# Common Access to Geographically Referenced Data


USER MANUAL

# CommonGIS User Manual

European Commission, DG INFSO, ESPRIT Project No. 28983
(Project Deliverable D4.7.2; JRC-ISIS)

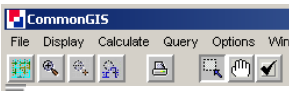
June 2001


# THE COMMONGIS USER MANUAL AT A GLANCE

## PART 1 - OVERVIEW



## PART 2 - A WALKTHROUGH USING THE FOREST FIRES APPLICATION




# HOW TO USE THIS MANUAL

**How to use this manual**

This short manual is intended both to be read "off-the-computer", as an introduction to CommonGIS, and to be used in front of a computer as a first tutorial to CommonGIS.

**Manual plan**

The User manual is divided into two parts:
Part 1 is an introduction and presentation of CommonGIS aims, solutions and requirements.
Part 2 is organised as a tutorial and aims at taking the user through a quick guided tour involving some of the main features available.
It is divided into steps and each step is in turn divided into sections. Although each section is organised as a one (rarely two) page self-standing unit of information, we suggest, whenever possible, to follow all the pages in a step without interruptions.

This manual is intended to demonstrate only the usage and user interface of CommonGIS software, and not to evaluate the exemplary data sets used here, which are only functional to introduce the program use.

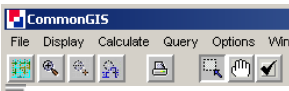
**Special notation**

Scattered through all the guided tour steps there are special parts marked by shadowed boxes: these are ADDITIONAL INFO BOXES.

**ADDITIONAL INFO BOX —…**

*These boxes contain notes on current actions being described or hints on alternative actions to take in case some options are not available or suitable to the user.*
*They also host quick hints on more functions available or suggestions for user self exploration of program features.*


# PART 1 - OVERVIEW






CommonGIS aims to disseminate and make available spatially-referenced data to a broad cross-section of the public. With this initiative, we hope to have succeeded in our purpose: *GIS for everyone, from everywhere.*

"*GIS for everyone*" because the target audience of CommonGIS is a wide variety of people who need to use geo-data for work or study but are not specialists in GIS and data presentation design. Users include local authorities, teachers and marketing professionals, just to name a few. CommonGIS doesn't exclude, however, highly-qualified professionals in various fields who aren't proficient in operating GIS and don't have time to learn. The goal is to make GIS data available to all that cannot afford expensive GIS software and equipment and/or do not posses the knowledge required to efficiently use it.

"*GIS from everywhere*" because CommonGIS applications can be accessed through the Internet using a standard Java-enabled Internet browser. This allows casual users to access and utilise geo-referenced data from any networked computer.

In general terms, CommonGIS makes geo-data readily accessible and usable for everyone, from everywhere, by providing a web-based Geographical Information System (GIS) with specific functions to automatically generate thematic maps.

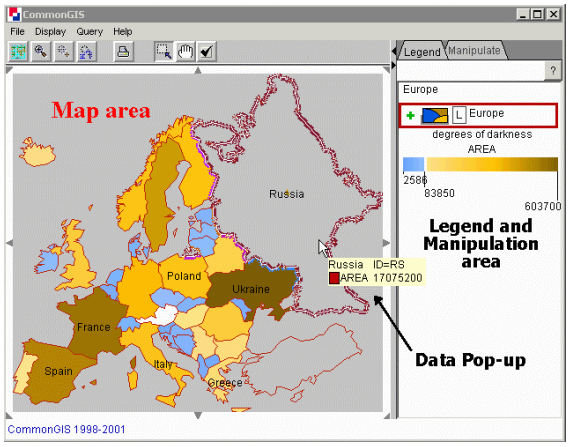
CommonGIS makes it possible to explore and analyse geo-data easily and clearly with interactive and direct manipulation tools.
This translates into software that:

- provides access to remotely located geo-data through the Internet
- automatically generates thematic maps that correctly and effectively present map-based visualisations of geo-data sets selected by the user;
- displays the generated maps on the user's side;
- supports exploratory geo-data analysis by enabling map modification with the use of direct manipulation techniques;
- provides all necessary user interactivity while requiring no special software from the user's side except a standard (Java -enabled) Web browser.

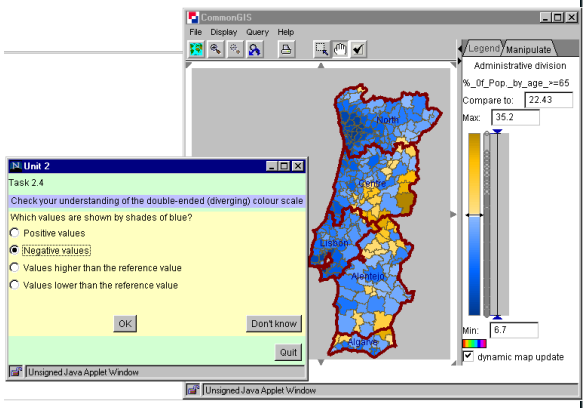



The solution is based on Java technology, so the interactive interface can be downloaded on-demand independently of the location, hardware and operating system of the user.

In order to analyse spatially referenced data, it is necessary to present them on a map, which should be properly designed with respect to data characteristics and relationships among data items.
Since each presentation method imposes certain limitations on data it can be applied with, a system that automates the preparatory stage offers considerable help to the analyst. It releases the user from working on map design and therefore from the necessity to learn the principles of graphical presentation.
The user is therefore able to devote more time and attention to data analysis.

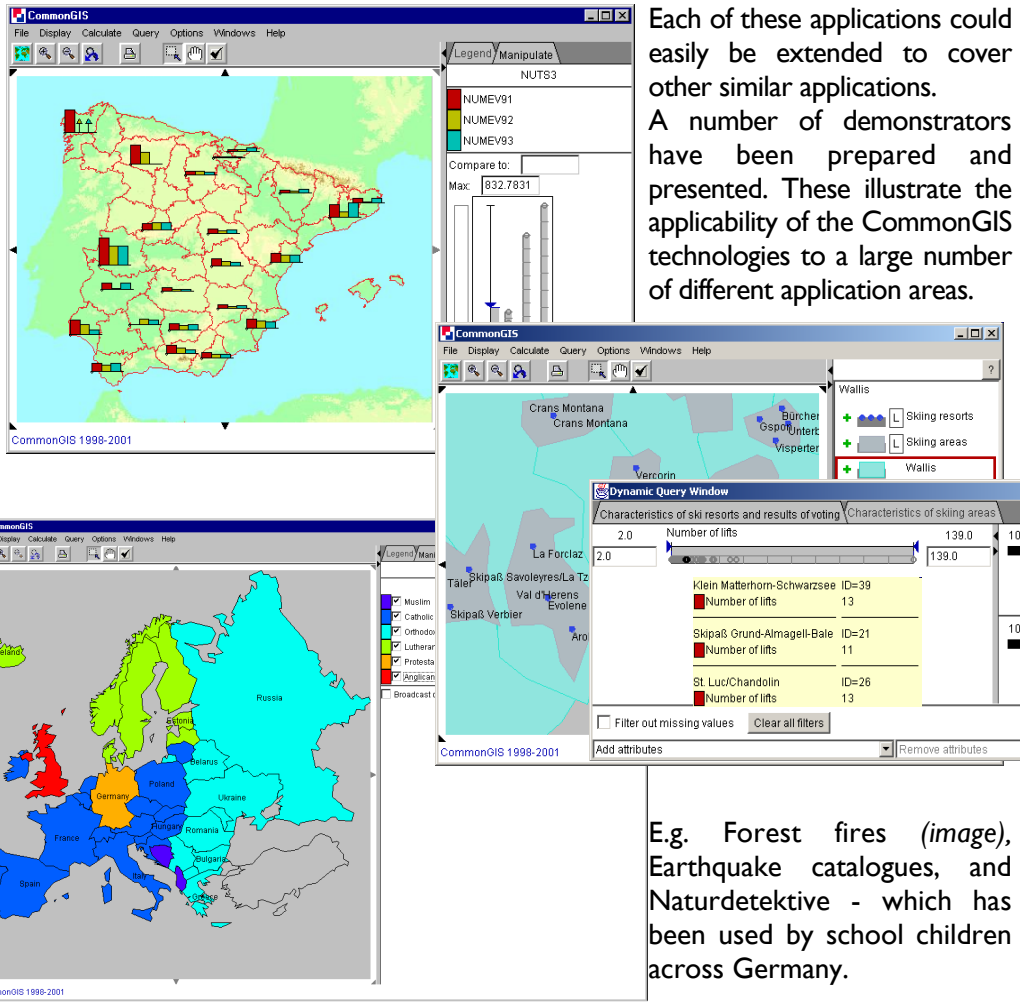



A significant new feature is the knowledge based task assistant, which can be accessed by users, advising them on the best visualization options for their applications. Such support is particularly important for novice users. The fact that this parameterized knowledge base automatically instantiates itself to the notions of a new domain represents a very effective user adaptation strategy. The techniques developed can also be ported to other application areas.



Two representative application scenarios using the CommonGIS product were selected and developed in the project:

- The "Buy a House Scenario" - selection among spatial locations or areas (e.g. selection of a house to buy, selection of a vacation site, etc.)
- The "Education Scenario" - exploration of statistical data referring to administrative areas (e.g. exploration of demographic data about European states).




Each of these applications could easily be extended to cover other similar applications.

A number of demonstrators have been prepared and presented. These illustrate the applicability of the CommonGIS technologies to a large number of different application areas.

E.g. Forest fires *(image)*, Earthquake catalogues, and Naturdetektive - which has been used by school children across Germany.




From the users' perspective, CommonGIS supports this work scenario:

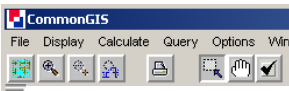
- By way of a standard WWW browser the user has access to a catalog of available geo-data, indicating for each data set its topic (population, housing, industry, environmental pollution etc.), territory (Germany, Europe, …), and territorial units (cities, districts, countries, …) the data refer to. The user selects a data set to work with. In response, an index of attributes contained in the selected geo-data set will be shown.

- The user selects one or more of these attributes. In response, the user immediately receives a map that visualizes data for the selected attributes. The map is supplied with a legend. Map and legend are generated completely automatically, without any involvement of the user. The system takes care about the *correct* presentation and visualization of the data in the maps, i.e., visualization techniques are properly chosen depending on characteristics of the data fields being represented and relationships among them, in compliance with principles of graphic and cartographic presentation. This prevents misinterpretation of data and supports adequate and effective data analysis, and on this basis, facilitates proper problem solving and decision making.

- Remaining within the WWW browser, the user can view the map with the aid of all necessary facilities: zooming, panning, layer selection etc. The user can also access the exact data values associated with geographical objects: the values are shown when the mouse cursor approaches an object in the map.

- The map on the user's screen is not a mere reproduction of a paper map. It is dynamic, i.e. able to change its properties in real time in response to certain user actions (direct manipulation). The direct manipulation tools offered to the user are designed in a way that promotes the revelation of interesting and important data features and spatial patterns that could remain unnoticed in a static map.

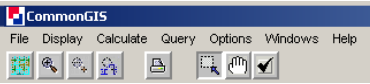
- The system also supports database querying and manual construction of derived fields by means of arithmetical or logical operations over existing fields. The results of these operations can be automatically visualized and analysed with the help of the direct manipulation techniques.






# Features - Functions

| | |
|---|---|
| **Map visualizations ("mapping")** | Choropleth maps for one numeric attribute<br>Choropleth maps for one qualitative attribute<br>Choropleth maps for cross classification<br>Choropleth maps for other classifications<br>Multiple choropleth maps |
| **Diagrams** | Bar charts<br>Pie charts<br>Stacked bars<br>Triangles for two attributes<br>Utility bars<br>Utility pies |
| **Graph visualizations ("charting")** | Dot plot<br>Scatter plot<br>S-plot matrix<br>Parallel coordinate plots<br>Tukey's box plots<br>Histograms |
| **Data transformations ("calculation")** | Classification of one attribute<br>Classification of two attributes (cross classification)<br>Classification by dominant attribute<br>Classification by n-dimensional attribute similarity<br>Ideal point evaluation<br>Ordering of values<br>Average/Median/Quartiles/Variance<br>Calculation of arbitrary formula<br>Filter objects according to specified attribute values |
| **Basic map functions** | Zoom out (to maximal extent)<br>Zoom out (by factor)<br>Zoom in (with rectangle)<br>Zoom in (by factor)<br>Undo last zoom<br>Shift the map<br>Select mouse mode (zoom, pan, select or explore) |
| **Layers** | Change the order of layers<br>Change layer properties<br>Change the size and color of symbols |






| | |
|---|---|
| Open new window with current map<br>Minimize all<br>Restore all<br>Close all<br>Bring an open window to the front | **Windowing** |
| General system help<br>Task support guide: support based on characteristics of data and intended goal of the user<br>General information about system and application<br>Show advanced menu items<br>Show menu items for application building | **User support** |

## Features - Data Input and Output

**Data Input**

- Load attribute data from: DBF, Oracle Spatial, CSV (Excel), TXT (delimited text), ODBC/JDBC, clipboard.
- Load geographical data from: OVL (GMD Descartes), SHP (ESRI Shapefile), JPEG, GIF, FLT (grid data), WKB, Simple Features and GML (OpenGIS)
- Open a pre-defined map description MWI

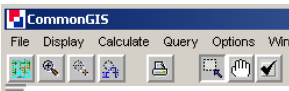
**Data Output**

- Display data records on mouse-over
- Edit options for display of data records
- Print map
- Save map as image
- Save application
- Select objects by mouse-click
- Find objects according to specified attribute values
- Display table with all objects

## Hardware and Software Requirements

The CommonGIS system is implemented in **Java™** language, and can run as applet in the web browser; therefore it will run if the Internet browser supports **Java™** applets. A recent version of Netscape or MS IExplorer will be enough. Some browsers have an option to disable **Java™**. If you disabled it, you can't run the applet, too.

A PC computer, with at least 16 MB of RAM, can run the system using **Netscape 4.x** or **Internet Explorer 4.0** or higher.






The roots of CommonGIS software lie in the rich experience of the partners in computer graphics, GIS, knowledge-based systems and data visualisation.
The CommonGIS Consortium is composed of seven public and private companies from five countries of the European Union. It is very market-oriented and took into consideration the user needs and requirements during the development process.

CNIG (Portugal) is an institution responsible for running the Portuguese network of geo-referenced data. They provided geo-data sets and specifically interacted with the end users in the validation process.

Dialogis (Germany), an independent GMD spin-off, commercialised a version of IRIS/Descartes system, an advanced prototype for the automatic generation of thematic maps. It contributed to further professional development and commercial exploitation of CommonGIS.

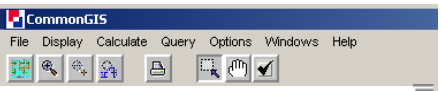
GMD (Germany) develops the IRIS/Descartes system and has been responsible for the overall management of the project, together with JRC.

IGD (Germany) has built another prototype for thematic mapping (Vizard). They supplied direct experience in studying the user acceptance and adequacy of different map presentations.

JRC (Italy) contributed knowledge about developing distributed applications, particularly for the use of geographical and statistical information. It also managed the dissemination and standardisation activities.

PGS (Netherlands) built a Java-based GIS (LAVA), which has been integrated with IRIS/Descartes and appropriately extended for the specific needs of this project. PGS and Dialogis have agreed on a mutual utilisation of results (see the License information).

The European GIS association GISIG, subcontractor of JRC, put to use its excellent dissemination channels to promote the results of the project and to help in the standardisation effort.

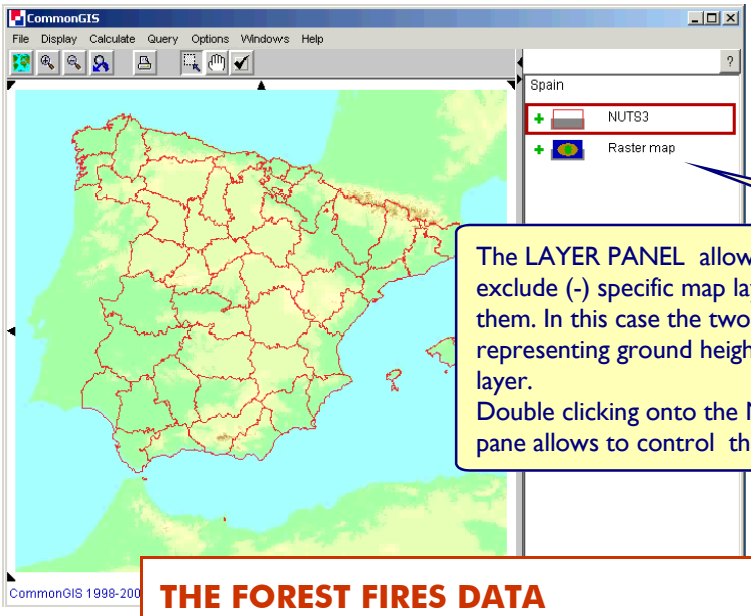



# PART 2 - AN EXEMPLARY WALKTHROUGH

## STEP 1 : Comparing Attributes

# THE FOREST FIRES APPLICATION

1. Let us start up the Forest Fires CommonGIS application by accessing it through a JAVA-enabled WWW browser at http://commongis.jrc.it/forestfires/ .
2. After the JAVA application has been downloaded (this requires a variable time, depending on the Internet access speed available), the main CommonGIS window shows up.

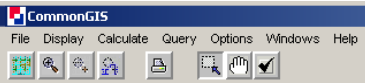



The LAYER PANEL allows to include (+) or exclude (-) specific map layers by clicking on them. In this case the two layers are a Raster Map representing ground heights and a NUTS3 region layer.
Double clicking onto the NUTS3 layer in this pane allows to control the line and/or fill colours.

## THE FOREST FIRES DATA

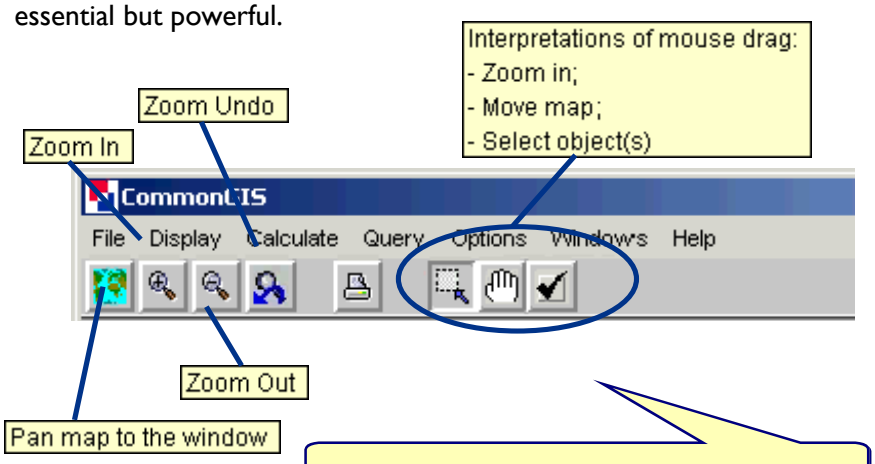
*The Forest Fires application uses data about fires in 23 regions of Spain, collected by the JRC during the years 1991-1993.*
*The attributes available for each region and for each year are:*

- *the total number of events (NUMEV91, 92, 93)*
- *the total area burned (ARBURN91, 92, 93)*
- *the MIN, MAX and AVERAGE delay between the first alarm and the start of extinguishing intervention (MIN-MAX-AVDELAY91, 92 , 93)*
- *the MIN, MAX and AVERAGE duration of the fire (MIN-MAX-AVDUR91, 92, 93)*

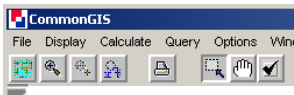





3. With CommonGIS it is possible to start exploring the data without wasting any time learning complicated systems: the user interface is essential but powerful.




Most of the buttons visible have familiar appearance: simple map operations (like zoom in, zoom out, pan, select feature) can be done using these buttons.
Useful tool tips pop-up when the mouse "touch" buttons and controls to clarify the meaning of any element of the interface.

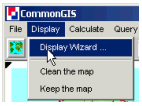


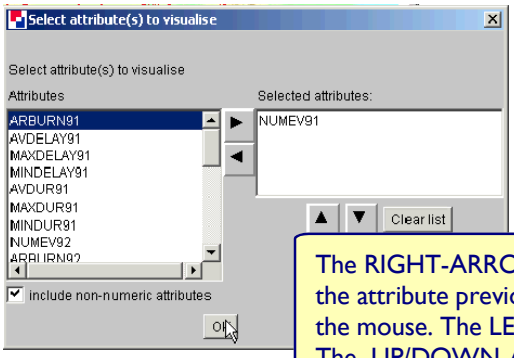



# SHOWING THE NUMBER OF FIRES

**Which is the region that had most fires in year 1991?**

1. To answer to this question it is possible to build a map that could show with degree of darkness the attribute "Total events in 1991".
2. Click on display and start the display wizard.

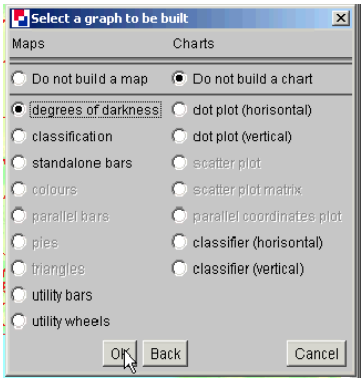



3. Select the attribute "Number of events in 1991" (**NUMEV91**) and click "**OK**".

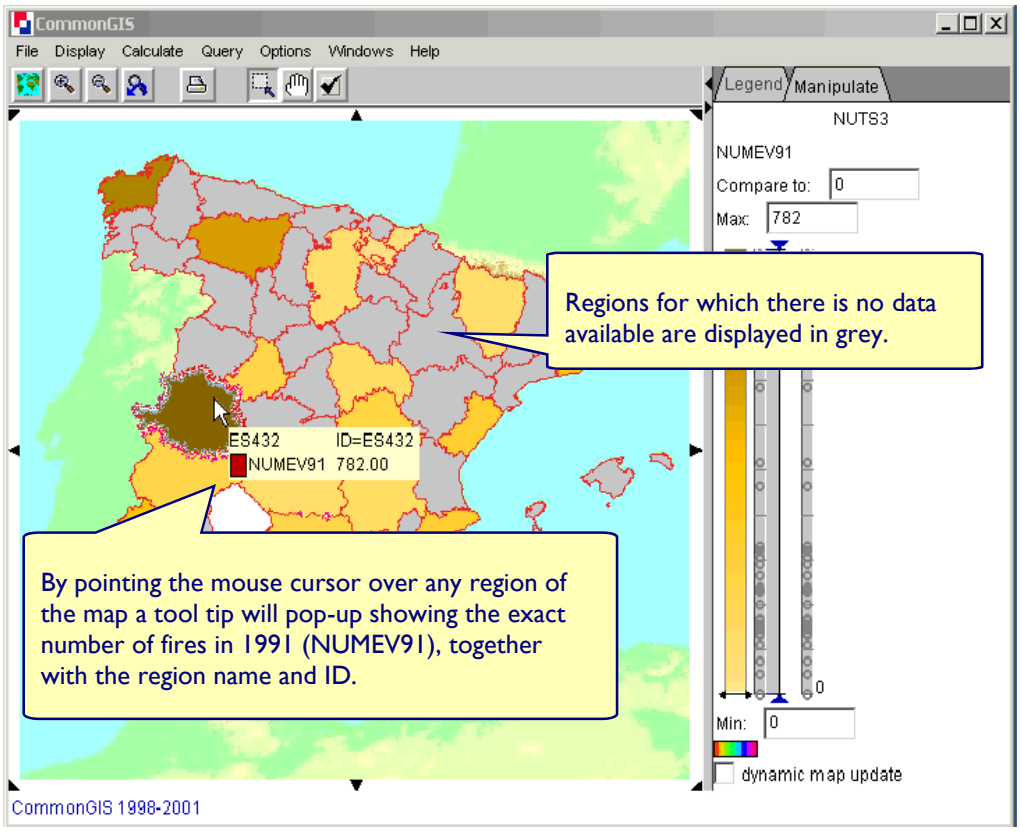
The RIGHT-ARROW button adds to the display list the attribute previously selected in the left pane with the mouse. The LEFT-ARROW removes attributes. The UP/DOWN-ARROW buttons allows to change the order of the attributes selected for display.

4. The second stage of the wizard asks what kind of representation to use. Click on "**degree of darkness**" and then on "**OK**".
5. The map which shows up on the CommonGIS window displays the regions with higher number of fires in 1991 with darker colours.



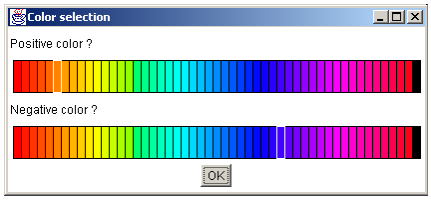


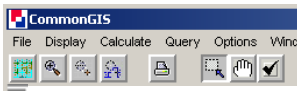

6. While it is evident which region was mostly affected by fires, there are little differences in the presentation, between the regions that have lower numbers of fires: we will see how CommonGIS can help.




## CHANGING THE RANKING COLOURS


*Clicking on the "rainbow" rectangular icon in the bottom of the right pane a Colour selection dialogue opens. You can change the positive and negative colours to be used. Note that since in the NUMEV91 attribute no negative values are allowed, the negative colour is never used.*



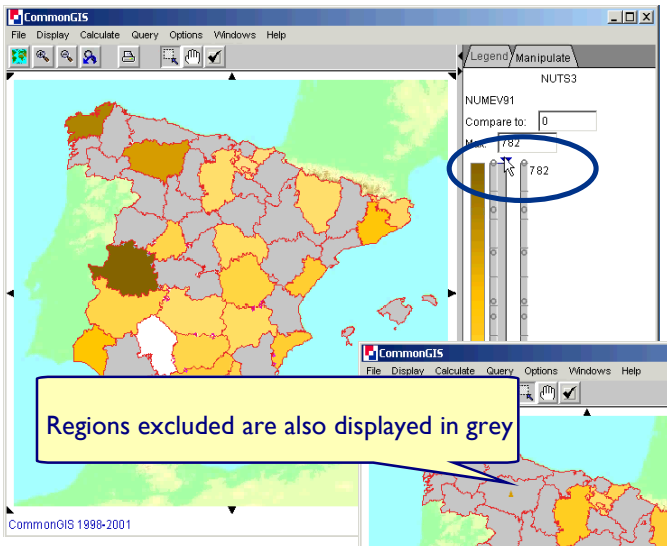




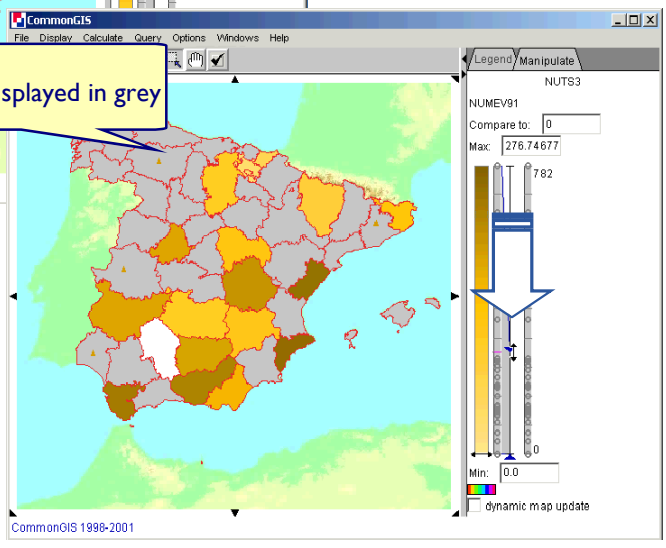

# ENHANCING THE MAP DISPLAY

**How can we discriminate better among regions with lower numbers of fires ?**

1. There are small differences in the display colours of the regions that have lower numbers of fires. It could help the visualization to put emphasis on the lower values.



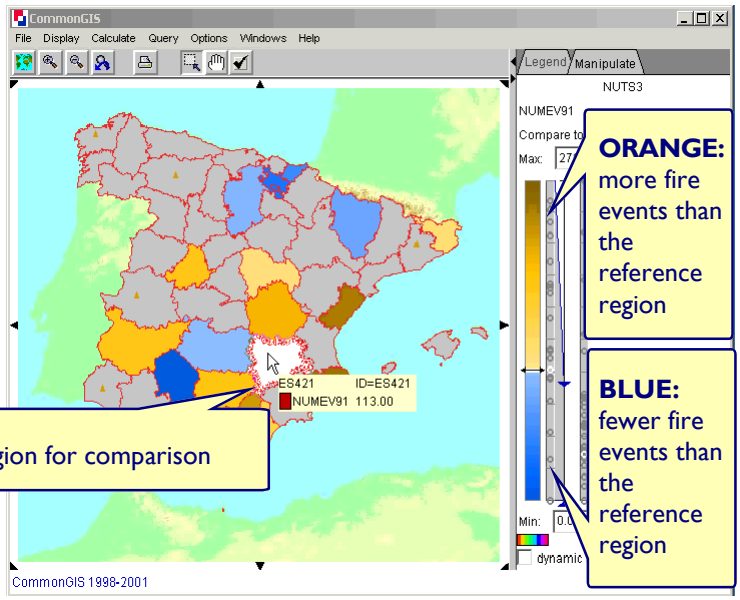

2. In the right pane, i.e. the legend/manipulation pane, **drag the upper triangular** delimiter to remove the so called "outliers" (the values that are much higher or lower than the mean).




3. The new max display value is reported in the Max numerical field.
The Min display value can be set similarly.


**How does one region compare to another ?**

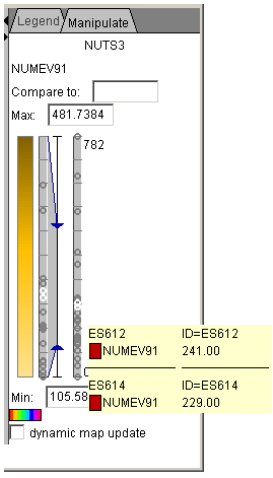
4. Clicking on a region, sets the value associated as a reference point thus enabling visual exploration capabilities.




**ORANGE:** more fire events than the reference region

**BLUE:** fewer fire events than the reference region

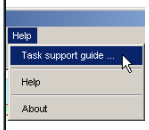
Reference region for comparison




## THE DOT-PLOT AND THE MAP

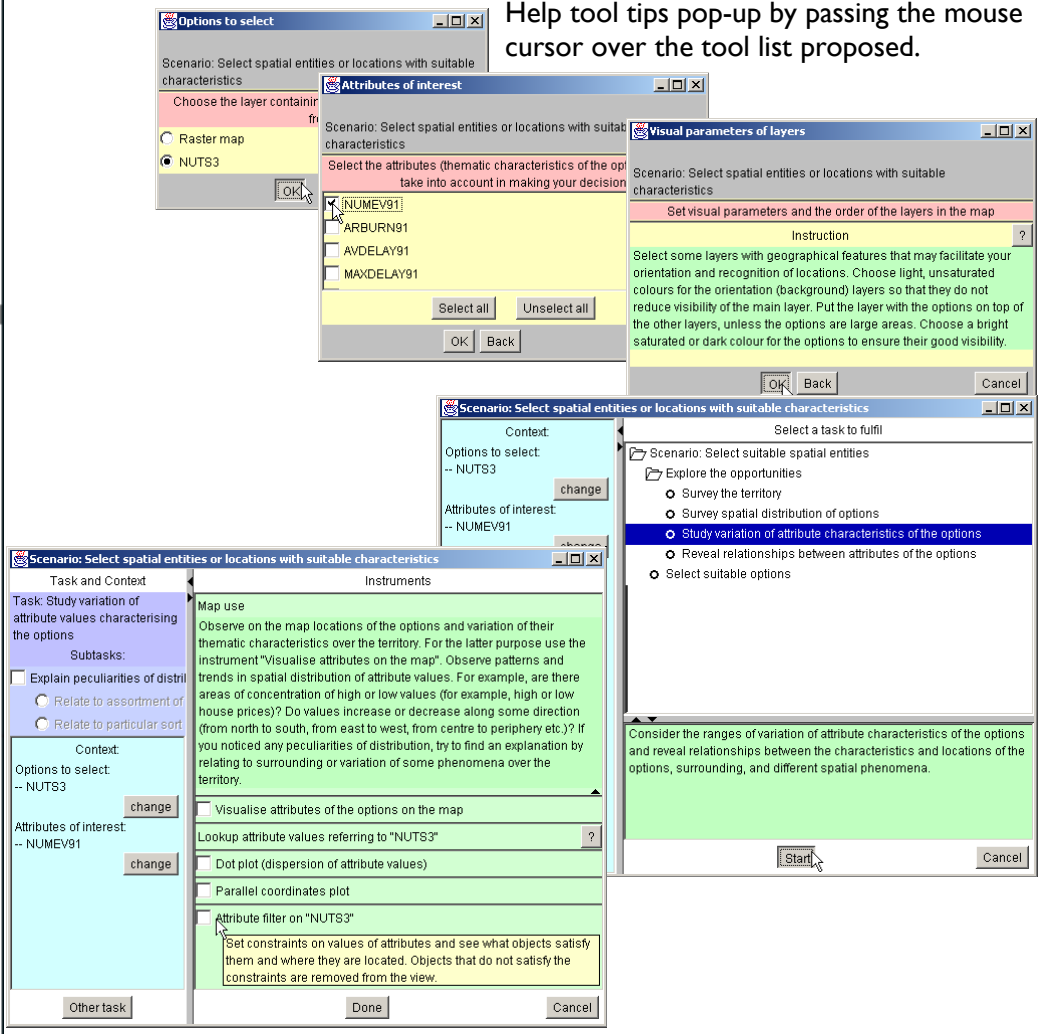
*The dot-plot diagram is composed by two main grey plot-bars, plus the left colour scale bar we have already seen in action. These bars are also active and linked to the map. By hovering the mouse on the bars the closest dots-values are highlighted, their values and region identifier are displayed and the corresponding region in the map gets highlighted. The right plot-bar always shows the full set of values for the attribute being displayed, while the mid bar shows only the values within the upper and lower limits set, repositioning the dots to cover the full bar range.*
*The upper and lower values-to-be displayed in the map can be set either by dragging the triangular handles or by typing numerical values in the "Min" and "Max" fields. Also the reference value for comparison (see the map above) can be set numerically with the "Compare to:" field.*


# THE TASK SUPPORT GUIDE

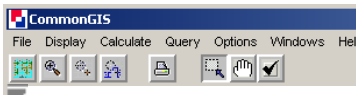



Activating the Task Support Guide "wizard" (menu **Help -> Task Support Guide …** option) gives another way in the use of CommonGIS. The systems guides the user through a number of selections and offers instructions (always in green background), task choices and, given a certain task, suggests actions and possible tools useful to that aim. Choosing tools (instruments) will ultimately start the display/analysis tools using the proper attributes.

Help tool tips pop-up by passing the mouse cursor over the tool list proposed.



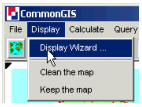

# STEP 2 : Showing Trends





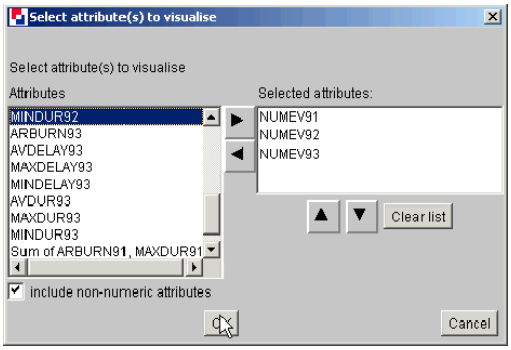

# TRENDS IN THE QUANTITY OF FIRES

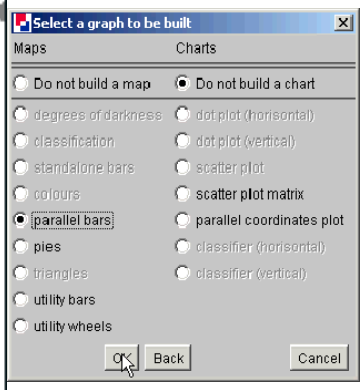
1. Since in the dataset there are also the data for years 1992 and 1993, it can be interesting to see the trends in the quantity of fires for each region and find out when the highest number of fires for each region occurred. One appropriate method to discover these things is to use a parallel bar visualization.




2. From the **Display** menu start the **Display Wizard** again.

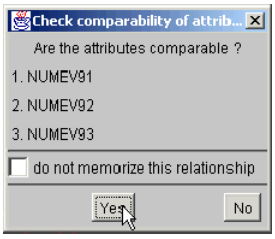
3. Add the attributes "Number of events" for years 1992 and 1993 (**NUMEV92** and **NUMEV93**) and click the **OK** button.

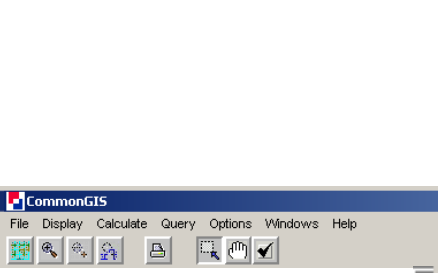



4. From the representation methods available choose "**Parallel bars**", useful to detect trends and compare values. Click the **OK** button.
Please note that only the display options which could apply to the attribute selection are enabled.

5. In the "Check comparability of attributes" dialogue showing up click **YES** to confirm. Note that because of this confirmation, unless you tick the "do not memorize …" option, CommonGIS will learn (memorise) that these attributes are comparable and will not ask you for any further confirmation for the same attribute choice.

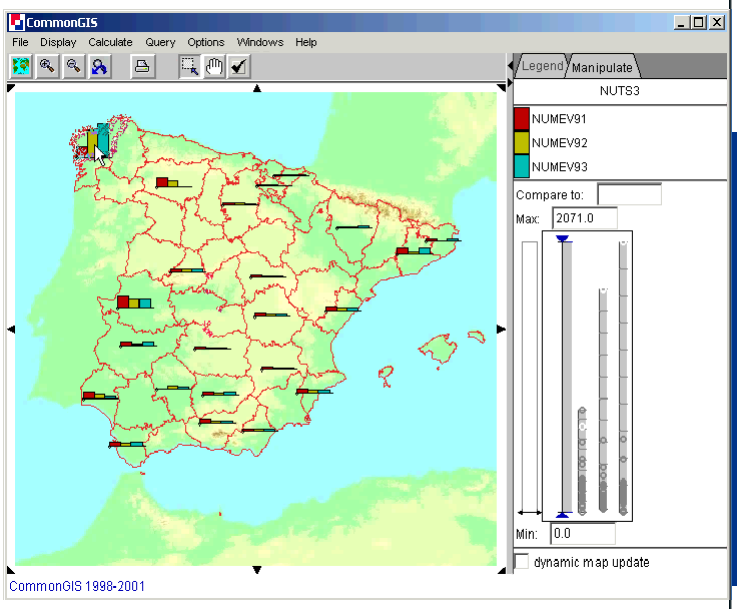







6. In the map window, it is easy to detect the region that has a steady increase in the number of fires during the period of time 91-93.

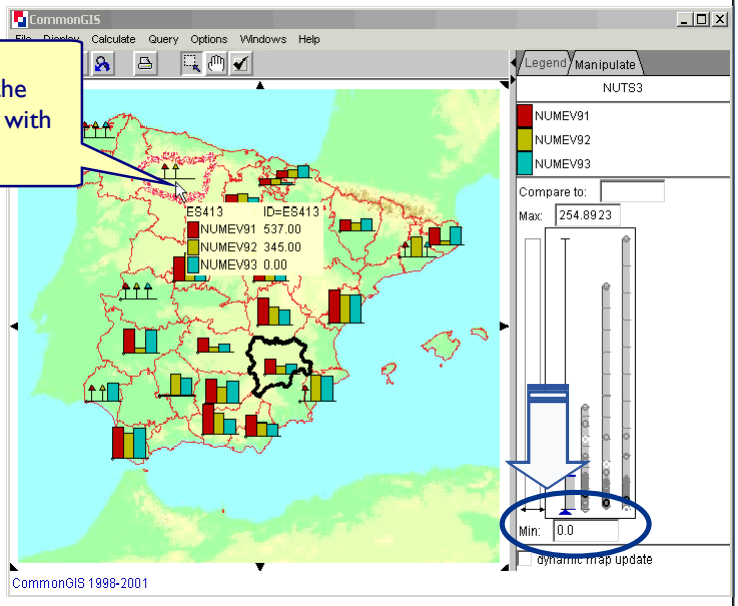
   Also that region has the highest number of events, thus making the parallel bar display of other regions poorly representative




7. By dragging the upper arrow in the manipulation window to exclude a few outlying values, the visualization can be adjusted to put more emphasis on lower values, which are all grouped in a smaller interval.

The values removed from the current display are marked with arrows.

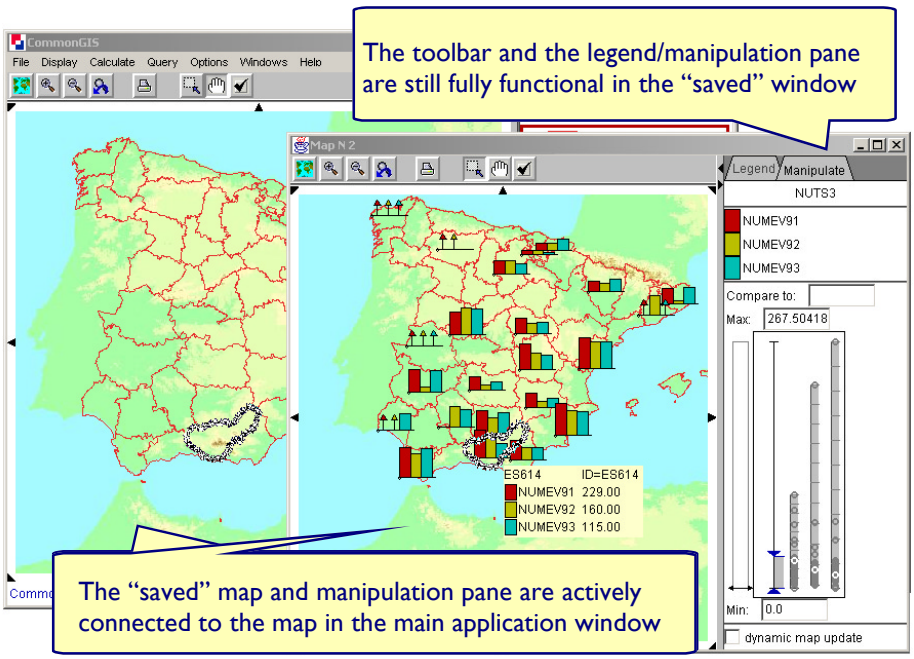
Now we can see that the other regions do not show dramatic increase in the number of events: their values seem to be pretty stable.






# KEEPING MAPS


1. To keep the current map, for later comparison, select the **Display** menu and the "**Keep the map**" item.
2. A second window opens with the saved map .



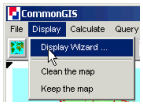

This saved map is:

- Still active and configurable: the manipulate and legend pane are fully functional as well as the toolbar. It is therefore possible to zoom, pan, remove outliers, change colours, etc., exactly as in the main application window.
- Connected to the main application window: hovering the mouse over points in the manipulation pane or in the map in the "saved" window, causes the corresponding map area in the main window to be highlighted/selected.

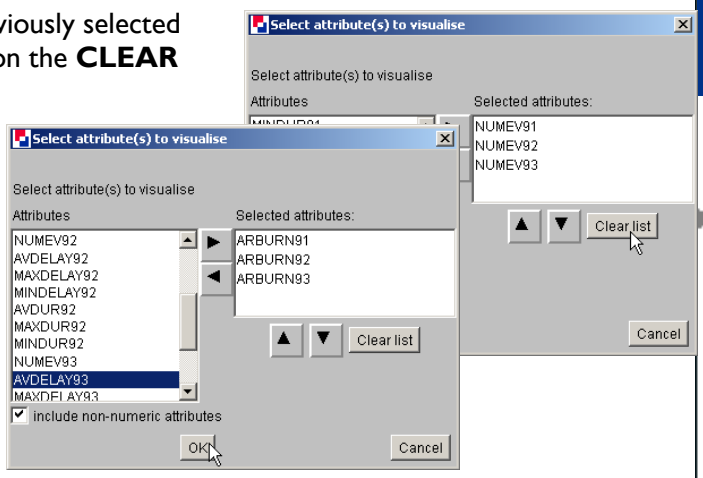



# TRENDS IN NO. OF FIRES AND AREA BURNED

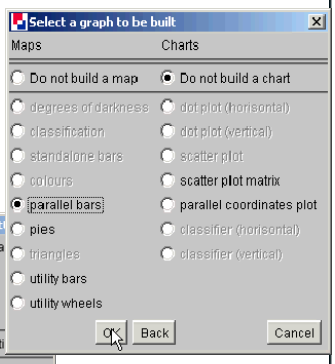
**Is the trend in area burned per region similar to the trend in the quantity of fires ?**



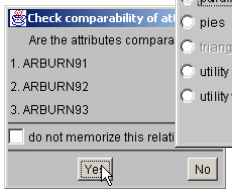

1. We first need to display the trend in area burned per region: from the **Display** menu start the **Display Wizard** again
2. Let us first clear the previously selected attribute list by clicking on the **CLEAR** button.
3. Then select **ARBURN91** (area burned in 1991) in the left pane and use the **RIGHT-ARROW** to add it to the attributes to visualise.
4. Repeat the previous selection also for **ARBURN92** and **ARBURN93**.



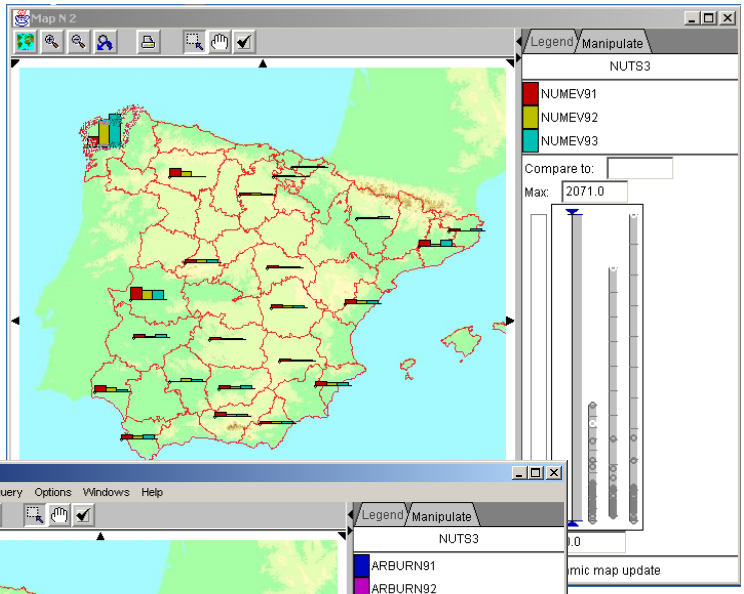

5. In the "Select a graph to be built" dialogue choose "**Parallel bars**" and click on the **OK** button.

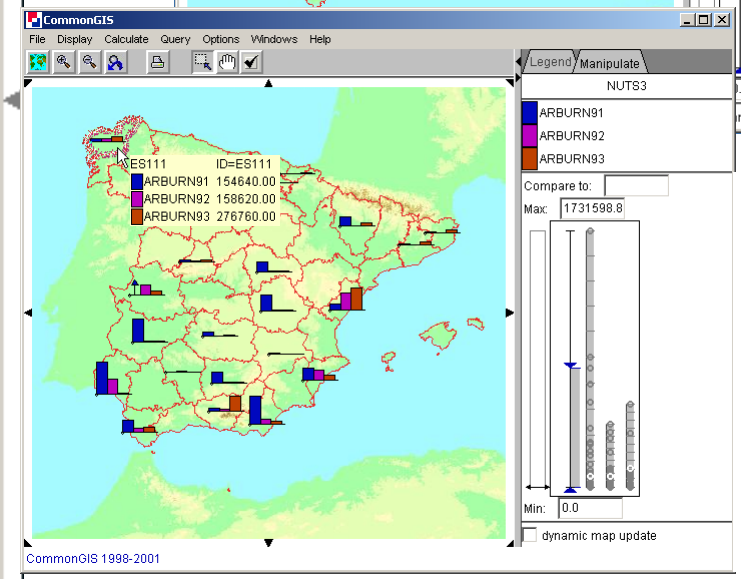



6. In the "Check comparability of attributes" dialogue showing up click **YES** to confirm.



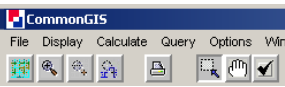
7. Visually exploring the "Area Burned" trend map, which is still actively connected with the "Number of Fires" trend map saved previously we can see that the two trends do not seem to coincide in every region.



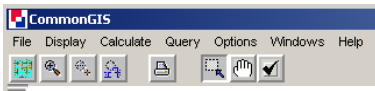




Some regions also exhibit opposite trends in the area burned and in the number of fires.

8. There are other useful tools to search for relationships between the area burned and the number of fires.
In the next step we will consider and compare total quantities, over the 3 years spanned in the database, for the same attributes.




# STEP 3 : Seeking Relationships





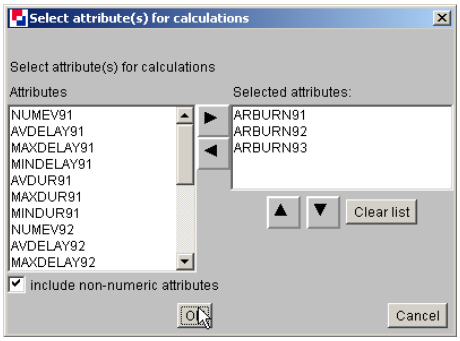

# CALCULATING THE TOTAL AREA BURNED

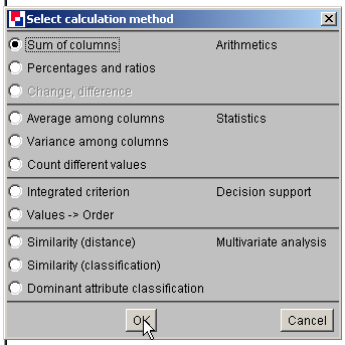
**Is the total area burned per region high where the total quantity of fires is also high ?**

1. To address this question we must first compute the aggregated data. Within CommonGIS it is possible to calculate the both the total area burned during the period 1991-1993 and the total quantity of fires in the same years span.

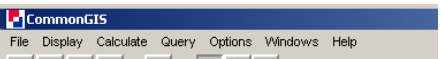

2. Start the Calculate Wizard by selecting menu and item **Calculate -> Calculate….**

3. Since in the "Select attribute(s) for calculation" dialogue we already have the area burned attributes for years 1991-1993, we keep this selection and hence start by computing the sum of the area burned. Click the **OK** button to confirm.



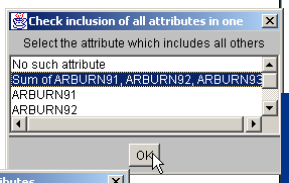




4. Choose **Sum of columns** as a calculation method in the next dialogue and click **OK**.

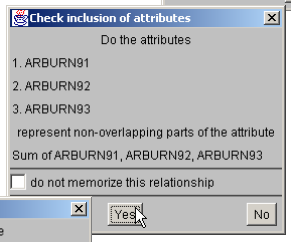




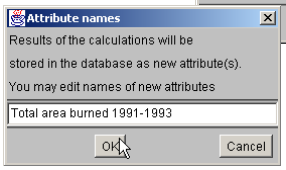

5. In the subsequent "check inclusion of all attributes in one" select **Sum of ARBURN91, ARBURN92, ARBURN93** and click **OK** to confirm.



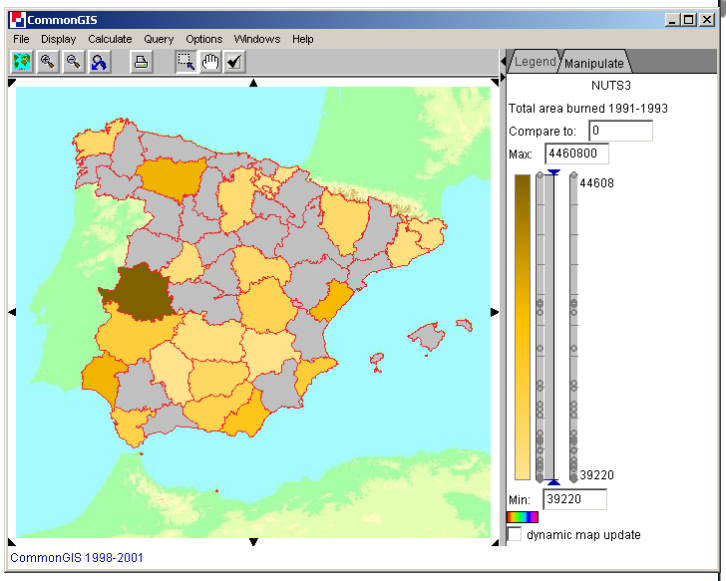

6. Then, in the "check inclusion of attributes", we press the **YES** button to confirm that the 3 attributes chosen represent non overlapping parts of the new attribute being created.




7. Finally we give a meaningful name to the attribute being calculated, like **Total area burned 1991-1993** and click **OK**.

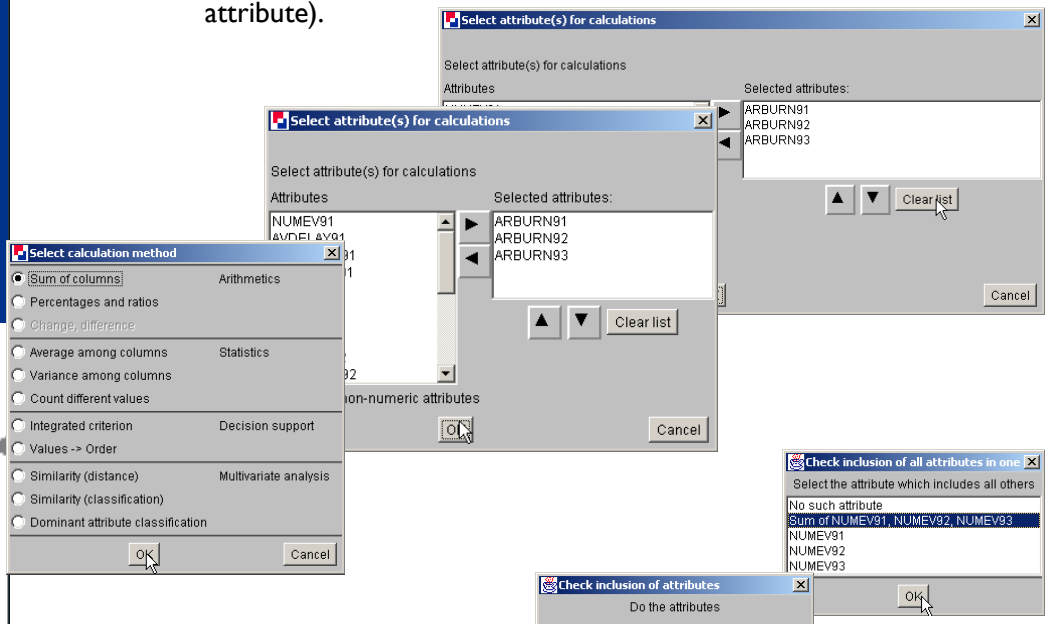



8. CommonGIS displays the darkness map of the total area burned in each region within the period 1991-1993.

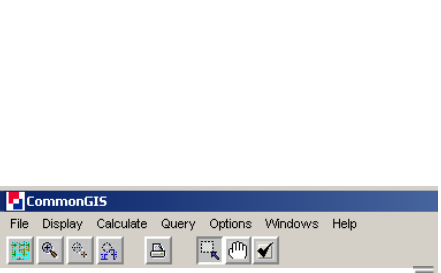


# CALCULATING THE TOTAL NUMBER OF FIRES


1. To calculate the total quantity of fires during the period 1991-1993 we proceed exactly as in the previous section (remember to clear the attribute selection list when calculating the new aggregated attribute).



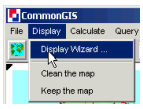

2. At the end of the procedure CommonGIS displays the darkness map of the total quantity of fires in each region within the period 1991-1993.



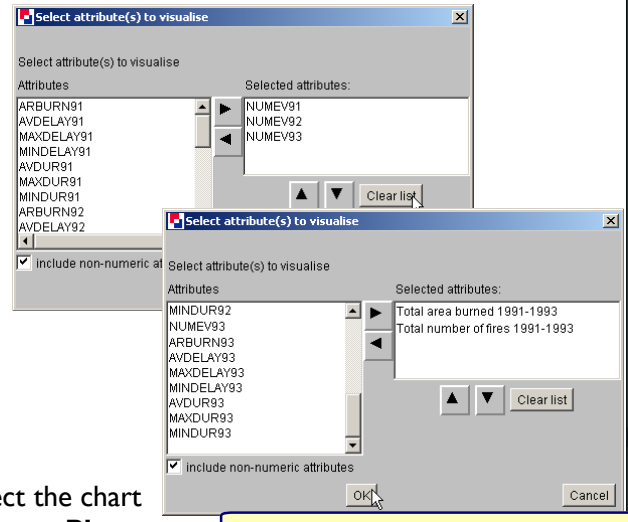


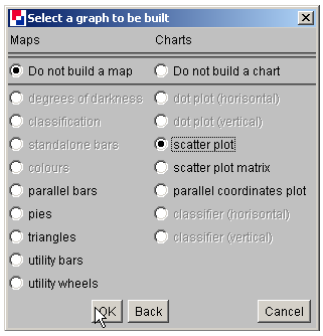

# BUILDING A SCATTER PLOT GRAPH

1. After calculating the total number of events, it is possible to get a scatter plot graph. Start the **Display Wizard** …

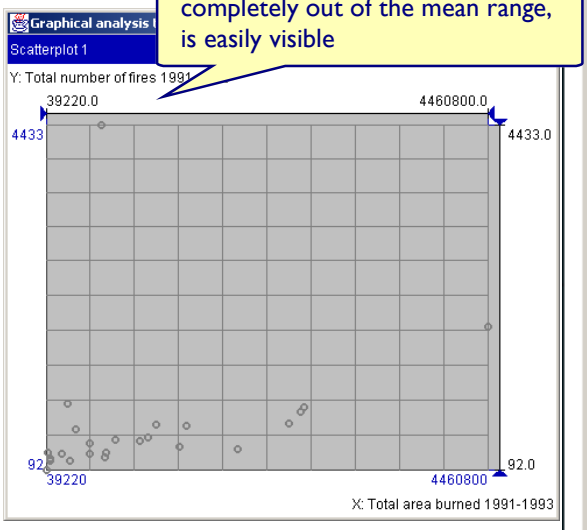



2. Push the **CLEAR LIST** button to get rid of the previous selection.
3. Then select the calculated attributes:
   **Total area burned 1991-1993** and **Total number of fires 1991-1993**
   and click the **OK** button to confirm.



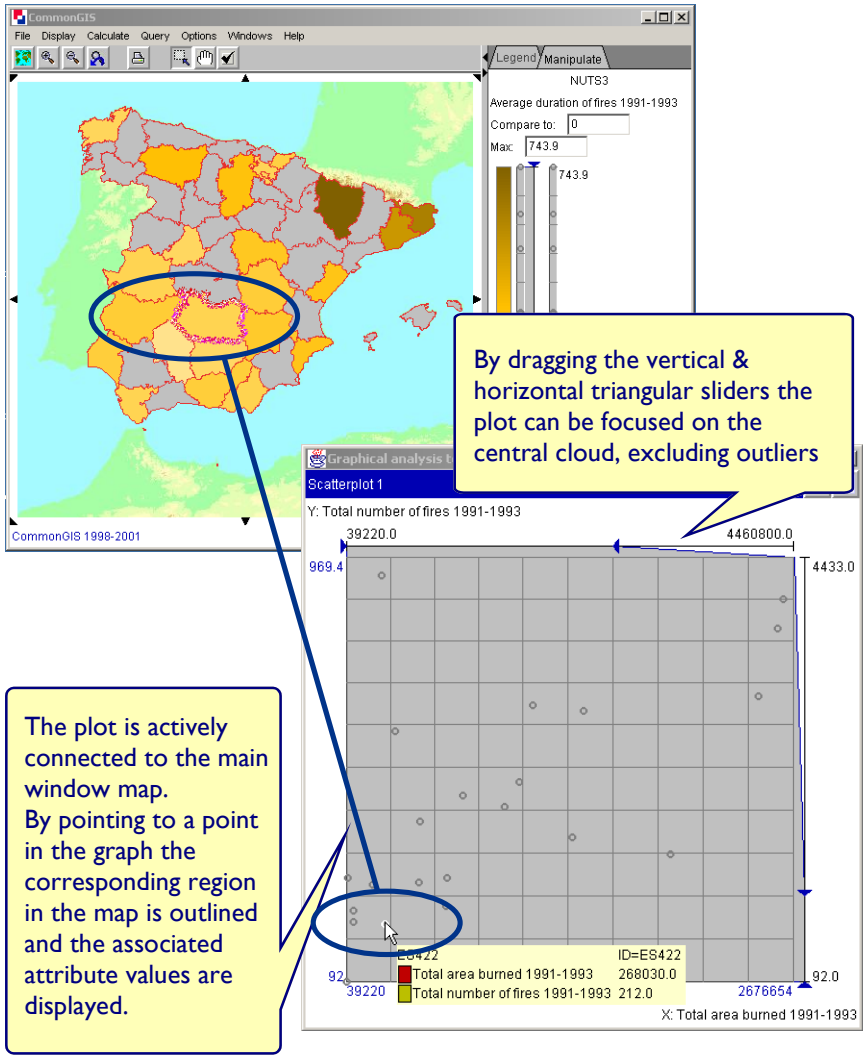




4. Select the chart **Scatter Plot** and click the **OK** button.

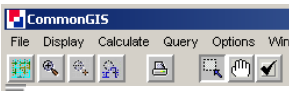



5. The scatter plot graph shows that some sort of linear correlation may exist between the number of fires and the total area burned, since the dots representing the (no. fires, area burned) attribute couples are approximately distributed along a straight line .

# THE SCATTER PLOT GRAPH




# STEP 4 : More Relationships



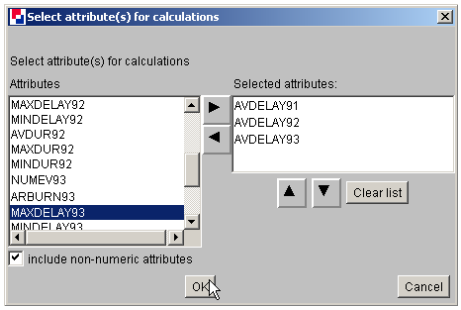


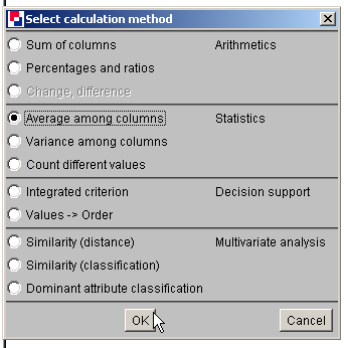

# PLOTTING AVERAGE DELAY AND DURATION

**Is there any relation between the number of fires and the delay or the duration of fires?**

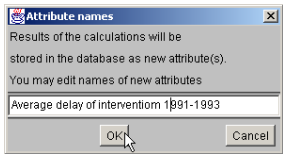
1. To address this question it is necessary to calculate the average duration of fires and the average delay between the alarm and the beginning of the intervention. We will use averages across all the time span covered by the database, i.e. 1991, 1992 and 1993


2. Start the Calculate Wizard by selecting menu and item **Calculate -> Calculate….**
3. Clear any possible previous selection by pushing the **CLEAR LIST** button, then select and add attributes "average delay between alarm and intervention" (**AVDELAY**) for the years 91, 92 and 93. Click the **OK** button to confirm.

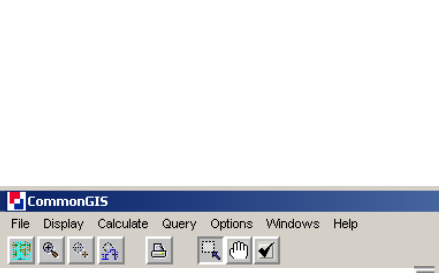



4. Choose **Average among columns** as a calculation method in the next dialogue and click **OK**.

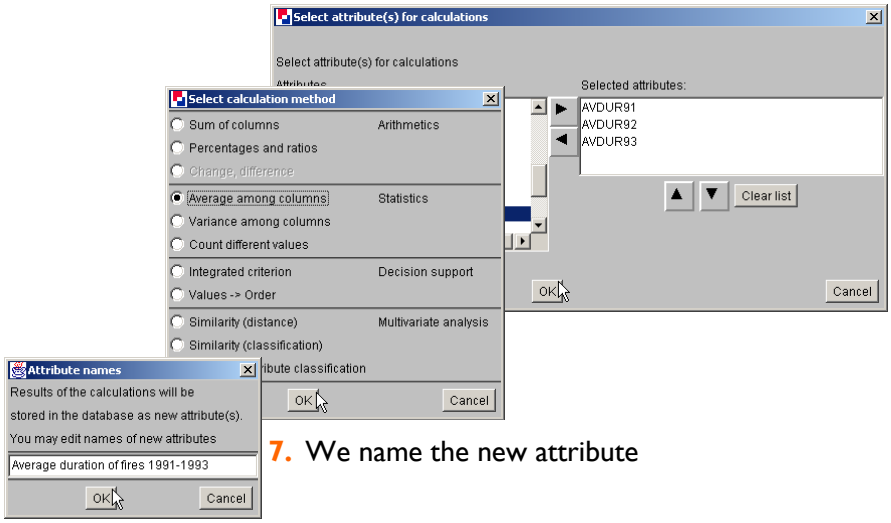



5. Finally we give a meaningful name to the attribute being calculated, like **Average delay of intervention 1991-1993** and click **OK**.



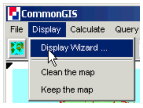


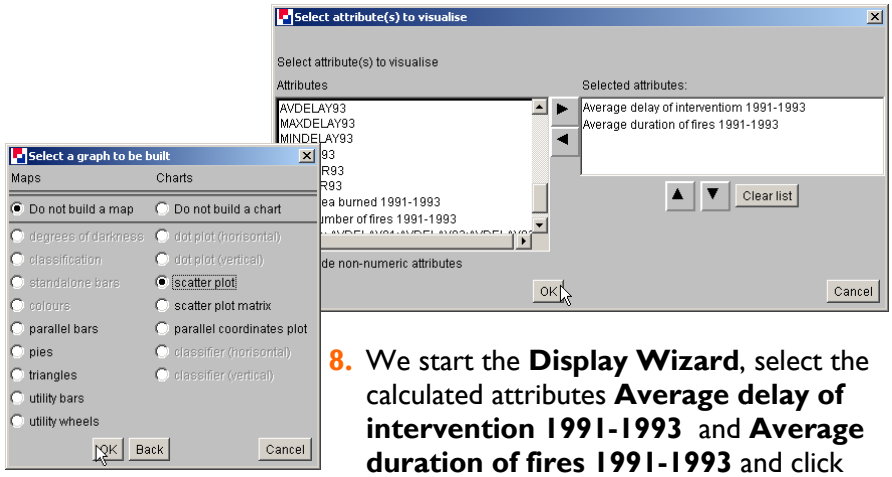

6. Repeat the whole procedure using the "average duration of fires" (**AVDUR**) for the three years 91, 92 and 93.




7. We name the new attribute

**Average duration of fires 1991-1993.**

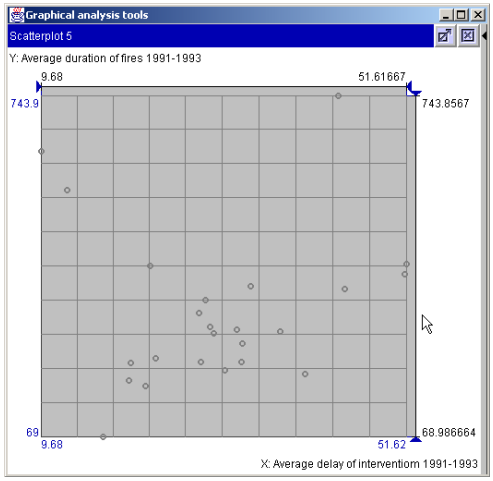


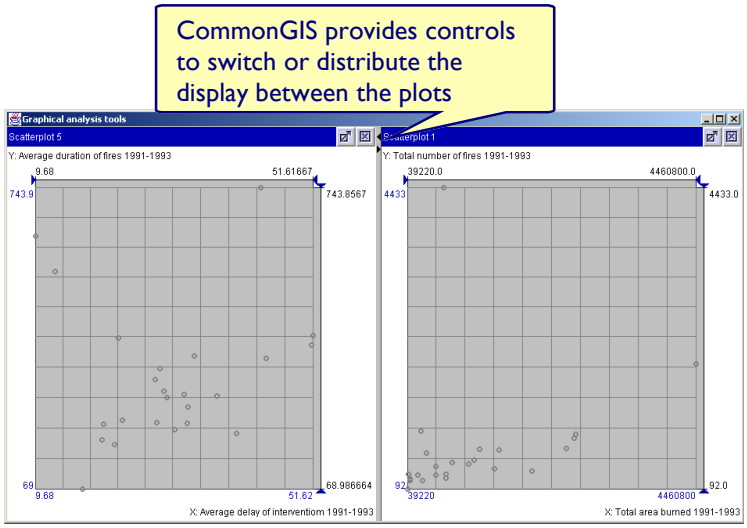

8. We start the **Display Wizard**, select the calculated attributes **Average delay of intervention 1991-1993** and **Average duration of fires 1991-1993** and click the **OK** button.

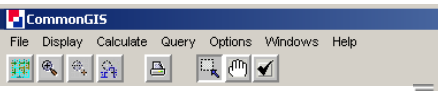



9. Finally we select **Scatter Plot** and click the **OK** button.




10. The scatter plot confirms that there is no strong correlation between the duration of the fire and the delay in the intervention.
11. This could be more evident if we compare this scatter plot with the previous one (the one displaying number of fires versus area burned).
In fact CommonGIS keeps the previous plot (s), unless

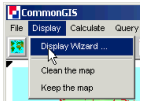




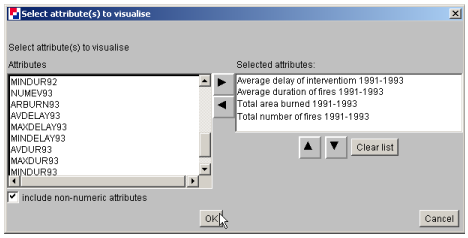



# USING THE PARALLEL COORDINATES PLOT

1. Start the **Display Wizard** …

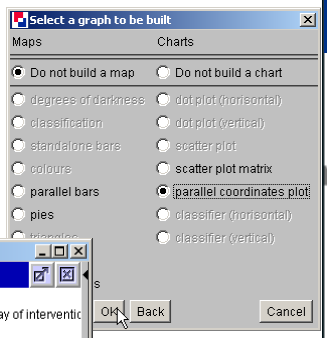


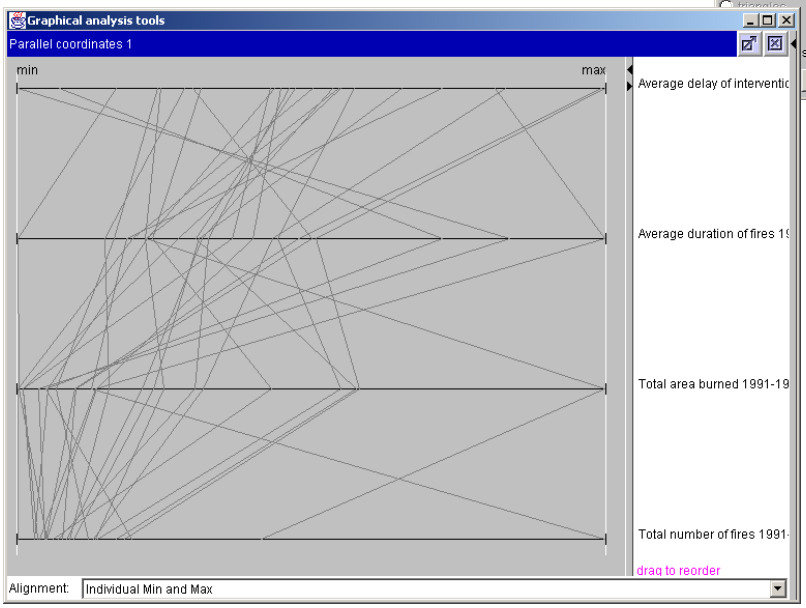

2. Then select the following attributes: **Total area burned 1991-1993**, **Total number of fires 1991-1993, Average delay of intervention 1991-1993, Average duration of fires 1991-1993** and click the **OK** button to confirm.




3. Select the **Parallel coordinates plot** chart and click the **OK** button.

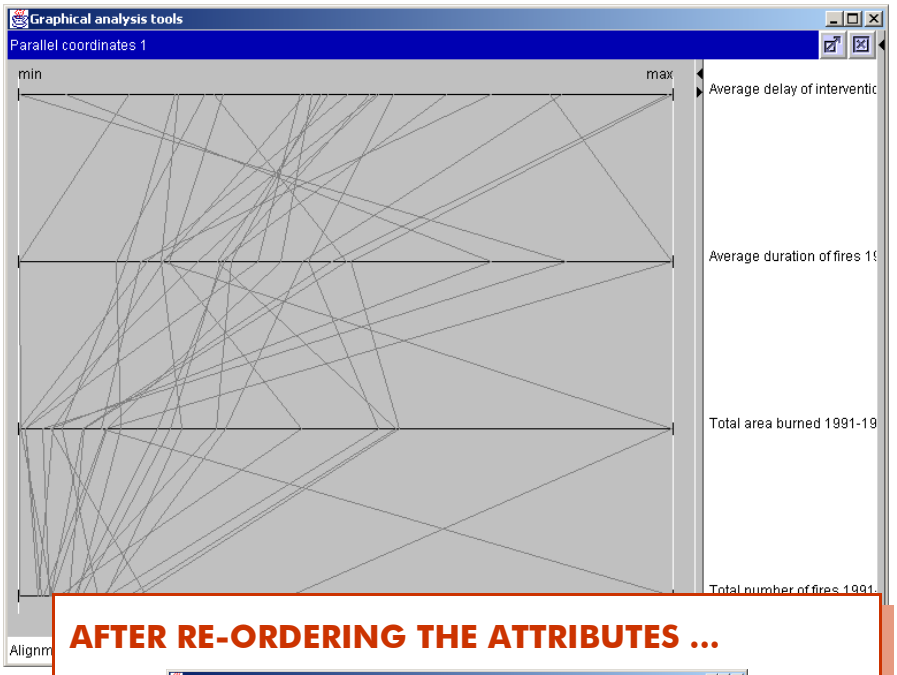
4. The new window shows a parallel bar plot.



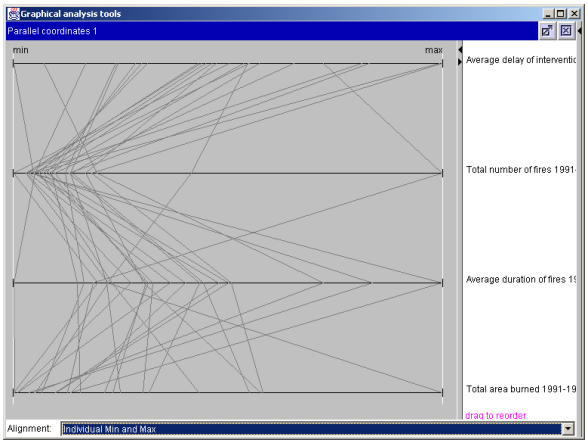






5. The parallel bar plot graph is useful for studying relationships between variables.
   It is possible to reorder variables by dragging the attribute names in the right window pane: mostly non-intersecting lines indicate positive correlation, whilst mostly-intersecting lines indicate negative correlation.




**AFTER RE-ORDERING THE ATTRIBUTES ...**



Designed by Diciannove & Doc-A-Ware