

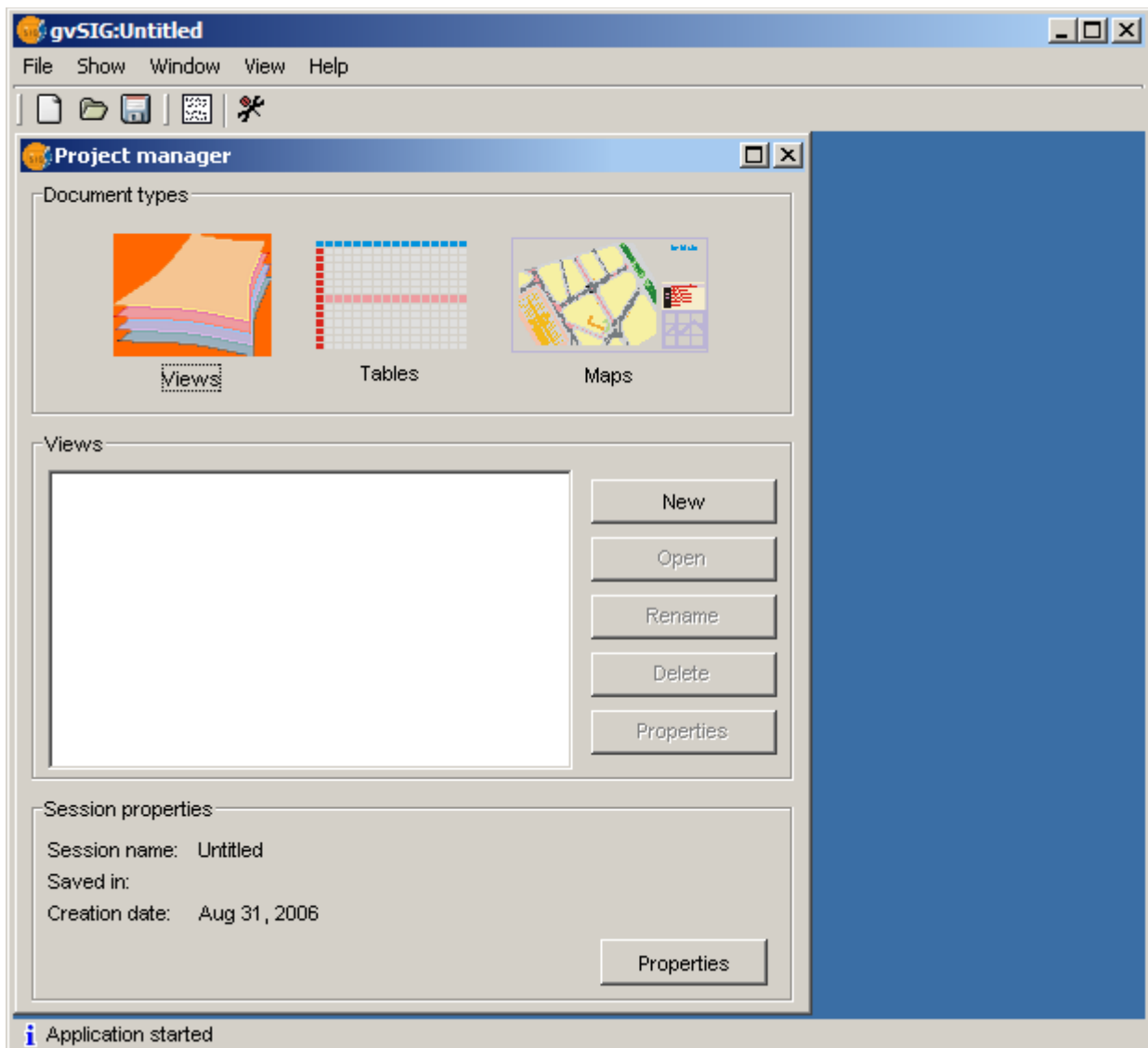
gvSIG Workshop

The goal of this workshop is to get in touch with the main functionality of the gvSIG application, included in the 1.0 release. We will take a simplified look at both commonplace GIS tools and workflows as well as more innovative tools that gvSIG provides.

GvSIG provides the basic tools for spatial data visualization and navigation. It is able to read and display all common data formats, including raster and vector formats, PostGIS databases and standard OGC remote services. Basic tools allow us to navigate through the layers in multiple graphical views, explore record tables and compose maps.

Exercise 1: Data visualization

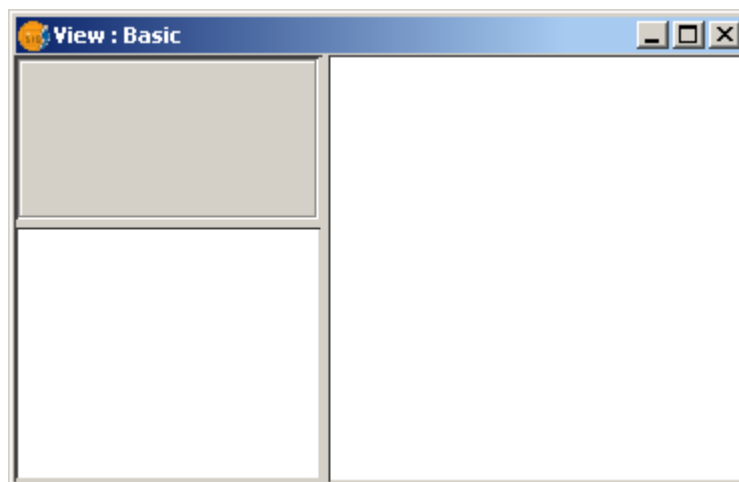
When you start gvSIG, you will see the *Project Manager* window (if you need to open this dialog later on, use the *Show / Project window* menu option):




The gvSIG application manages three *document types* in each project. *Views* display sets of geographic layers, *Tables* include record sets from feature layers added to the views and also stand-alone alphanumeric tables. *Maps* are graphic layouts combining multiple views and elements like legends, north arrows and scales, usually created for printing.

- **A simple view**

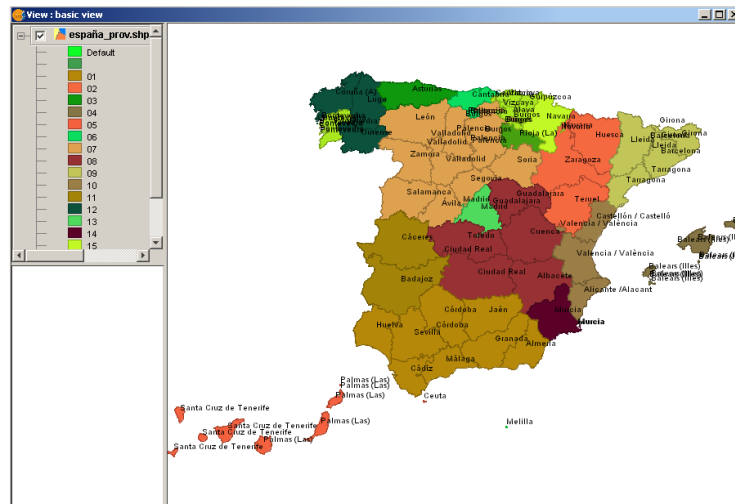
- Make sure the document type *View* is selected in the Project manager and click on *New*. Select the new view and click on *Rename* to change the default view name (for instance, to *basic view*). Open the view by using the *Open* button or just by double-clicking on its name.




- The view will open, showing three areas: the area on the right is the *geographic view*, the area on the top left is the *Table of Contents (TOC)* where the layers are listed, and the area on the bottom left is the *Locator* area of overview.
- Use the Add layer tool  that you can find in the toolbar or in *View / Add layer*. The *Open layer dialog* will open. In the *File* tab, click on *Add* to see a file browser. Since we are going to load a Shape file, keep the default file filter *gvSIG shp driver* and find *Spain/españa_prov.shp*. Click *Open* and then *OK* in the open layer dialog.
- You will now see the layer added to the TOC and the provinces of Spain displayed in the geographic view. Now click on the layer name in the TOC to make it the *active layer*. Many operations in gvSIG will use the active layer or layers.
- Right-click on the layer to open the context menu, and choose *Properties*. In the *Layer properties dialog*, go to the *Symbols* tab and select the *Unique Values* option. Select *COM* (for Community) as the *classification field*, then click on *Add All*, and then on *Apply*.

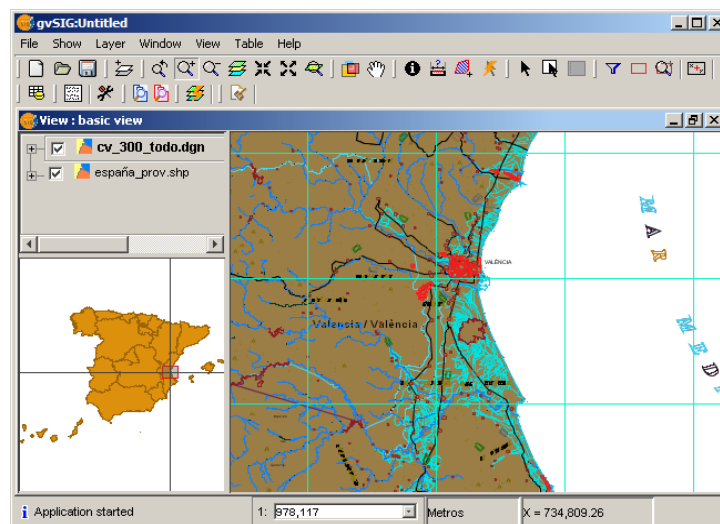
In this way, each province will be displayed with a symbol depending on which region or community it belongs. We can also pick the *Intervals* symbology option to classify the features depending on numeric attribute values.

- Now click on the *Labelling* radiobutton to go to the labelling properties. Set the *Enable labelling* checkbox, choose *NOMBRE99* as the *labelling field* and set a fixed text height of 10 in pixel units. When you click *OK*, the province names will display on the view.




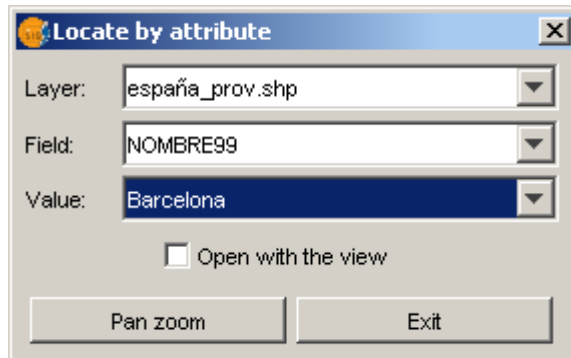
Navigation

- First, let's set up the locator. Go to the *View / Configure locator map* option, click on *Add layer* and add the *Spain/españa_comaut.shp* layer. A map of the regions of Spain will show up in the Locator area. Close the dialog.
- We can now add to the view another layer, the *Valencia/cv_300.dgn* dataset. Don't forget to select the *gvSIG DGN Memory driver* filter when browsing for the file.
- Now we can use some common *navigation tools* like zoom and panning, from the main toolbar or under *View / Navigation*. We can also directly *zoom to a layer* using this option from the layer's context menu.
- When navigating, notice that the view area is shown in the *Locator*. We can also navigate by clicking or dragging a rectangle on the locator area.
- Use the *View/Navigation/Zoom Manager*  to store the view extent with a name and restore the saved extents when convenient.

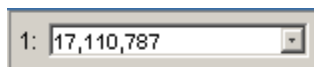


- **Locate by attribute**

- A quick way to navigate to a certain place is by using the *View / Locate by attribute* tool  and specify the value of an attribute in your feature layer.
- For instance, find the province named *Barcelona* in Spain by entering this information in the *Locate* dialog.



- Then click on Pan zoom to locate the feature in the view.
- Notice that you can *control the scale* of the view just by typing it in the status bar scale control:



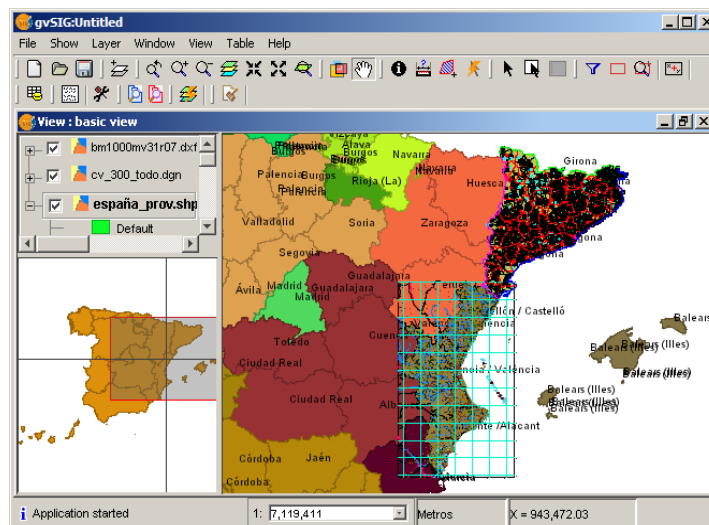
- **Feature reprojection**

- Try adding to the view *Spain/Catalonia.dxf* (choose DXF Driver filter). You will see that the data doesn't appear in the right location in the northeast of Spain.

This happens because the view is using the UTM Zone 30 (EPSG:23030) as default coordinate system (it can be changed in the View properties), while the DXF file uses coordinates in UTM Zone 31, when the data is located.

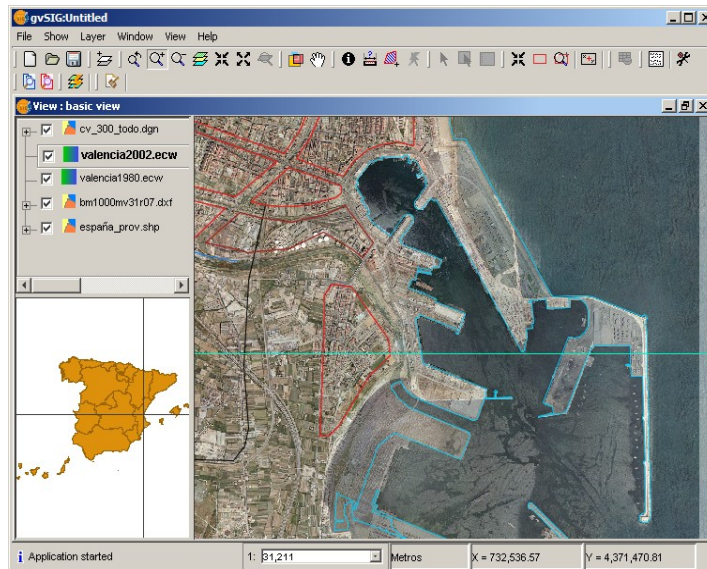
To make it work, delete the layer using its context menu option, and add it again. This time choose EPSG:23031 as *current projection* in the Open layer dialog and accept the warning message when you add the layer.

The coordinates of the new vector layer will now be projected to UTM Zone 30 and will match the rest of data in the view.



- **Image transparency**

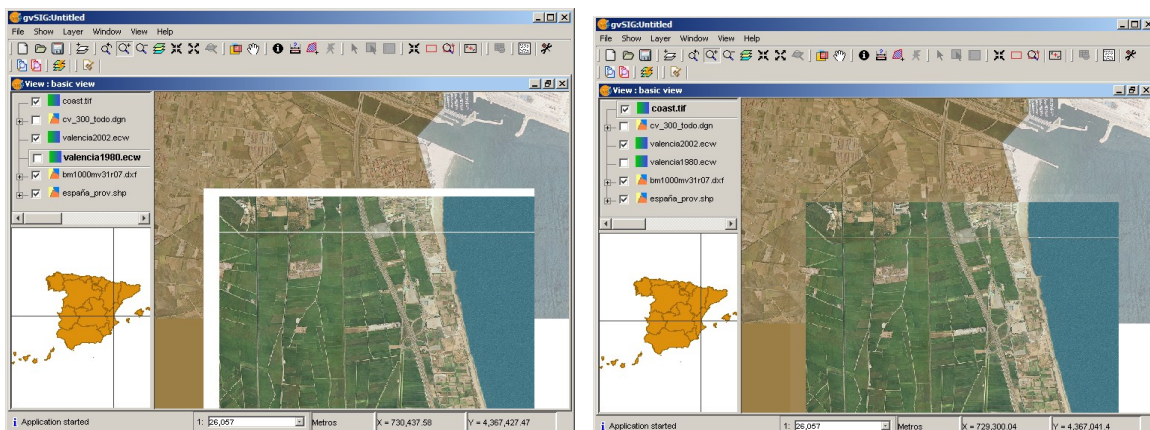
- Let's load two images for the same area, taken on different years. Add the following datasets to the view: *valencia1980.ecw* and *valencia2002.ecw* from *Valencia* (choose the *gvSIG Image Driver filter* in the file browser), and zoom to any of them.
- In the TOC, place the *cv300* layer on top, followed by the *valencia2002* image. Zoom to the Valencia harbour area and you will see that the coast lines in the DGN and the 2002 image fit together. Now, go to the *valencia2002 raster properties* (in the layer's context menu) and select the *Transparency* tab. If you activate the opacity control and set a value around 50%, you will be able to see the changes in the harbour structures between 1980 and 2002.



- **Pixel transparency**

- First, turn off the 1980 orto, DGN and DXF files. Now let's load the *coast.tif* image in *Valencia*. You can zoom to the layer's extent and then a little out to see the context. This image gives us information about some other areas in the south coastal region, but it includes white borders and lines that occlude the large image, so they don't match nicely.
- To fix this, go to transparency properties of the *coast.tif* layer and enter the RGB code for white: 255 in each of the three edit boxes. Then click on the right-pointing arrow to add this condition for transparency per pixel and OK the dialog.

The white areas will now be transparent and both images should fit together nicely.

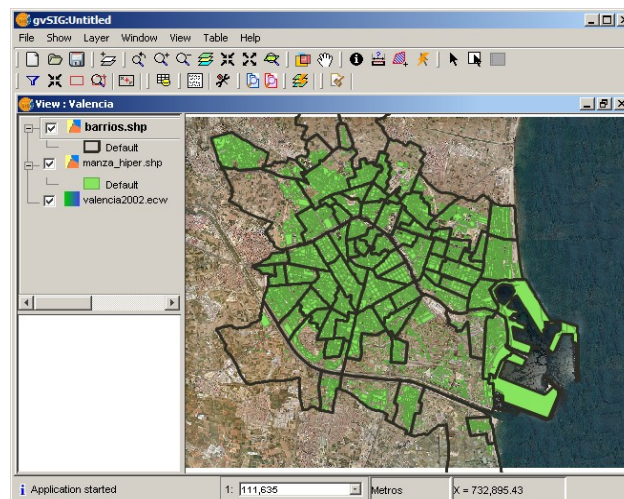


Exercise 2: Visual analysis


We will take a look now at how to work with the legend, selection and query tools to get useful information at a glance.

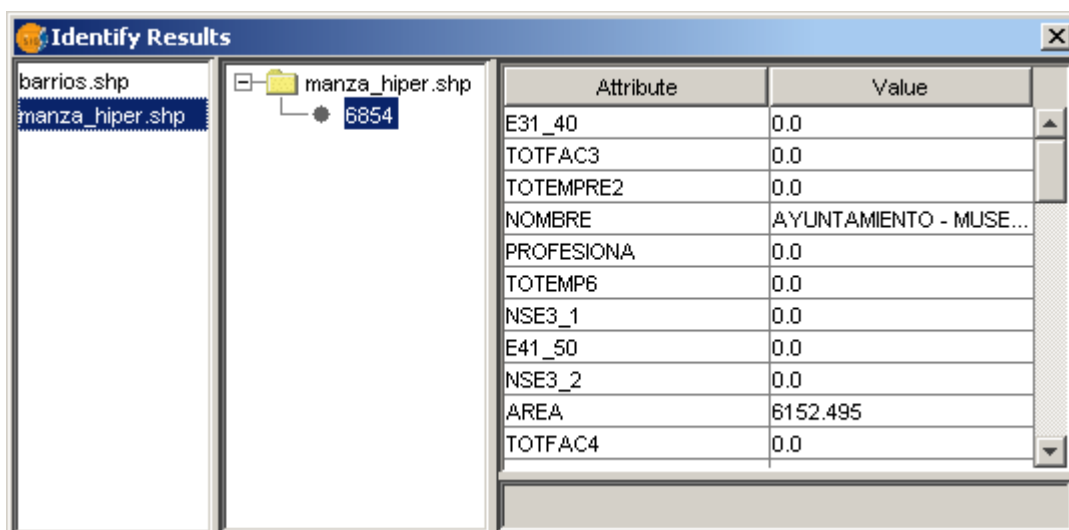
- **Create another view**

- Go back to the Project manager window (*Window/Project manager* menu option) and open another view. You can call it *Valencia*.
- Go to the basic view, activate the *valencia2002.ecw* layer and use its context menu to *copy* it to the clipboard. Now go to the new *Valencia* view, open the context menu in the empty TOC and choose *paste*. A copy of the layer will appear in the new view.
- Add the city neighbourhoods: *Valencia/neighb.shp* (don't forget to **change the input coordinate system back to Zone 30**). Because we just want to see the boundaries, go to the *Properties / Symbols* of the layer and (leaving the Unique symbol option) uncheck the *Fill* checkbox. You can also increase the *line width* to 3.
- Now add the city blocks in *Valencia/blocks.shp*.



- **Information tool**

- You can use the information tool  to get attribute information about one or more active layers (select more than one layer in the TOC with the Ctrl key). The info dialog will show up:





- **Using a saved legend for quick classification**

- The city block data has some demographics information. We could use a previously-saved legend with predefined symbols that we commonly use to classify this kind of data. For instance, go to the Properties / Symbols page of *blocks*, click on the *Load legend* button and browse for *Valencia/block_popul_classes.gvl*.
- This will load an *Interval legend* with specific classification fields, ranges and semi-transparent colours that give us quick information about population density.


- **Using basic selection**

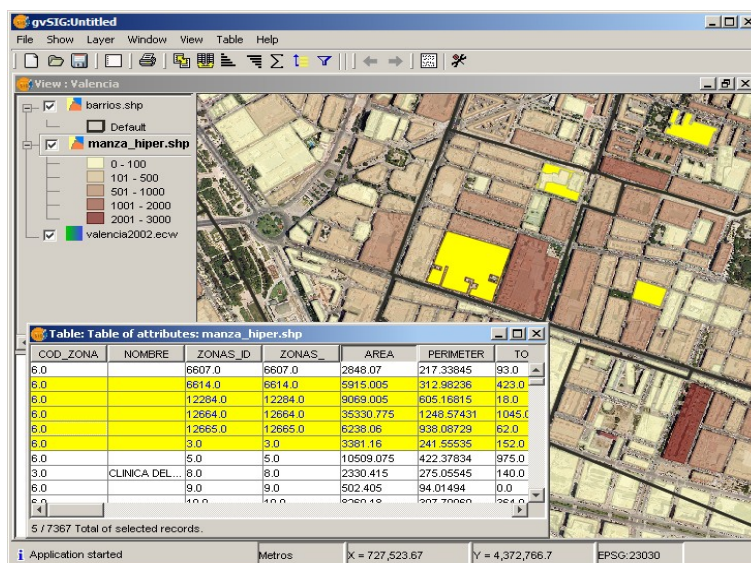
Keep in mind that each layer keeps its own selection set, and selection operations only affect the selection set of the active layer.

- Use the *Select by Point* tool  pick one or more features (use Ctrl key for multiple selection).
- Try the *Select by Rectangle* tool  by dragging a box on the active *blocks* layer.

- **Explore the attribute table**


Sometimes it's useful to visualize directly the feature attributes to get a glimpse of the characteristics of our data.

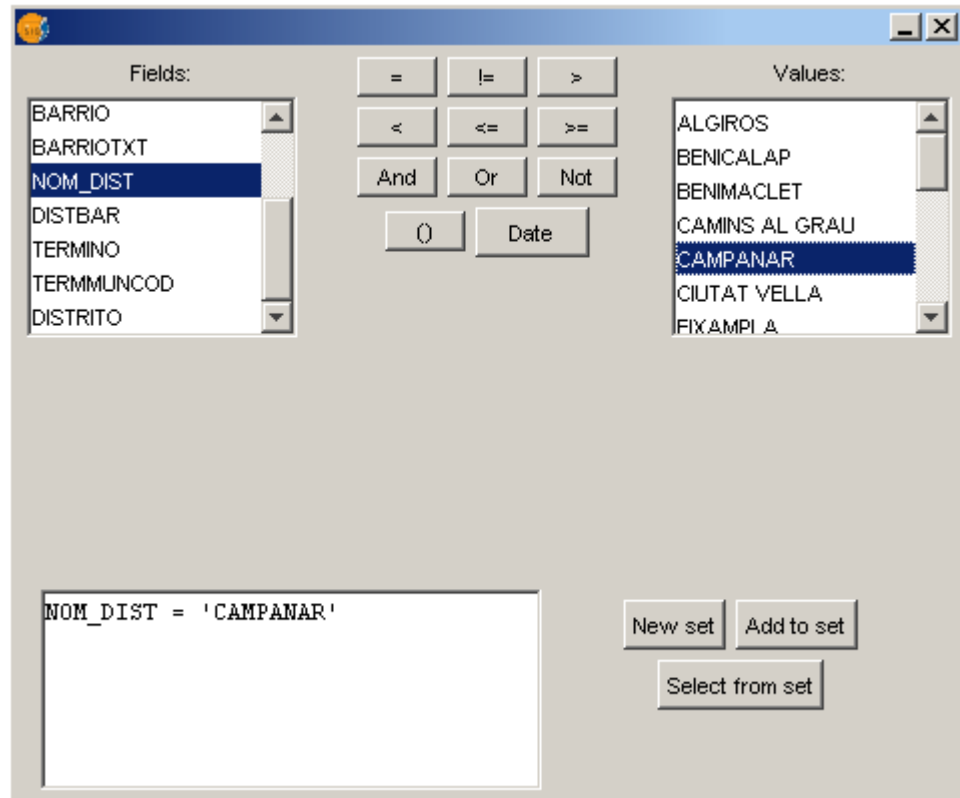
- Make a layer active with some selection in it. Go to *Layer / See table of attributes* and open the record table for the layer. Notice that a new set of *tools* is available in the toolbar area. You can, for instance, perform table joins and links here.
- Click on a field name (like *Area*) to use the ascending and descending sorting tools.
- Use the *Move selection to top* tool to display the selected elements at the top of the table.
- Notice that selection can be performed on the table as well as in the view, and the selection set will be displayed in both with the selection colour.
- You can use the *Zoom to Selection* tool  in *View/Navigation* to find the selected elements in the view.
- Use the *Layer / Clear selection* menu option to clear the selection set of the active layer.



- **Analysis by search and filtered selection**

Suppose we need to find a suitable location for a new senior citizen centre in the Campanar district of the city.

- First, let's find out which neighbourhoods comprise the Campanar district. Make the *neighb* layer active and choose the *Filter tool*  which can be found in the toolbar or in *Table / Filter*.
- In the Filter dialog window, build the expression $NOM_DIST = CAMPANAR$ by clicking in the field, operator and value areas. Hit the *New set* button and use *Zoom to Selection* to view the location of these neighbourhoods.



- Now we need to find the city blocks in these neighbourhoods with a high percentage of senior citizens. We'll do that in two steps. First, make the *blocks* layer active and use the *View/Selection/Selection by Layer* tool. Select the *intersected with* operation on the *neighb* layer. Click on *New set* and then cancel. To see the block selection clearly, change the active layer to *neighb* and clear its selection.
- The second step: use again the Filter tool on the *blocks* layer, building the expression $E99999 \geq 25$ (percentage of population 65 or older is at least 25%). Now click on the *select from set* button (to filter the previous selection, not to make a new one).

So, we have found the city blocks that satisfy two conditions: a spatial condition (they belong to a certain district) and an attribute condition (a high percentage or elderly inhabitants).

- If you want to save a layer's selection to a new dataset, use the *Layer / Export To...* commands which will save only the selected features of the layer (or the whole layer if there is no selection).

Exercise 3: Using Remote Services

As an Spatial Data Infrastructure (SDI) client, gvSIG allows us to add and work with remote Geographical Information. The remote data will be retrieve through OGC standard services such as WMS, WFS, WCS, Catalog and Gazetter services. gvSIG can also access other common web services which provide spatial data, such as ArcIMS Services.

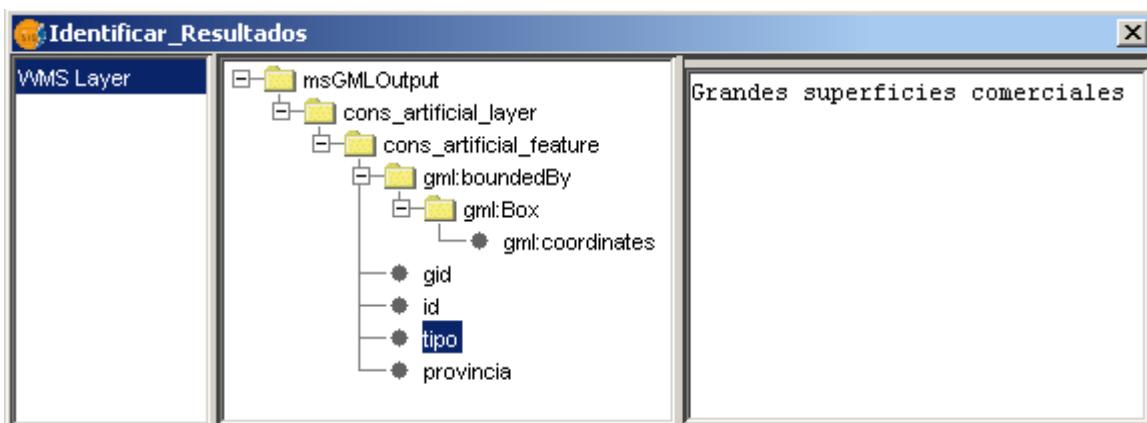
A third way to retrieve remote spatial data from gvSIG is connecting us to remote spatial databases like PostGIS or MySQL via JDBC, which allows us to use efficiently large geographical datasets.

In this way gvSIG acts like a central meeting point where different kinds of GeoServices (OGC-compliant or not) can be accessed and used, becoming in this way a useful and powerful building block in applications that use SDI technology.

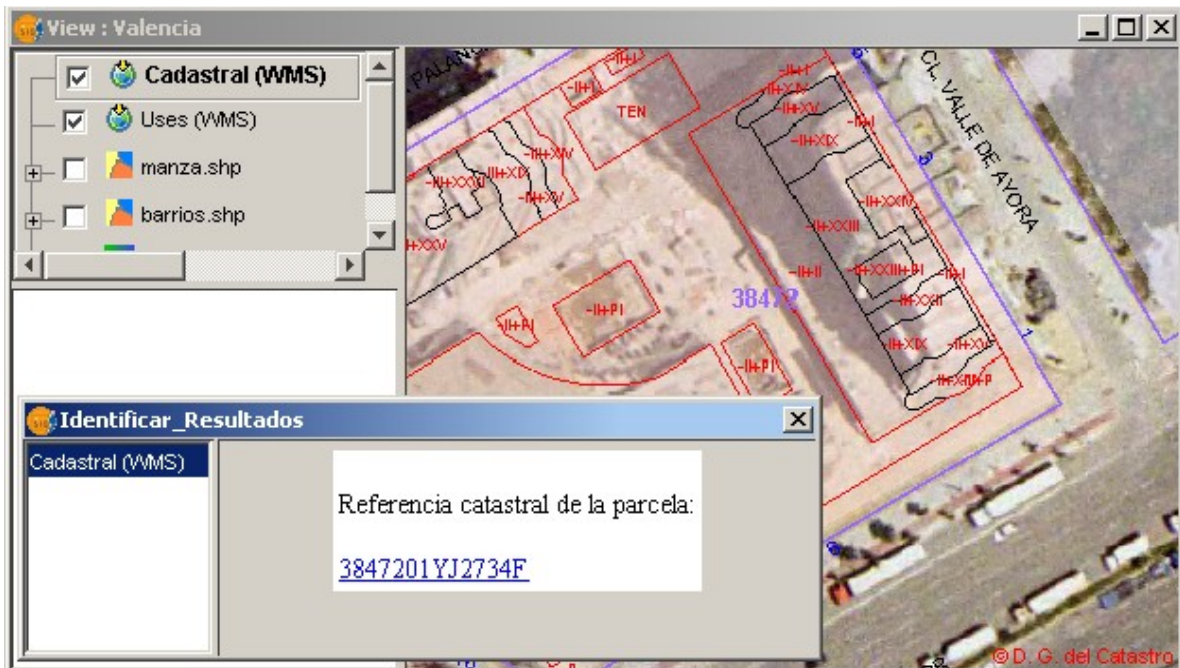
- **Using WMS services**

In the Valencia city scenario that we developed in the previous exercise, we can get some additional information from available WMS resources.

- To add an WMS service, use the WMS tab in the Open Layer dialog. Copy this URL: <http://www.simoncit.cop.gva.es/cgi-bin/wms> and click on *Connect*. After a while, some text should appear in the description area.
- Click Next twice to get to the *Layers* tab, where you can pick the *artificial constructions* data in the [CV 25K] folder, then click on the *Add* button. In the next page, select the *png format* (to have transparency values) and the *23030* coordinate system of the view.
- Once the layer is added, you can change its *opacity* to see through the constructions.
- You can now use the information tool to get attribute information. In this case, we would be especially interested in the type of use of each area (Educational, Residential, Commercial...), which we can find in the *tipo* field.



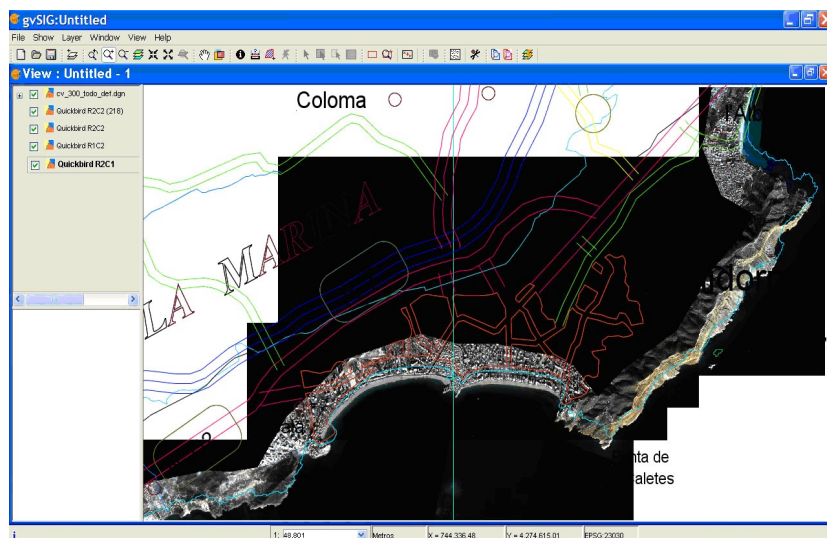
- We can get even more information if we use the Cadastral information from <http://ovc.catastro.meh.es/Cartografia/WMS/ServidorWMS.aspx> (this server is already in the default list, you can just pick it from there). Just pick the only layer, the *png* format and the *23030* coordinate system.
- If we zoom close to a block that interests us, we'll see the parcels defined in the cadastral census. The info tool can provide us with the Reference Number of a parcel, which we could then enter in the cadastral census web site (<https://ovc.catastro.meh.es/CYCBienInmueble/OVCConsultaBI.htm>) to get very detailed information.



- **Using WCS services**

The Web Coverage Service specification allows access to geospatial 'coverages' or raster data sets that represent values or properties of geographic locations (cell values), rather than just the pictures contained in WMS generated maps. You can work with WCS layers as with any other raster layer. Notice that the Raster properties are all available for them.

- Open a new view and click on the open layer tool
- Select the WCS tab, and use this URL: <http://www.simoncit.cop.gva.es/cgi-bin/wcs>, or another one in the list.
- Once the connection is established, click on the next button and select one of the available coverages.
- Before adding the coverage to the view you must select the SRS and the output format you want to get the coverage from the server.
- The last step, you may be requested to choose from the available parameters, like the image bands (for a natural colour image, you'll typically select all the bands)

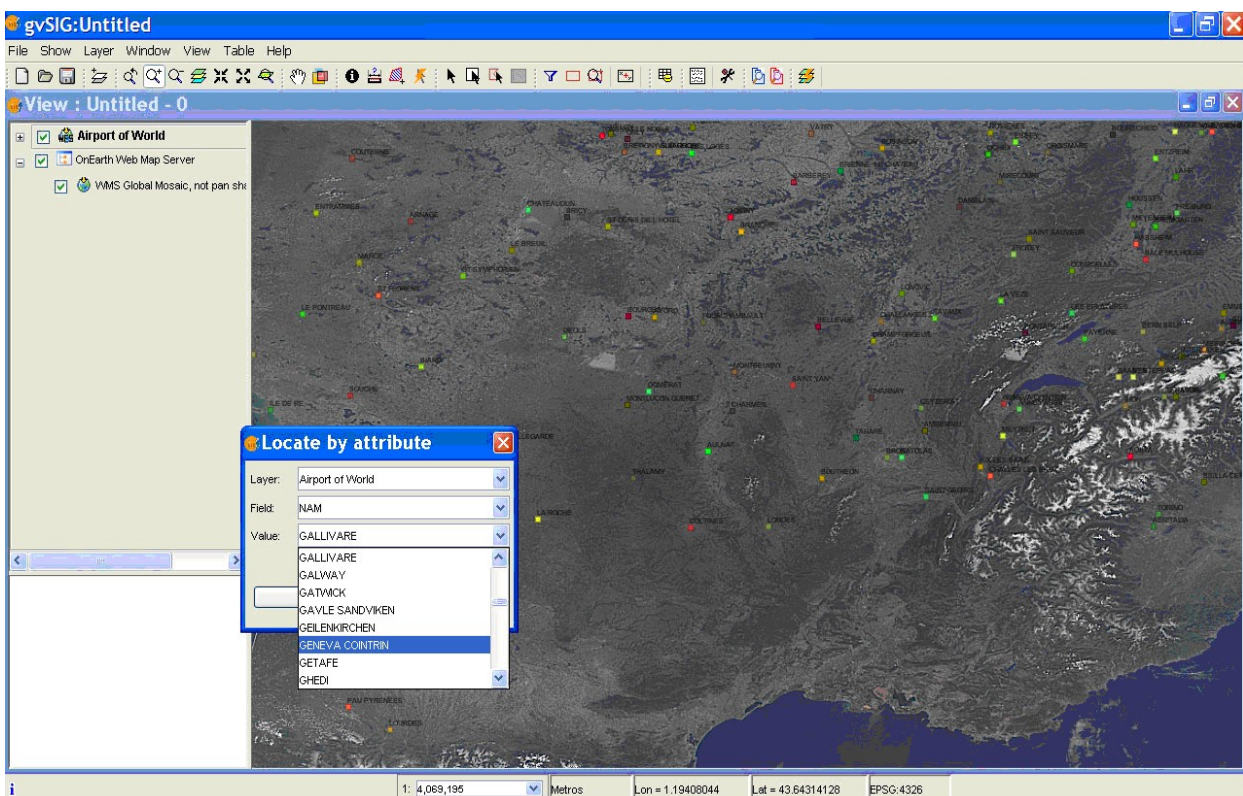


- **Using WFS services**

The Web Feature Service specification is an interface allowing requests for geographical features across the web. It is highly interoperable, as it uses the XML-based GML format for geometry and attribute data exchange.

- Open a new view.
- Change the view projection (in *View/Properties*). For a good visualization of the global WFS layers we are using in this exercise, it is a good idea to set the projection in geographic coordinates, using Datum WGS84 (EPSG:4326)
- Add a reference WMS layer. Click on the add layer button and choose the WMS tag, select the <http://onearth.jpl.nasa.gov/wms.cgi> server, pick up one of the available layers (like the Global Mosaic), and for this exercise select the SRS EPSG:4326.
- We can now load a WFS layer with the WFS tab in the add layer wizard. For this example you can use the OGC Feature Service located at <http://webservice.ionicsoft.com/worldData/wfs/WORLD>
- Select the layer *Airports of the World*. At this point you will be required to select all the attribute fields you want to retrieve attached to this spatial data, choose at least the field *NAM*. In the last options tab, increase the *buffer size* to 10000, so you can get all the airports.
- Once the layer is added (it may take a while) you may have a look at the attribute table to see, all the actual attribute data you have retrieve from the WFS.
- We can now use the WFS layer as any other feature layer. We can, for instance, create a legend and add labels to this layer.

You can see that the WFS layer acts like any other vector layer. We can also export the layer to a local file or database. We can also do editing or any kind of feature geoprocessing (as we'll see later on), and save the changes to a local dataset.

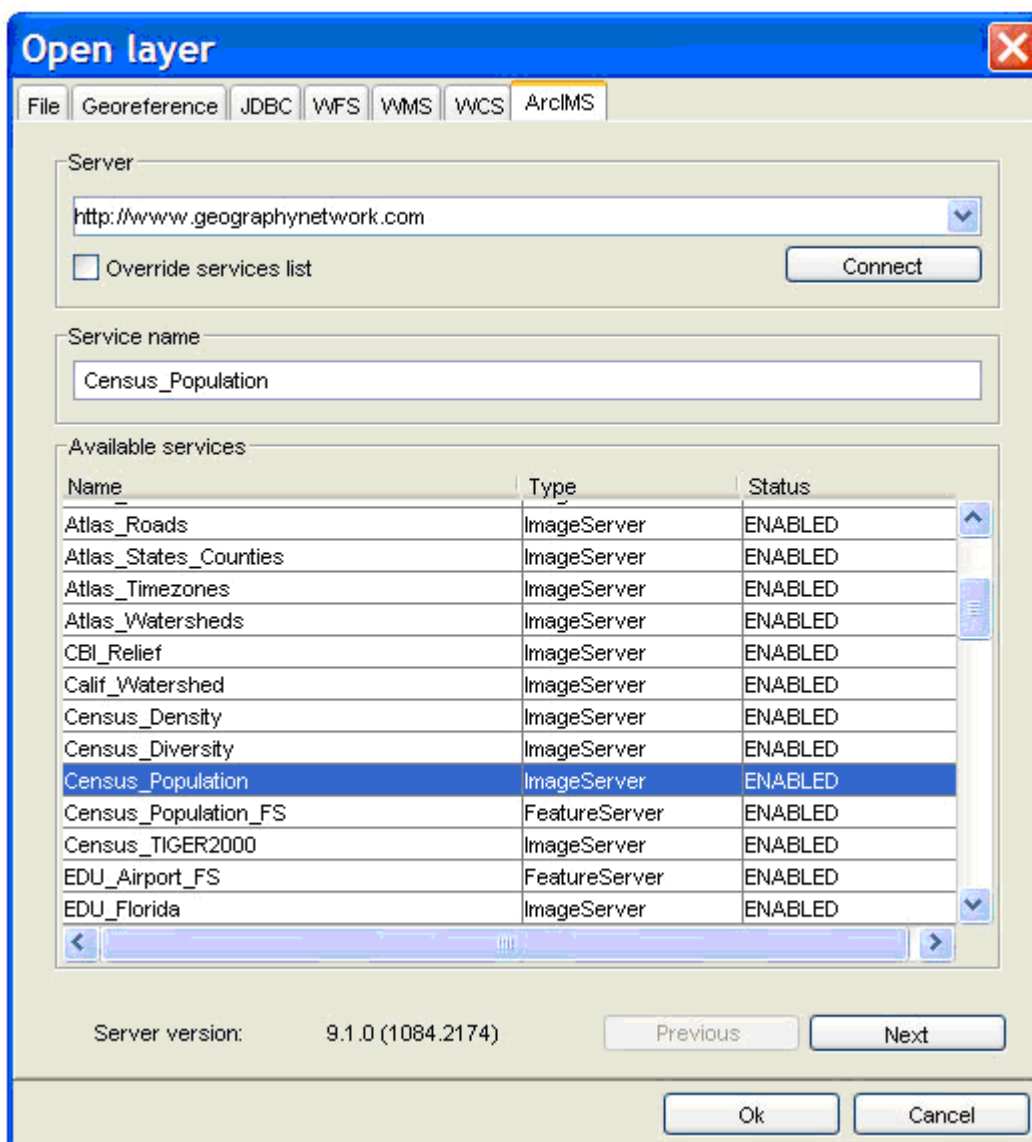


Notice that you can change the properties of each WMS, WFS or WCS layer without having to add the layer again, just use the specific service properties from the context menu of each layer. For instance, to change the buffer size and get more features in a WFS layer, you can go to the *options* page and change it there.

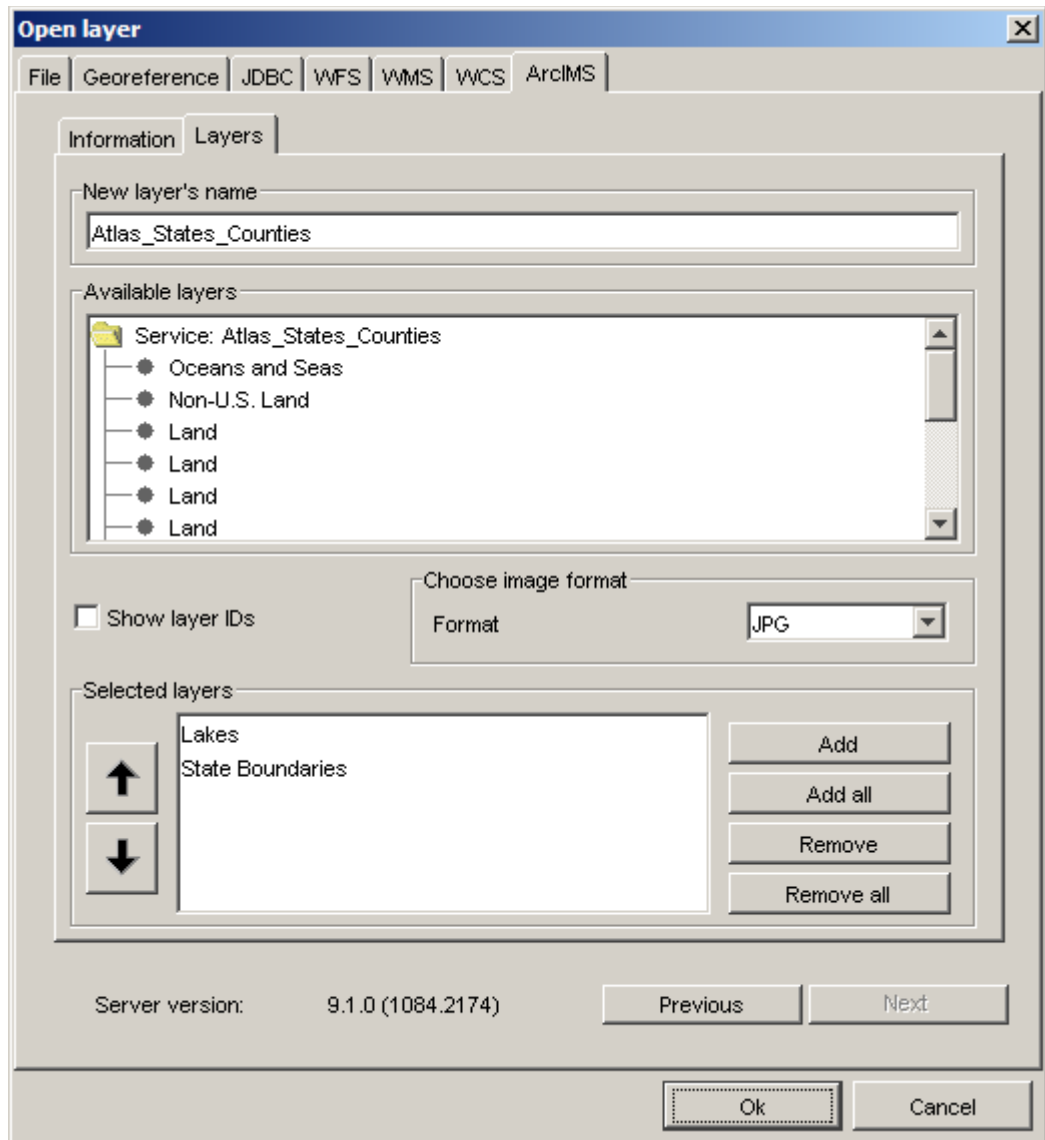
- **Using ArcIMS Image and Feature services**

ArcIMS is ESRI's proprietary server technology with a large user base, providing Web publishing of GIS maps, data, and metadata. gvSIG in its new 1.0 version includes ArcIMS client functionality, supporting both Image and Feature services.

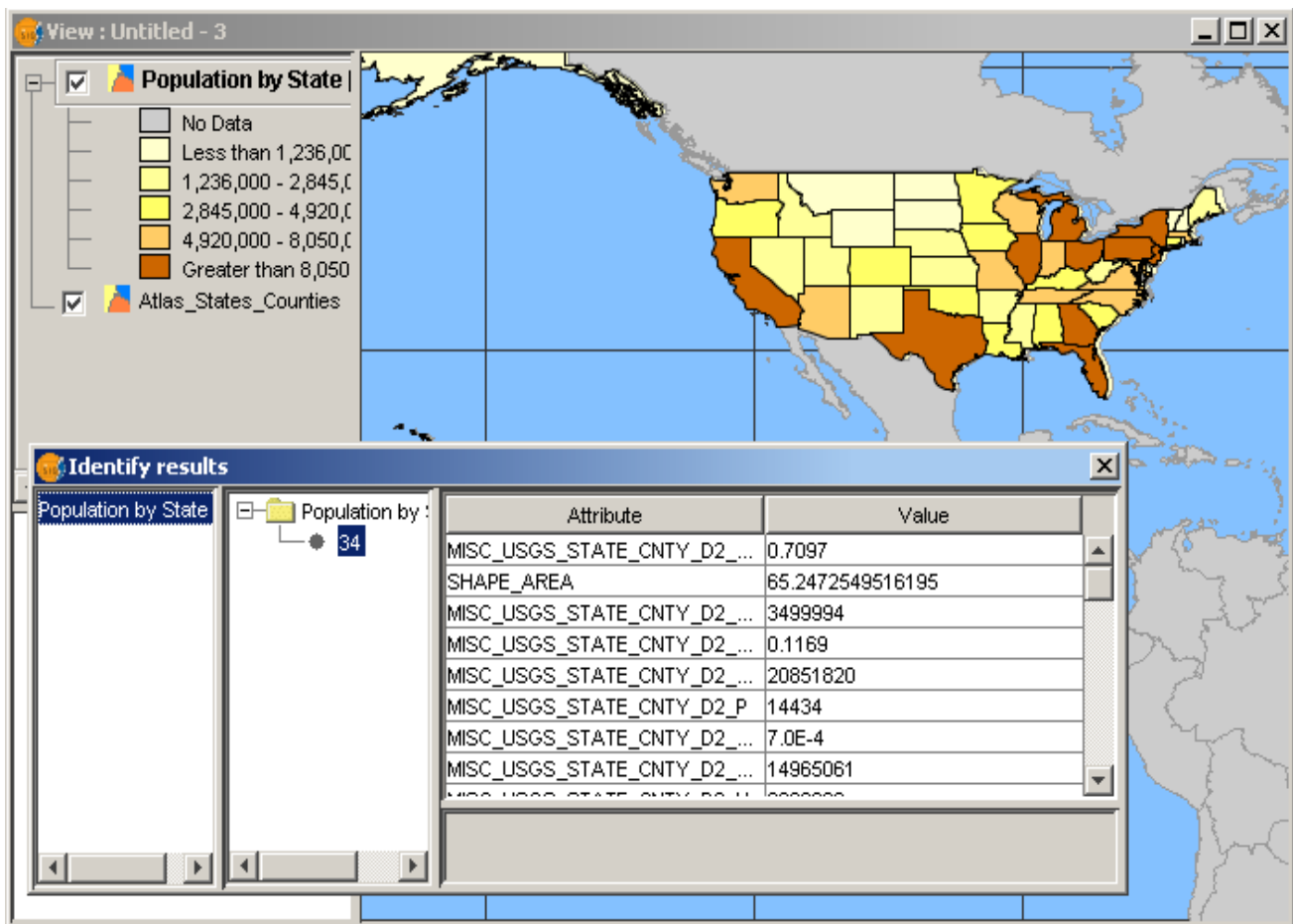
- Open a new view. Change its projection to *geodesic coordinates and datum WGS84 (EPSG 4326)*
- Select open layer tool and click on the ArcIMS tab. Click to connect to the default *GeographyNetwork* server. A list of available services should appear. Classified as either *ImageService*, which is similar to WMS, and *FeatureService* which is like WFS.



- Pick up one of the **Image Services** like *Atlas_Roads* or *Atlas_States_Counties*, click on the next button to see general information about the service, and then again on next to see the available layers.
- Similar to the WMS wizard, you can now choose the layers and the output format you want to get from the service.




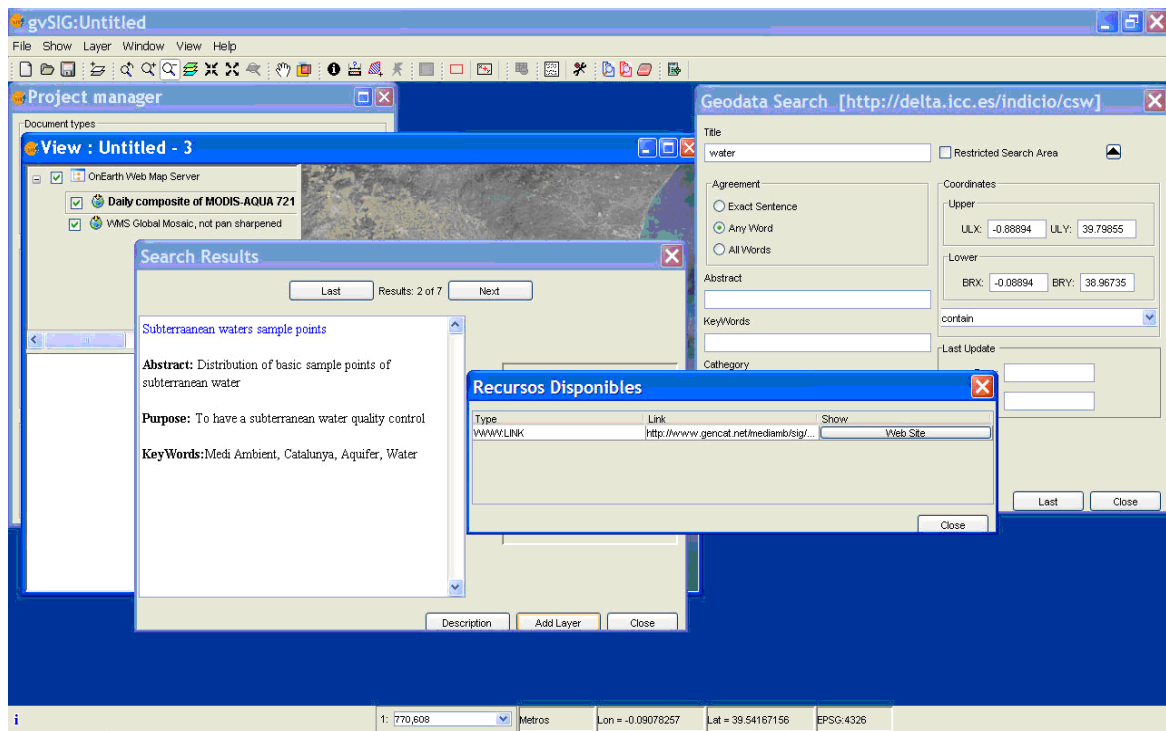
- Once displayed, you can use the info tool on the layer, assign it transparency, etc.
- In the same way, we can add an ArcIMS Feature Service, which will behave very much like a vector layer. Open add layer wizard and select the ArcIMS tab again and the *GeographyNetwork* server, choose now a FeatureService like *Census_Population_FS*, click on next and select the layers you want to add to the view, for instance *Population by States*.
- Like a regular vector layer, if you select this layer on the TOC you can change its legend, perform queries, editing, and in general have access to all feature information and geometry,



- **Using Catalogue web services**


Catalogue Services allow us to search for geographic information in data repositories and in some cases add the datasets directly to our application.

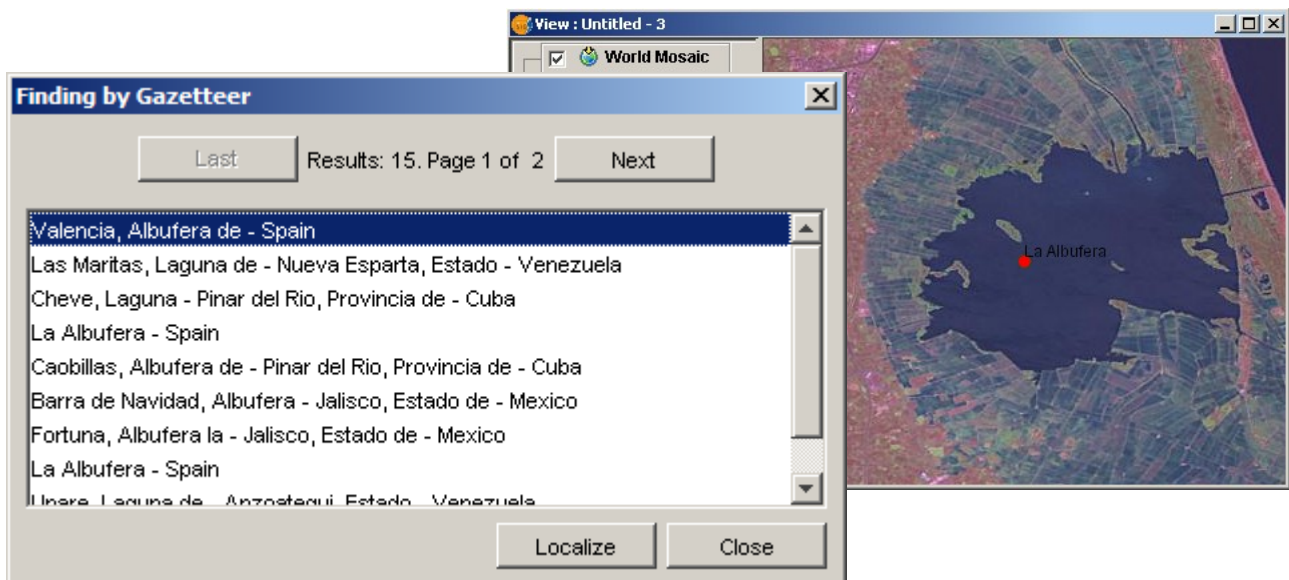
- Click on the Geodata Search tool: 
- Choose the Catalogue server from *ICC (Cartography Institute of Catalonia)*. The CS-W protocol will be automatically selected (if you use a new catalogue that is not in the list, you'll need to indicate the protocol).
- Connect to the server. Open the detailed search window and select the “Any word” condition. Search for a title word like “water” or “map”.
- You will get a list of results with some description. When you click the Add layer button you may get a new layer added to your view, if the data comes from a web service, or a link to a web site if the data is some kind of document or web page.



- Using Gazetteer web services

Gazetteer services give you the location of a specific geographic feature that can be searched by name. gvSIG supports standard web services that provide this functionality, and allows you to discover data and locate it in the view.

- Click on the add layer tool and add a global image layer from WMS <http://onearth.jpl.nasa.gov/wms.cgi>. We want to locate on this image a lake nearby Valencia city in Spain, named *La Albufera*.
- Click on the *Gazetteer Search* tool:  and connect to the *Alexandria project* gazetteer. The protocol will be selected automatically as the ADL Gazetteer Protocol.
- Search for *Albufera*. You will get some result records. Select one and click on the *Locate* button to find it in the view.



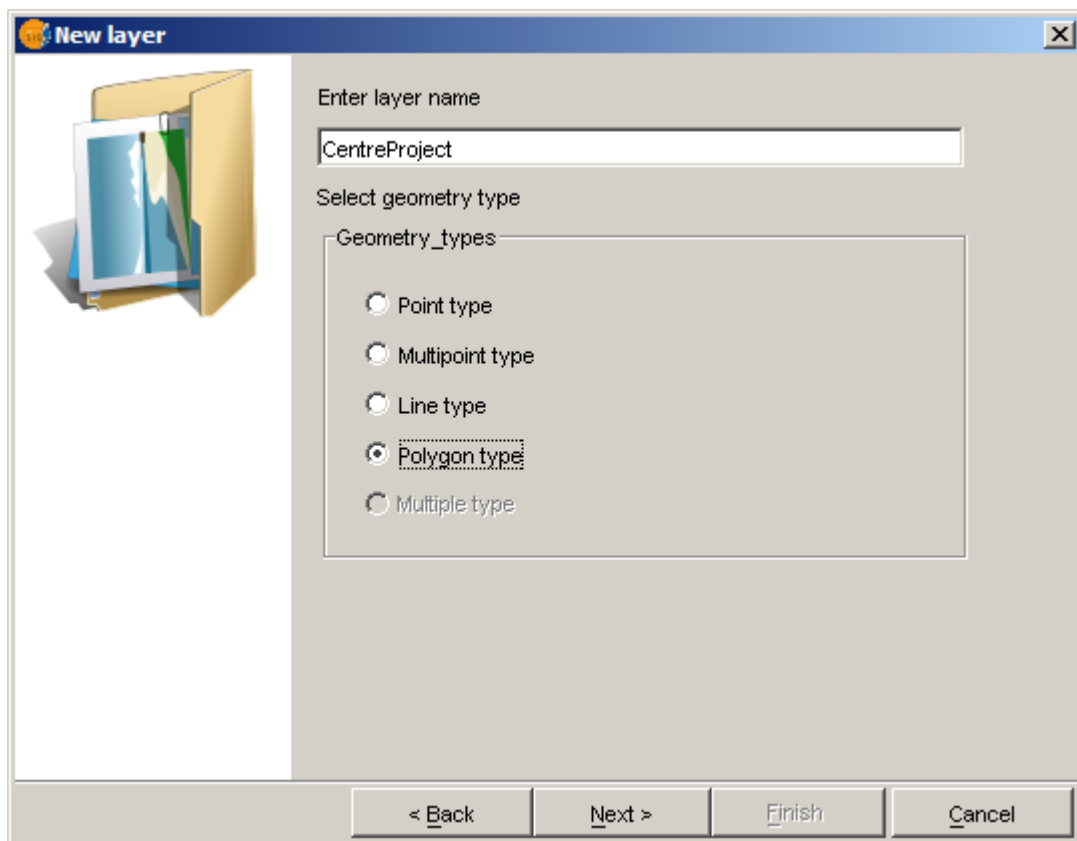
Exercise 4: Editing

Based on the analysis done in a previous exercise, we can pick a suitable location for a new social centre in the Campanar district. We'll try now to sketch the structure of this new development, creating polygons that describe different features: buildings, recreation areas and green areas.

To do this, we'll make use of the new editing capabilities of gvSIG at version 1.0.


- **Create a new layer**



- Use *View / New Layer / New Shape File (.shp)*
- Select *Polygon type* as geometry type. Click next.
- Add a field named *Use*, leave the default type (String) and size
- Set a path for the output file in the computer's harddisk (a writable location), like *Workshop/CentreProject.shp*

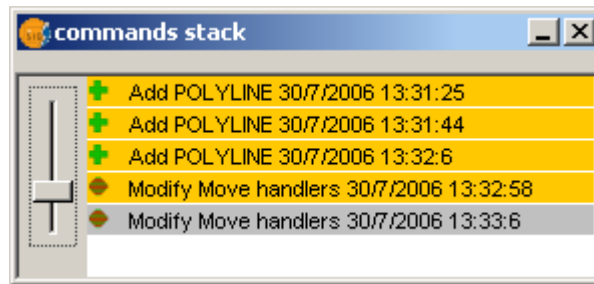


You should see a new layer added to the TOC, and marked in red, to show that the layer is in editing mode. You will also see that the editing console has opened at the bottom of the view, and a number of new editing tools show up in the toolbar area.

- **Sketch your features**

- Select the Polyline drawing tool 
- Click on the location for the first point of -let's say- a new building boundary. Click then on the location of new vertices to draw the outline. To close the polygon, use the context menu *Close polyline* option, or type *C* in the editing console.

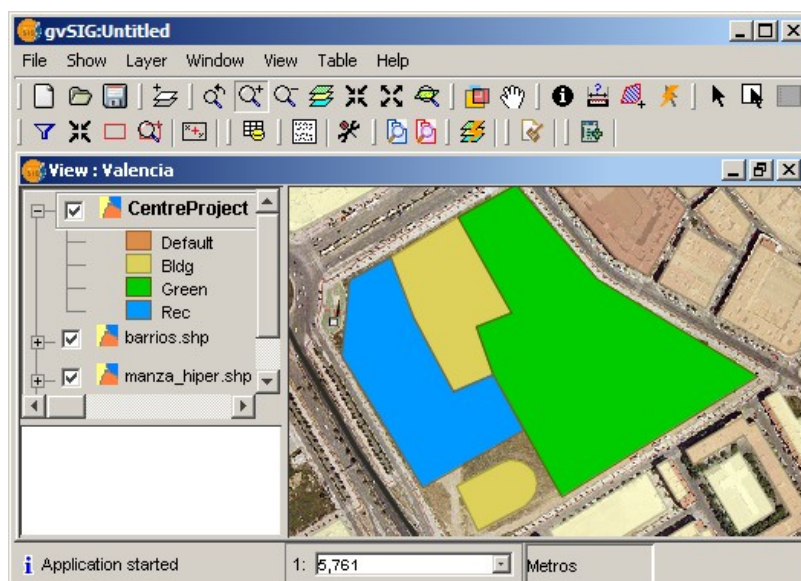
- You will see that the new polygon is highlighted with the selection color. You can now go ahead and create more buildings, and other polygons for the recreation and green areas of your project. Try combining *line and arc segments* by selecting these options in the context menu. Also, notice how the active *snapping* will help you to place new points on previous vertices or sides of your polygons, so you can easily avoid gaps.
- If you want to *change the position of some vertex*, switch to the selection tool , click on the vertex that you want to move, release the mouse button and then click on the new location for the vertex.
- You can use the *undo/redo* tools, or open the *command stack* tool  to go back to previous editing states.



When you are done, make sure the layer is selected in the TOC and use the *Layer / Finish edition* option, choosing *Yes* when asked if you want to save the results.

- **Assign attributes to the sketched areas**

- Select the *CentreProject* layer in the TOC and choose *Layer / Start edition*
- Choose *Layer / See table of attributes*. To change the value of any field, click on the table cell, type the new value and hit the Enter key. The polygon whose attributes you are editing will be selected when you click on the table, and viceversa.
- For instance, assign values like *Building*, *Rec* and *Green* to the *Use* field.
- Close the attribute table and finish editing, saving the results. For a nicer display, choose a Unique Value *legend* for this layer and assign proper colors to each *Use* value). And, if haven't done it yet, **SAVE THE PROJECT** in a writable location (we'll use it later).




- **More editing**

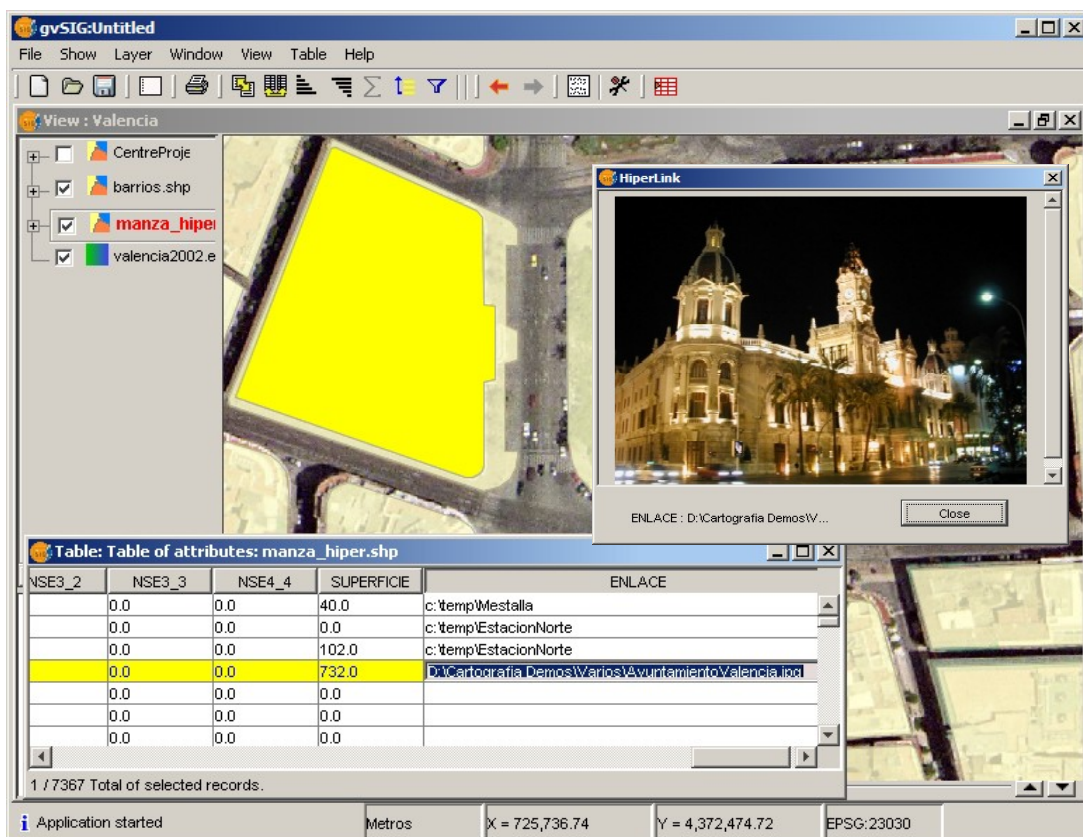
Unlike other GIS packages, gvSIG allows you to edit multiple layers at the same time.

You can also edit any feature dataset as long as you gvSIG can read it (including WFS) and then save the results to writable formats by using the *Layer / Export to...* menu.

- **Using attribute editing to create hyperlinks**

We can associate text or images to features and access this linked information by using the link tool. We'll see how to create this hyperlink information.

- Start editing the *blocks.shp* layer. The application will give you a warning if this layer is in a non-writable location (like a DVD) but we can save the results in a different location or just keep the changes in memory for demonstration purposes.
- Open the attribute table. Locate the *Enlace* (link) field to the far right. Click on the fields's name and sort it by descending order. You will see that some links have been defined, for a few blocks.
- Change the path of *AyuntamientoValencia* image to be *...Valencia* and add the missing *.jpg* extension. Leave this block record selected and use the *Zoom to Selected* tool to find it in the view.
- We also need to configure the layer's hyperlink. Go to the *General* page of the layer's properties and select the *ENLACE* field as hyperlink field. OK the dialog.
- Now we can use the link tool  (*View / Query / Link*) on the selected block. A window with the building's image should show up.
- Finally, finish editing on the layer. You may again get a warning if the data location is not writable. In that case just say yes.




Exercise 5: Geoprocessing

We are going to see how to use the geoprocessing tools to perform spatial analysis. The idea is to find which city blocks may be affected by work on a proposed new metro line.

- **Sketch of a metro line proposal**

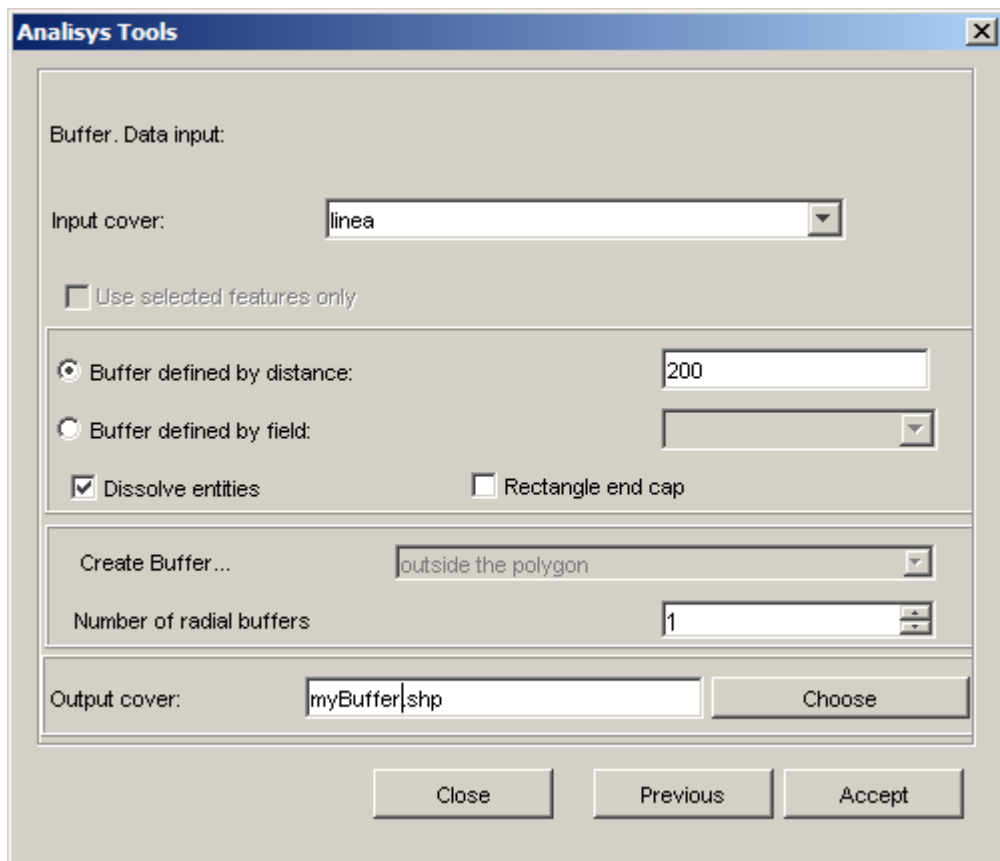
- Create a new layer with Line as geometry type, let's say *metro_line*. In this case we don't need to add any fields.
- Use the polyline tool to define the path of the metro line. Then finish editing and save the results.

- **Calculate a buffer around the metro line**

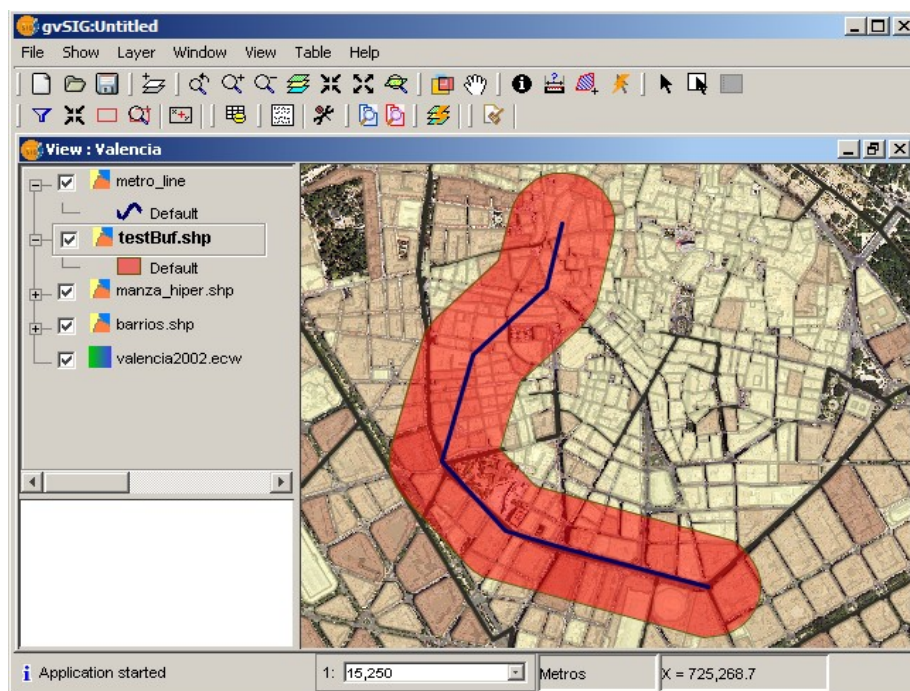
- Open the *geoprocessing wizard* with View / Geoprocessing Wizard 

Note that in the final 1.0 release, the Wizard will become an extensible Toolbox, but the dialog windows for specific operations will not change.

- Select the *buffer* operation, and in the next page, enter *metro_line* as the input cover.
- Select the default *buffer defined by distance* option and enter the *distance* (e.g. 150 meters). Choose the option to *dissolve entities*.
- Browse in a writable location and assign an *output cover* (the file that will be created containing the result). Click on *accept*.



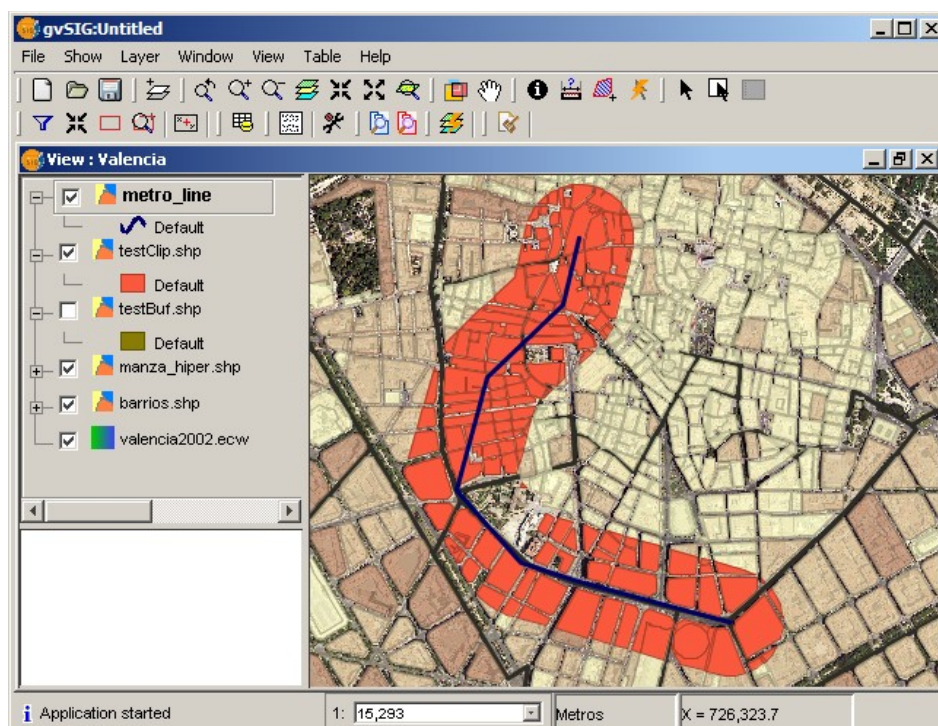
You should see a new layer added to the TOC, containing the buffer area. You can set a transparency value to the legend of this layer to see through the buffer.



- **Intersect the buffer with the city blocks**

- Open again the geoprocessing wizard and select the *clip* operation.
- Set *blocks* as the input cover, the new buffer layer as the clip cover and pick a suitable name and location for the output. Click on *accept*. We don't need a spatial index for the result (it should be quite small).

You should see now a new layer added to the TOC containing the clipped city blocks affected by the metro project. The attribute information is preserved, so we could now do some more analysis on what kind of population is affected and so on.

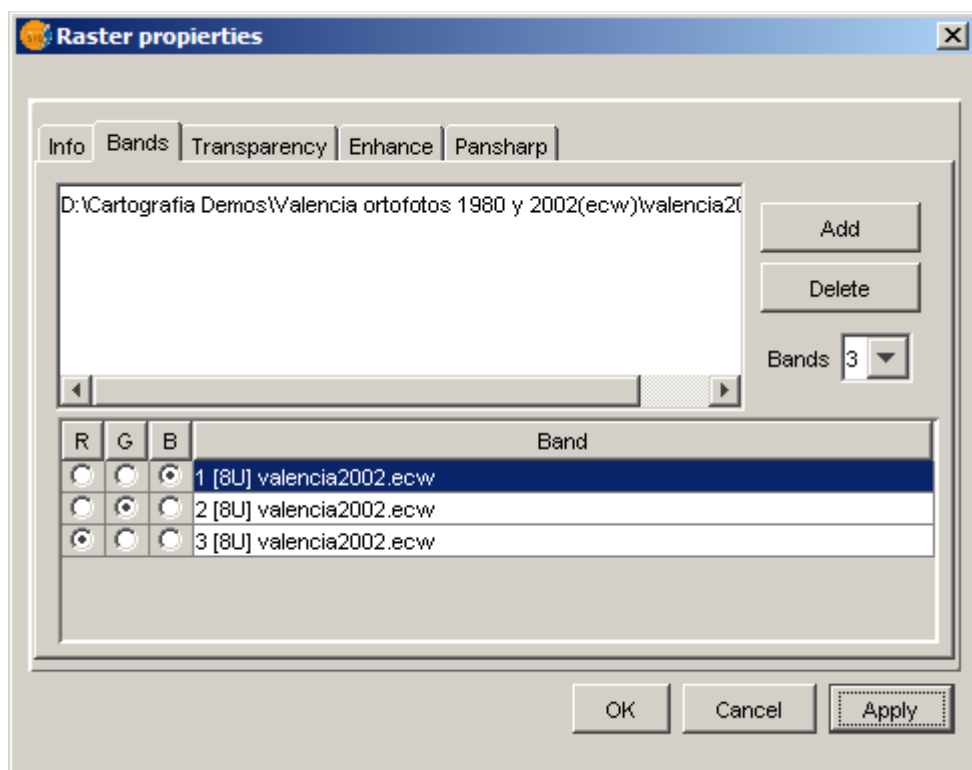




Exercise 6: Raster Georeferencing

This is yet another new capability of gvSIG 1.0 whose basic features we can see with a simple example.

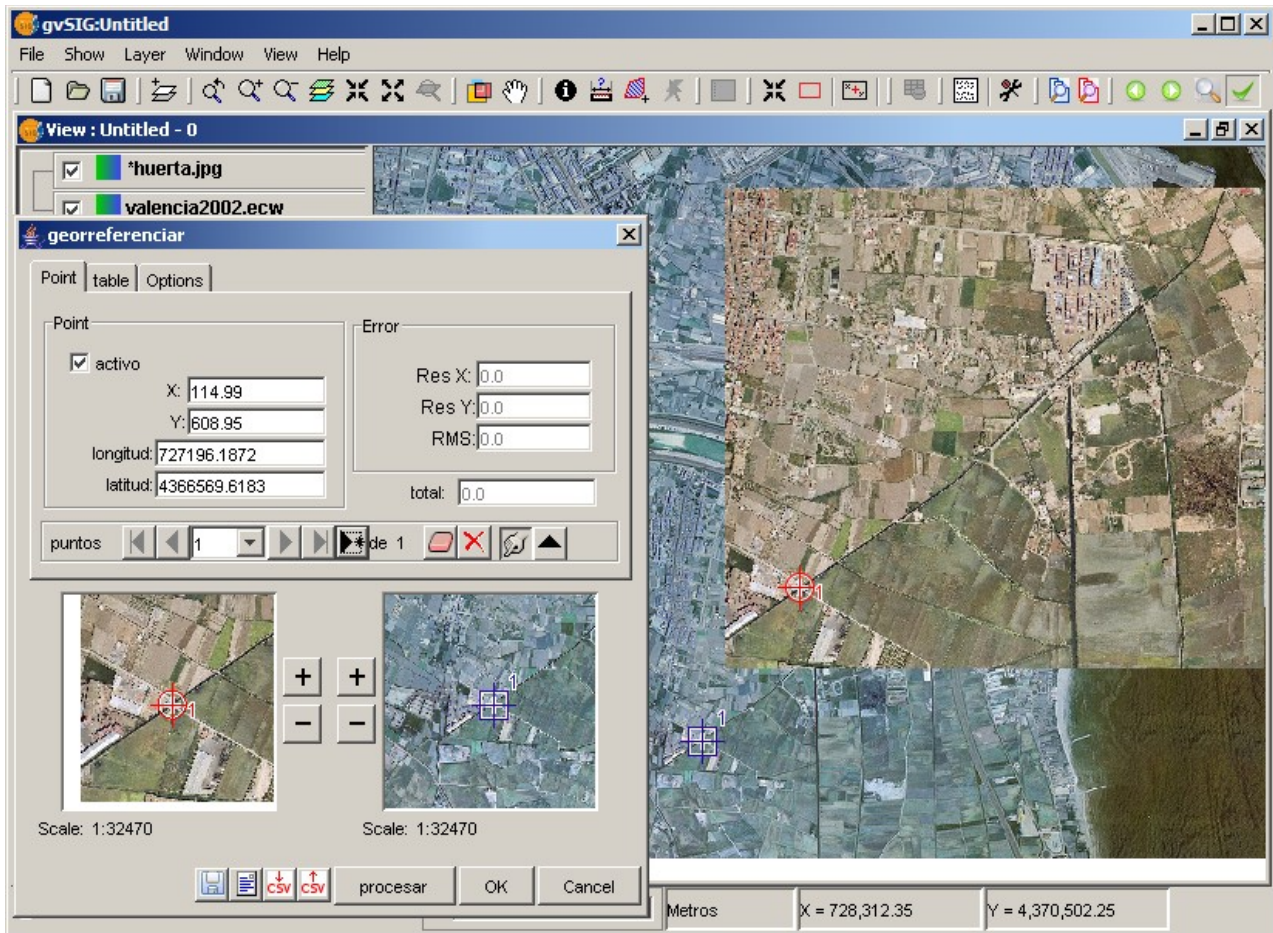
- **Load and georeference an image**

- Create a new view or project and load the *Valencia2002.ecw* orthophoto.
- Since we are going to georeference a subimage that looks very similar, we can change the band assignment of the reference image, so we can distinguish both clearly. To do this, go to the *Raster properties / Bands* page and change the radio buttons for the RGB bands.



- Create a writable copy of the image to be georeferenced, from *Valencia/huerta.jpg* to a writable hard disk location, if it isn't already in one.
- Now we need to load the image, which will initially appear fitting the center of the view. Since we know this image is smaller than the large ortho and it's located in the South, we can first *zoom* a little to the South and then use the *Add Layer* tool. In the *Add Layer* dialog, open the *Georeference* tab and browse for the image copy in the writable location.
- Use the *Move Georeferenced Image* tool  on the newly added image to position it near the area where it must be placed (see next figure).
- In the *Georeference* dialog, hit on the downward arrow button to extend the dialog. Then click on the *New* control point tool  and then on a clear landmark within the image being georeferenced.

You'll see that the image will disappear to allow you to see the underlying reference data more clearly. Locate the same landmark point in the reference image and *click* on it. When you do this, both control points will be marked on the view, and also displayed in the small detail viewing areas within the Georeferencing dialog.



- Use the *+ and - buttons* in the detail views to zoom in and refine the position of the control points, dragging them with the mouse to more precise locations.
- Click again on the *New* tool and add at least a couple *more control points* (a minimum of three is required for georeferencing to work).
- To try the final result, click on the *Process* button. If the result is not acceptable, you can add new points, or refine their position. Once you are satisfied, click to *accept* the result and end the process.
- To verify that the image is now georeferenced, delete the *huerta* layer and add the file again as a regular image. It should now automatically appear in the right location.


Exercise 7: Map authoring

Creating maps that show accurate and meaningful information is one of the key functionalities of any professional GIS. We'll see at a glance how to do this with gvSIG.

- **Create a Map document in the project**

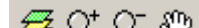
- *Open a project* you have previously saved with at least a couple of views
- In the Project Manager window, select the Map type of document and click on *New*. You can rename it as you did with Views.
- Double click on the map name or use the Open button to display the map layout canvas. Notice that a new *Map menu* and lots of new tools are now available.

- **Add Views to the map**

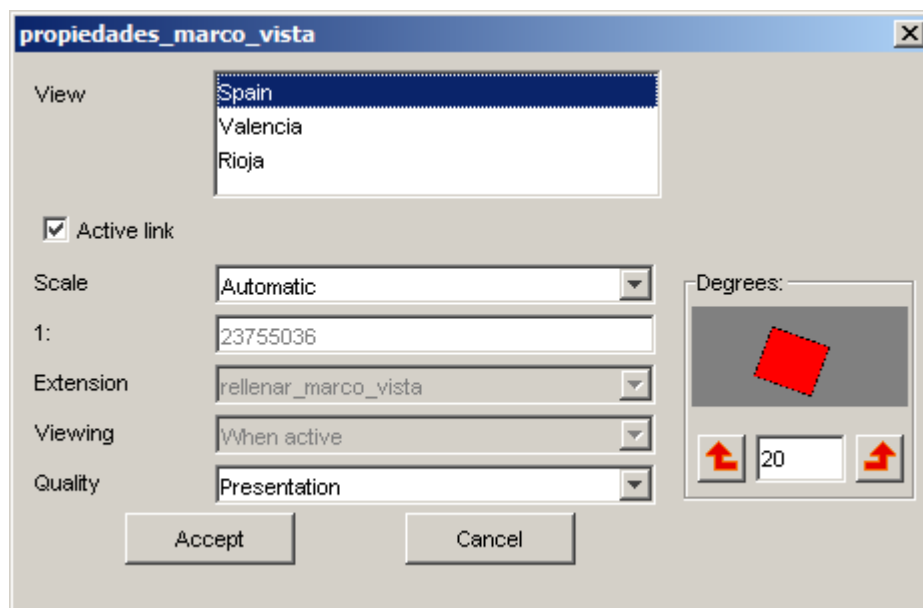
- Click on the *Map/Insert/View* tool  and drag a rectangle on the map layout. You will see a dialog to select one of the views in your project. After you *accept*, the selected view will be displayed on the rectangle. You can repeat the same process with other views.

- You can navigate on the map layout using the map navigation tools:




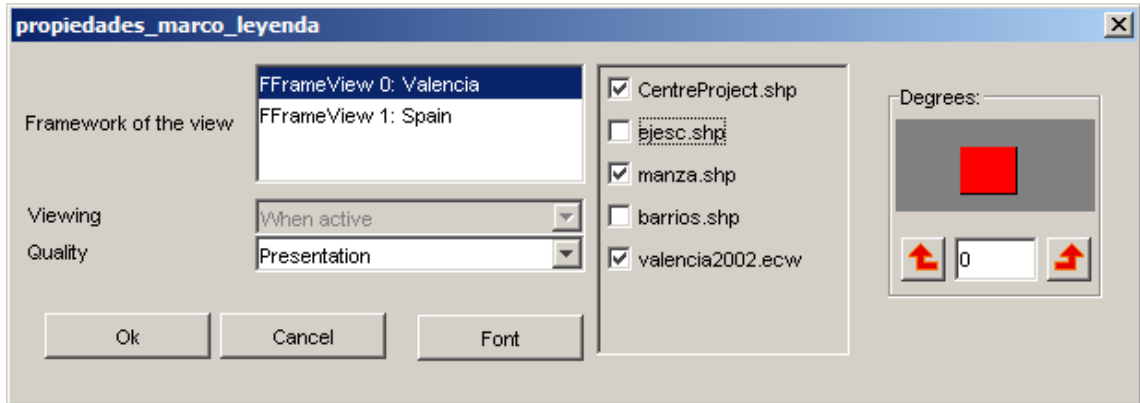
- You can also change the extent displayed within the views in the map by using the View Frame zoom tools (make sure the View is selected): 

- In addition, you can *Rotate* a view in the map. Select it and open the *Properties* by using the context menu on it (right mouse button). In the bottom right corner you can specify and preview the rotation angle.




- **Add legends to the map**

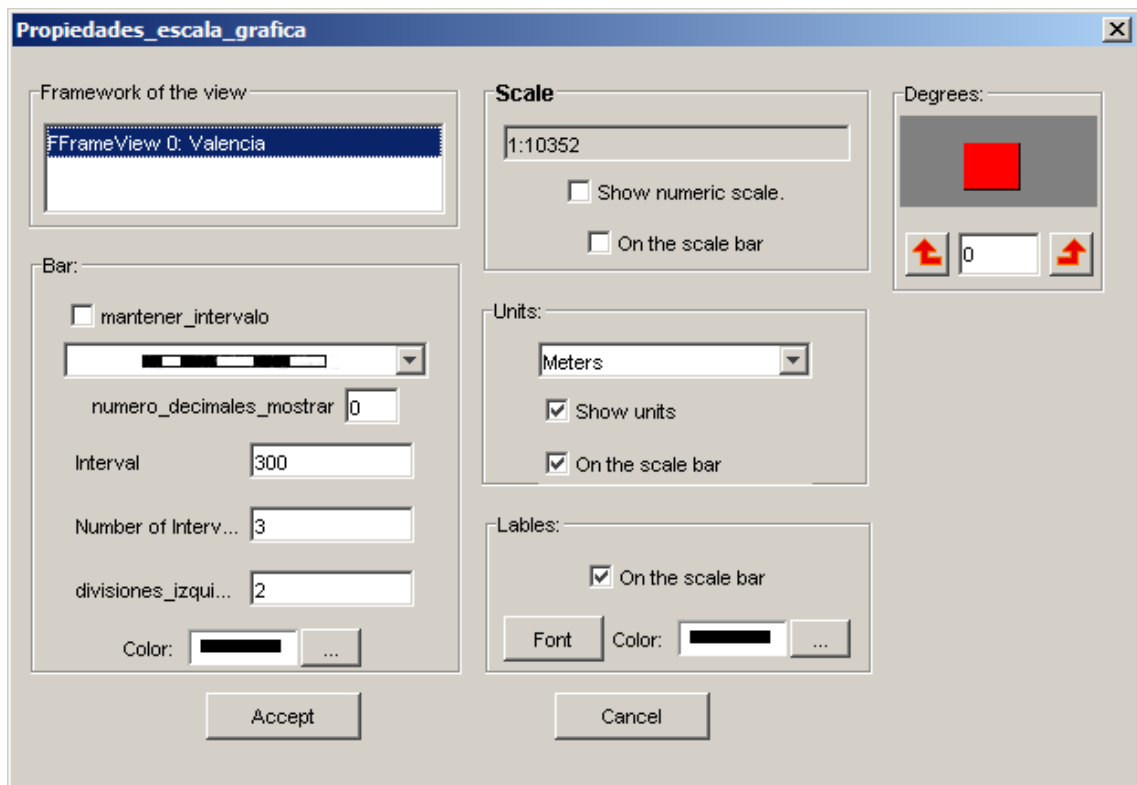
- You will typically add a legend to show what symbols are applied to the layers in your view. To do this, use the Add Legend tool  and drag a rectangle. The following dialog will pop up to select the view and layers



- Once the legend is drawn, you can refine its design by working with its individual elements. To do this, select the legend and use the *Map / Graphics / Simplify legend* tool.

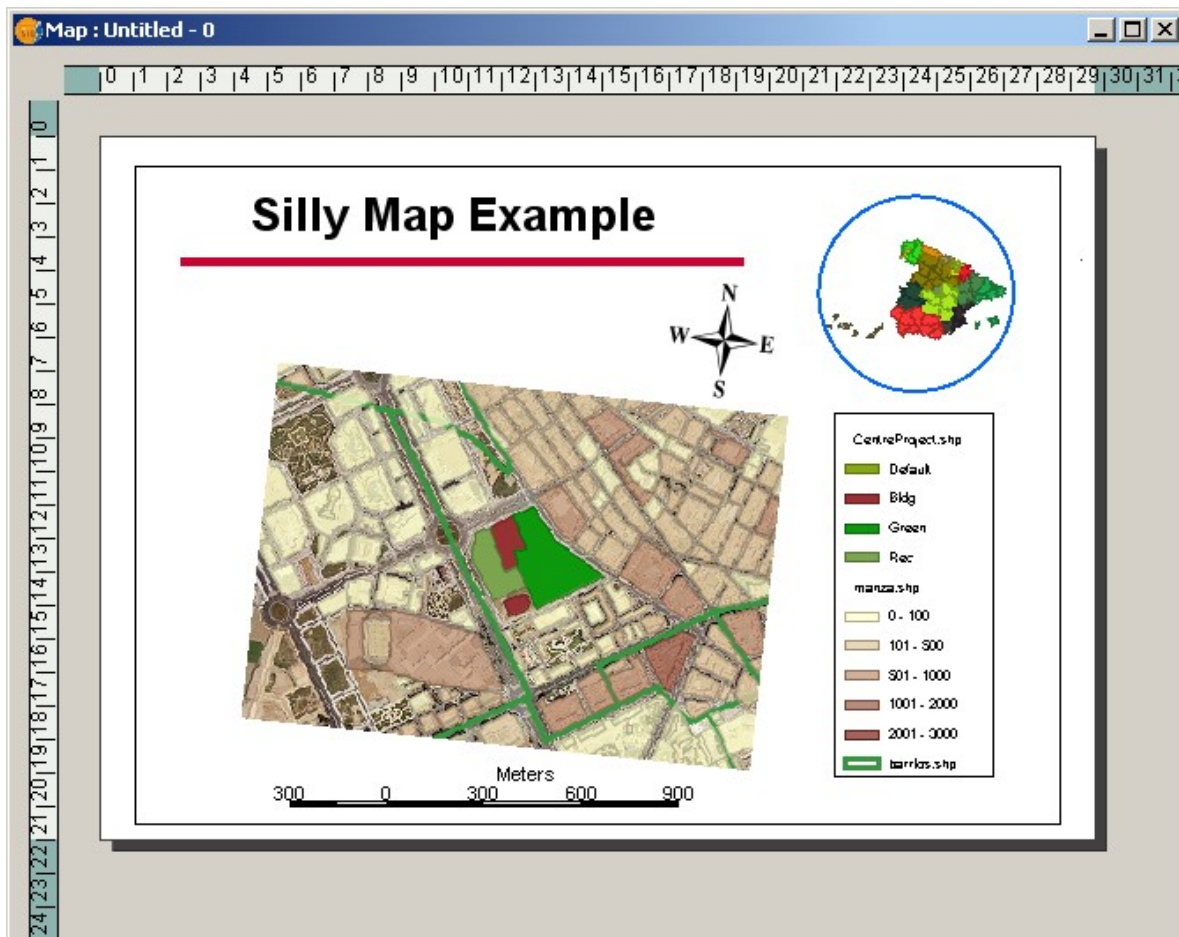
- **Other map elements**

- A common map element is the Scale, associated to a view. You can add scales to the map by clicking on the *scale tool*  and dragging a rectangle on the layout. The following dialog will let you choose some properties for the scale display:



- Another common element is a North Arrow, that can be added in the same way by clicking on the *north arrow tool*.
- You can also add to the map graphic elements like text, rectangles, lines, etc. by using the corresponding tools. You can also import image files.
- Map elements can be grouped or moved and their depth order changed by using the tools available for these operations.
- The properties of any map elements, like the color of a graphic element, can be modified by selecting it and using the *Properties* option in the context menu.

The following figure shows an example combination of most common map elements displayed in the layout.



- **Publishing and printing**

- The map can be *exported* to PDF and PostScript formats by using the options under the File menu.
- It can also be printed by using the option under the Map menu.

WMS (Web Map Service) Services:

<http://www.simoncit.cop.gva.es/cgi-bin/wms>
<http://ovc.catastro.meh.es/Cartografia/WMS/ServidorWMS.aspx>
<http://wms.larioja.org/request.asp?>
<http://www.idee.es/wms/IDEE-Base/IDEE-Base>
<http://idena.navarra.es/ogc/wms.aspx?>
<http://www.idee.es/wms/IDEE-Limites-Hojas/IDEE-Limites-Hojas>
<http://wms.jpl.nasa.gov/wms.cgi?>
http://www2.dmsolutions.ca/cgi-bin/mswms_gmap?
<http://demo.deegree.org:8080/deegree/wms>
http://orto.cth.gva.es/wmsconnector/com.esri.wms.Esrimap/wms_urbanismo_tematicos
http://orto.cth.gva.es/wmsconnector/com.esri.wms.Esrimap/wms_pgof

WFS (Web Feature Service) Services:

http://www2.dmsolutions.ca/cgi-bin/mswfs_gmap

WCS (Web Coverage Service) Services:

<http://www.simoncit.cop.gva.es/cgi-bin/wcs>
http://maps.gdal.org/cgi-bin/mapserv_dem
<http://hypnos.cbs.umn.edu/cgi-bin/mapserv?map=/data/wcs/demo.map>

Catalogue services:

EUITTO (Universidad Politécnica de Madrid):

- **Protocol:** z39.50.
 - **URL:** mapas.euitto.upm.es:2100
- FAO (Food and Agriculture Organization of the United Nations):**
- **Protocol:** z39.50.
 - **URL:** 193.43.36.137:2100
- Instituto Cartográfico de Cataluña:**
- **Protocol:** CSW
 - **URL:** <http://delta.icc.es/indicio/csw>
- IDEE:**
- **Protocol:** SRU/SRW
 - **URL:** <http://idee.unizar.es/SRW/servlet/search/ExplainSOAP>

Gazetteer Services

Infraestructura de Datos Espaciales de Cataluña

- **Protocol:** IDEC
 - **Area:** Catalonia
 - **URL:** http://www.geoportal-idec.net/gestor/webservices/idec_ws.php
- Alexandria Digital Library
- **Protocol:** ADL
 - **Area:** World
 - **URL:** <http://webclient.alexandria.ucsb.edu/>
- Degree**
- **Protocol:** WFS-G
 - **Area:** --
 - **URL:** <http://demo.deegree.org:8080/gazetteer/wfs-g>

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