill used for objects. Clicking the small arrow will open a list of available formats. The Size combo box controls the size used when displaying objects. Clicking the arrow will display a list of available sizes. Finally, the Outline checkbox can be used to show or hide the outline of objects. After making changes press **OK** or **Apply** to display the new settings.

Note that individual shape files can contain different types of objects. The most commonly used object types are polygons or regions, points and lines or polylines. Because of this, feature options will vary with individual files. For example, Size is not available for files containing polygons. Similarly, the available Styles will change with object type. For example, the styles available for lines differs from those available for polygons.

### ***Labels***

If the shape file being used contains information attached to objects, this information can be displayed as labels on the map. Opening the Label combo box will display a list of the available labels retrieved from the shape file. Selecting an item and pressing **OK** or **Apply** will update the Map tool and display the requested labels. The format of the font used can be set by pressing the **A** button and selecting the required options.

### ***Background colour***

Pressing the ellipsis button (with the three dots) next to the Map Background Colour box and selecting a new colour can change the background colour used for the Map tool. The new colour will take effect when the **OK** or **Apply** button is pressed.

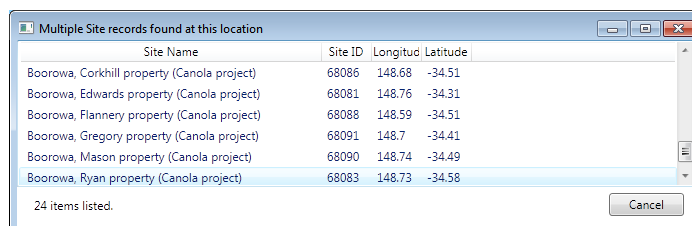
## **Printing and saving maps**

Maps can be saved as bitmaps or Windows enhanced metafiles using the **Save** button on the toolbar or the **Save** command on the **File** menu. Maps can also be printed using the **Print** button or the **Print** command on the **File** menu. To transfer a copy of the map to the Windows clipboard, press the **Copy** button or select the **Copy Map**

**Image** command from the **Edit** menu. Finally, points displayed on the map can be saved to an ESRI shape file and transferred to a GIS package for further analysis. To create this file, open the Layers window by clicking the **Layers** button or by using the **Layers...** command on the **Map** menu, select the point layer and press the **Save As...** button. A file name can then be specified for saving the file.

## Editing data from the Map tool

Details of any displayed site (and their associated site visits and material) can be retrieved and edited directly from the Map tool. To retrieve this information, place the mouse pointer over a site on the map, click the right mouse button and select the **Edit Site**, **Edit Site Visit**, or **Edit Material** command from the menu. If more than one item is present at the selected location a list of all sites will be displayed. Individual sites can then be selected and edited using the appropriate Detail window. To open the appropriate Detail window, select an item and chose the **Edit Site**, **Edit Site Visit** or **Edit Material** command from the **Edit** menu or from the menu which appears when the right mouse button is clicked.



| Site Name                                   | Site ID | Longitud | Latitude |
|---|---------|----------|----------|
| Boorowa, Corkhill property (Canola project) | 68086   | 148.68   | -34.51   |
| Boorowa, Edwards property (Canola project)  | 68081   | 148.76   | -34.31   |
| Boorowa, Flannery property (Canola project) | 68088   | 148.59   | -34.51   |
| Boorowa, Gregory property (Canola project)  | 68091   | 148.7    | -34.41   |
| Boorowa, Mason property (Canola project)    | 68090   | 148.74   | -34.49   |
| Boorowa, Ryan property (Canola project)     | 68083   | 148.73   | -34.58   |

24 items listed. [Cancel]

## Finding distances between map items

The distance and direction between items in the Map tool can be automatically calculated. To find a distance, place the mouse pointer over the first location on the map, click the right mouse button and select the **Drop Distance from anchor here** command. This will place a small dot on the map. Moving the mouse pointer will show the distance and direction from the anchor to the mouse pointer along the bottom of the Map tool window. This information is updated as the mouse pointer moves. To stop measuring, click the right mouse button or open the **Edit** menu and select the **Hide Anchor** command. To copy this distance and direction to the clipboard click the right mouse button or open the **Edit** menu and select the **Copy Distance from Anchor** command.

## The information panel

The **Feature Information** toolbar button (with the 'i' icon) is used to display information about map objects. Pressing this button will open a panel on the right hand side of the map that contains information about the currently selected map item or feature. This information is contained in the Shape file(s) being displayed. Click on an item on the map to see stored information about that item. If more than one layer is present information for all items under the mouse pointer will be displayed, each preceded by its map layer number (starting with 0 for the top-most layer). See *ESRI Shape Files* for further details.

## The status bar

The status bar (along the bottom edge of the window) displays information on the approximate position of the mouse pointer in both decimal degrees and degrees, minutes and seconds. In addition, if a site is displayed the distance and direction between the mouse pointer and the site is also displayed. Note, however, that this latter information will be overridden if an anchor is set (see *Finding Distances Between Map Items* for details).

## BioLink generated map layers

BioLink creates point-based map layers in ESRI Shape File format when creating distribution maps and bitmap files when using the modelling tool. These map layers can be saved using the Map Layers window.

When creating distribution maps, BioLink names the layer(s) using the name of the taxon on which it is based. The modelling tool names the layer as specified in the Output File field.

## ESRI Shape files

The maps displayed by the Map tool are based on ESRI Shape files. While the creation of new shape files is an advanced topic, shape files for many areas and suitable for use at many scales are available from a number of sources, often at little or no cost. See ESRI's web site at <http://www.esri.com/> for an assortment of shape files (both free and for purchase) as well as pointers to other sites which offer GIS data.

The following is from ESRI's documentation supplied with their MapObjects LT, the mapping tool formerly used within BioLink (see <http://www.esri.com>).

ESRI shape files are a simple, non-topological format for storing the geometric location and attribute information of geographic features.

The shape file format defines the geometry and attributes of geographically-referenced features in several files with specific file extensions that are stored in the same folder on disk. They are:

.shp: the file that stores the feature geometry

.shx: the file that stores the index of the feature geometry

.dbf: the dBASE file that stores the attribute information of features

ESRI provides a 17 page Technical White Paper called The ArcView Shape File Technical Description that provides all the technical information necessary for creating shape files without the use of ArcView or other ESRI software for organizations that want to write their own data translators. The document is available for downloading in Portable Document Format (PDF) from <http://www.esri.com/resources/papers/papers.html>. ESRI also distributes paper copies of selected white papers. In the United States, call 1-800-447-9778 (1-800-GIS-XPRT) or address E-mail requests to [info@esri.com](mailto:info@esri.com).

## Displaying raster-based files (bitmaps, TIFFs)

The Map tool can display information from both ESRI Shape files and raster-based files such as bitmaps and TIFFs. Before a bitmap can be loaded, it must be georeferenced. Instructions for georeferencing a raster-based file are given below. See *Map Layers* for cautionary notes on displaying a number of map layers, especially when a number of formats are involved.

### ***Georeferencing a file***

The following instructions are from ESRI's documentation supplied with their MapObjects LT, the mapping tool used within BioLink (see <http://www.esri.com>).

Vector data in MapLayers exists in a real-world or map coordinate system, measured, typically, in feet or meters. The x-coordinates increase from left to right and the y-coordinates increase from the bottom to the top. This is quite different from a raster image represented by an ImageLayer. A raster image is organized and measured by rows and columns. Each cell has a row number and a column number. If the origin is located in the upper left corner of the data, that cell would be identified as row 1, column 1.

For MapLayers and ImageLayers to be displayed simultaneously, the rows and columns of the image must be mapped into the x,y plane of a map coordinate system. An image-to-world transformation that converts the image coordinates to map coordinates must be established. Some image formats store georeferencing information in the file header of the image or, in the case of images that do not contain this georeferencing information, facilities exist in other products available from ESRI, for creating a file that contains the necessary transformation parameters. The file that contains the transformation parameters is called a world file. The world file always takes precedence over any header information.

### ***About the world file***

The image-to-world transformation is a six parameter affine transformation of the form:

$$x' = Ax + By + C$$

$$y' = Dx + Ey + F$$

where

$x'$  = calculated x-coordinate of the pixel on the map

$y'$  = calculated y-coordinate of the pixel on the map

$x$  = column number of a pixel in the image

$y$  = row number of a pixel in the image

$A$  = x-scale, dimension of a pixel in map units in the x-direction

$D, B$  = rotation terms. Note: Not supported for this release.

$E$  = y-scale (this value is always negative, because image space is top-down, whereas map space is bottom-up)

$C$  = translation term; x-Origin (x-coordinate of the center of the upper left pixel)

$F$  = translation term; y-Origin (y-coordinate of the center of the upper left pixel)

The transformation parameters are stored in the world file, an ASCII format, in this order, A, D, B, E, C, F; for example:

2.22123393184959      A

0.000000000000000      D

0.000000000000000      B

-2.22123393184959      E

10383.13600759092515      C

11611.48117990907485      F

Note that the parameter characters are included in the example for clarity. They don't actually appear in the file.

If a world file isn't present and there is no georeferencing information in the header of the image, a default mapping is still provided between image space and map space. MapObjects LT makes the origin of the image (0.0, 0.0), and sets the X and Y scale factors both to 1.0.

If you want to display a non-georeferenced image on a portion of your map, supply the georeferencing world file yourself, and make sure it maps the image to the portion of the map that you want.

### ***World file naming conventions***

The world file associated with an image is named by following the conventions in the table below. For example, if you have an image that's stored in a file named myimage.bmp, then the world file associated with it must be named myimage.bmpw or myimage.bpw.

| If the file extension of the image is | the world file extension must be |
|---------------------------------------|----------------------------------|
| bmp                                   | bmpw or bpw                      |
| tif; tff; tiff                        | tfw                              |
| gis                                   | gsw                              |
| lan                                   | lnw                              |
| bil                                   | blw                              |
| bip                                   | bpw                              |
| bsq                                   | bqw                              |
| sun                                   | snw                              |

|         |     |
|---------|-----|
| rs; ras | rsW |
| rlc     | rcW |

## The Map tool toolbar

The following commands can be accessed directly from the Map tool toolbar.

### *Save map image*

The currently displayed map can be saved to disk as either a bitmap or Windows Enhanced Metafile. The first toolbar button or the **Save** command on the **File** menu will open a 'Save Map image to file' dialog box from which a file name, location and format can be specified.

### *Copy map image*

The currently displayed map can be copied to the Windows clipboard using the second toolbar button, the **Copy** command on the **Edit** menu or by clicking the right mouse button while over the map. Once copied to the clipboard, the image can be pasted into most Windows applications using the **Paste** command.

### *Select tool*

The Select Tool is activated with the fourth toolbar button. This tool is used to find the Latitude/Longitude of points on the map (by moving the mouse pointer over the map), the coordinates being displayed on the status bar. It is also used to select map objects when using the Information panel (see *Feature Information* below).

### *Zoom In*

The Zoom In tool, the fifth button on the toolbar, is used to enlarge a section of the map. To zoom, use the mouse to draw a rectangle using the left mouse button. The map will zoom to fill the window with the section inside the rectangle. Scroll bars will automatically appear (when applicable) to allow movement of the map. The Pan tool (see below) can also be used to reposition the map.

### *Zoom Out*

To display a larger section of the map, select the Zoom Out tool using the sixth button on the toolbar or the **Zoom Out** command on the **Map** menu. Clicking the Zoom Out tool anywhere on the map will cause the map scale to increase, showing more of the map. To zoom out to the full extent of the map, use the **Full Extent** toolbar button (see below).

### *Pan*

Once zoomed, the visible portion of a map can be changed using the Pan tool (seventh button on the toolbar). To pan, place the Pan tool on the map, hold down the left mouse button and move the mouse.

### *Full Extent*

To view the entire map, click the **Full Extent** button, the eighth button on the toolbar, or use the **Full Extend** command on the **Map** menu. This will zoom out the map to its full extent.

### *Layers*

The **Layers** toolbar button and the **Layers** command on the **Map** menu open a window used to control the map(s) displayed by the Map tool. See *Map Layers* (below) for details on adding and removing layers.

### *Information*

Some map items may contain detailed information about themselves. To see this information, press the **Feature Information** toolbar button and select an item on the map. This will open the Feature Information panel and display information about the selected item. The information present will vary with the type of item, and in some cases may be absent. For additional details see *Information Panel* below.