GIS Editor

Introduction

The Diversity GIS Editor is a tool to create, visualize, edit and archive samples within a geographical environment. It may be used as a stand-alone application or as a component of the Diversity Workbench by other applications, e.g. DiversityCollection or DiversitySamplingPlots.

In combination with a background map, equipped with world coordinates, collections of Microsoft SQL Geometry Objects (points, lines and areas) may be displayed and edited in their geographical context. The screen and world coordinates of the objects will be calculated and shown in the status line. Color, thickness and transparency of the elements can be adjusted. The working area which keeps the maps and objects may be shifted or zoomed.

The background map could either be loaded from a storage device or created with an online map server tool provided by the editor. Other maps without world coordinates may be adjusted to the background map easily by setting 3 pairs of reference points on the background and the new map. The calculated world coordinates will be assigned and stored when the new map is saved.

A GPS functionality has been integrated. If a GPS device is connected, the current position will be displayed and - if an applicable background map is loaded - marked on the map.

The data transfer between application and GIS editor is made by interface function calls. In that way geometry objects of a Diversity database may be loaded to the editor, modified or extended and sent back to the application, which then updates the data base.
Chapter 1: GIS Editor Layout

The layout of the Diversity GIS Editor could be divided into 3 regions:

- Control Panel
- Sample List
- Working Area

Control Panel

The Control Panel consists of the following elements:

- 8 buttons to load, save, delete, print or add samples, switch GPS, detect samples, and to open the Settings window
- 2 text boxes for sample Identifier (ID) and Description (Text)
- 7 radio buttons to select the operation mode (Map, Shift, Adapt, Edit, Point, Line, Area)
- 1 button to switch to a new object, if the current sample is composed of multiple lines or areas
- 4 controls to adjust color and transparency of the samples (for stroke and fill) or to zoom the working area
- Status lines with screen and world coordinates (if any) and an appropriate symbol
- A hint about the user interaction, which is possible or expected

Sample List

The Sample List is the container for added maps or objects. Each entry is composed of the following elements:

- Identifier of the sample
- Delete button to remove the sample
- Toggle button to hide or show the sample

The toggle button is illustrated with a small picture of the associated sample. Switching these controls using the left mouse button will hide or show the corresponding sample. Using the right mouse button will show the corresponding sample and hide all others, except the background map. If the number of samples in the list do not fit into the window area, a scroll bar will be displayed.

Working Area

This is the drawing space containing loaded maps and objects. In Shift mode the area could
be moved or zoomed.
Chapter 2: GIS Editor Usage

The GIS Editor has 7 operation modes which are described in the following chapters:

- Map: Create an online map from the map server
- Shift: Move the working area with the mouse or zoom it with the slider
- Adapt: Calculate world coordinates for a new image using reference points of the background map
- Edit: Modify the current object and all visible samples of the Sample List
- Point: Create a number of object markers on the background map
- Line: Create a line string or a collection of line strings on the background map
- Area: Create an area or a collection of areas on the background map

When starting the GIS Editor as a stand-alone application the start-up operating mode usually is the Map mode. This is to remind the user that a background map with world coordinates is necessary to work with geographic objects.
Chapter 2.1: Map Mode

In Map mode the editor connects via Internet to the SNSB Google Maps service or alternatively to the Open Street Maps service, regarding on the GIS-Editor Settings, and displays an online map which can be moved, zoomed and switched as usual. The status area shows the Google or respectively the OSM symbol. The size of the map area adapts to the size of the working area, even when resizing the window.

In case of Google the controls for moving, zooming and map type are displayed by default. The overview window in the bottom right corner can be switched manually. The map can be adjusted to the user's needs as follows:

- Select map area: Press and hold left mouse button and move the mouse, or use the Google shift control
- Zoom map: Turn the mouse wheel (if any), double click (left mouse button) on a location or use the Google zoom control
- Switch map type: Use Google map type control
- Hide Google controls: Click right mouse button to hide, left mouse button to show them again
- Display overview window: Toggle arrow box in the bottom right corner of the window to hide or show it

In case of Open Street Maps the pan and zoom control is displayed by default. It can be switched off or on by clicking the left mouse button anywhere within the map area. The layer switch control is hidden and can be opened by pressing the or closed again by pressing the button on the right side. The map can be adjusted to the user's needs as follows:

- Select map area: Press and hold left mouse button and move the mouse, or use the OSM pan control
- Zoom map: Turn the mouse wheel (if any), double click (left mouse button) on a
location or use the OSM zoom control

- Switch map type: Open the layer switch and select a layer
- Hide or show pan and zoom control: Click left mouse button to toggle the control

If an appropriate area has been selected, just press the Add button +, then the area will be scanned and added to the Sample List as a reference map. A little image of the map will appear on the toggle button in the Sample List. The controls should be switched off before adding to get a neat map image.

The mode will be switched to Shift mode automatically and the status symbol will change to indicating that world coordinates are present. The screen and world coordinates will be shown in the status lines if the mouse is moved over the map surface.

The maps are subject to the Mercator projection, which is the GIS Editor's precondition for every bitmap used as a reference map. While the screen coordinates are linear in horizontal and vertical direction, the world coordinates are non linear in vertical direction.
Chapter 2.2: Shift Mode

This is the quasi default mode of the GIS Editor. The cursor changes to a move shape when touching the background map. The map is "frozen" and exists as an image sample on the working area. Changing the map region or resolution is no longer possible. But the Shift Mode provides 2 features:

- Move the working area
- Zoom the working area

**Moving the working area**

Press and hold the left mouse button and move the mouse to shift the working area within the display window. This is useful when having loaded a map from a storage unit which is larger than the GIS Editor's window, or in combination with zooming the working area.

**Zooming the working area**

Place the mouse cursor at the slider control, press and hold the left mouse button and move the control left to zoom out or right to zoom in to the working area. The range of the zoom is from factor 0.6 to 3.0. The current value is displayed beneath the zoom control. Double click the slider control to reset the zoom to default value 1.0.

Enlarging the working area makes it more easy to place objects precisely. The relevant area then could be selected by moving the zoomed working area. Downsizing the working area gives an overview of large map regions.

Note that the resolution of the map itself does not change any more when zooming in. But objects on the map are created in vector graphics, so the markers, lines or areas will remain sharp and clear while zooming. And they will adapt their thickness smoothly to the size.
**Chapter 2.3: Area Mode**

This mode is used to create areas (polygons) on the background map. The cursor changes to a cross line when touching the background map. Each click on the left mouse button sets a new point of the polygon. Every click on the right mouse button clears the last point set. The closed polygon defined by the points is displayed completely at any time. When holding the left mouse button the point can be placed while the lines of the polygon are shown as a "rubber band" display.

To create more than one area for a sample, just click the **next** button. This will finish the current polygon and start another one. It could be repeated without limitation of the number of polygons.
Setting the color

The areas are created as filled polygons, this means they have a border line (stroke) and a filling. The color of stroke and filling can be set independently or simultaneously by clicking the appropriate check boxes beneath the Color list box. Clicking on the list box will open a drop down menu with the complete set of 141 predefined brushes. Use the scroll bar to navigate to the preferred color and select it with the left mouse button.

Setting the transparency

Besides the color the transparency of the area could also be set for stroke and filling. In each edit mode the slider control is used for that. The area stroke or filling changes smoothly from invisible at the left till completely opaque on the right slider position. The value beneath the slider control indicates the opaqueness in a range from 0% to 100%. The default settings are 100% for stroke and 25% for filling.

Before adding the polygon to the Sample List an Identifier (ID) and a Description (Text) should be written to the text boxes in the control panel.

Clicking the Add button will put the current area(s) as one sample into the Sample List. The toggle button will show a small picture of the first area of the sample. The ID will be displayed above the buttons. Furthermore a tool tip will be created for the sample holding the ID and Description, which will pop up when moving the mouse over the toggle button or over the polygon in the working area.
Chapter 2.4: Line Mode

This mode is used to create line strings on the background map. The usage is adequate to the Area Mode. The cursor changes to a cross line when touching the background map. The points of the line strings can be set or cleared by clicking the mouse buttons. Clicking the button will switch to the next line string for the sample. The distance of the last drawn line string section is displayed beneath the status area.

Color and transparency can be set for the line strings using the appropriate controls, but only for stroke, because the line strings do not have a filling. Thus checking the Fill box will have no effect. After adding the lines to the sample list a small picture of the first line string will appear on the toggle button.
Chapter 2.5: Point Mode

This mode is used to create Points (object markers) on the background map. The usage is similar to the Area Mode. The cursor changes to a cross line when touching the background map. The object markers can be set by clicking the left mouse button, clicking the right mouse button will clear the last markers one by one again. The button has no impact, because each Point represents a complete object and needs not to be finished before creating the next one.

The shape of the object markers can be selected from a number of predefined Point symbols and icons within the Settings window, e.g.:

- **Pin:**
  - Assel:
  - Fish:
  - Mollusc:
- **Cross:**
  - Bird:
  - Fungus:
  - Myxomycete:
- **X:**
  - Bryophyta:
  - Insect:
  - Plant:
- **Circle:**
  - Echinoderm:
  - Lichen:
  - Reptile:
- **Square:**
  - Evertebrate:
  - Mammal:
  - Vertebrate:
- **Diamond:**
  - Needle:

Color can be set for the symbol markers using the appropriate controls. It depends on the selected point symbol, whether it just has a stroke (e.g. "Cross") or also a filling (e.g. "Pin"). Transparency can be set for both, the symbol and icon markers. The stroke thickness and the
size of the markers can be set in the Settings menu. After adding the object markers to the sample list a small picture of the collection will appear on the toggle button.
Chapter 2.6: Edit Mode

This mode is used to modify all samples (objects and images) which are currently visible on the working area. It applies to the elements of the Sample List as well as to the current sample.

Changing the position or shape of objects (points, line strings, areas)

To change an object one has to move the vertices ("corner points") which are defining it. To do so just move the mouse close to a vertex to localize it. As soon as the corner has been grabbed the cursor changes its shape to a hand symbol 🙍. Now press the left mouse button and hold it, then move the mouse to change the position of the vertex accordingly. The shape of the object or the marker will change in the same manner. Release the mouse button when the preferred position has been set.

Note that areas and line strings cannot be moved in total while keeping their shapes!

Changing the position or shape of images (maps)

Images (e.g. maps) can be moved completely (keeping their aspect ratio), scaled in horizontal and vertical direction and skewed within an affine transformation. Editing an image can be divided into 4 stages by grabbing and moving the following corners:

1. Top-left: Moving the total image by keeping its aspect ratio
2. Bottom-right: Squeezing or stretching the image horizontally and vertically
3. Bottom-left, top-right: Skewing the image in an affine way by keeping the corner points top-left and bottom-right at its positions
4. Bottom-right again: Skewing the image in an affine way by keeping the corner points top-left and bottom-left at its positions

Stages 1 to 4:

Changing color and transparency

Color and transparency can be set independently (or simultaneously) for the objects using the appropriate controls and check boxes for Stroke or Fill. The setting will affect all visible objects, so objects which should not be changed have to be switched off before with their toggle buttons. The color of images could not be changed, of course, but the transparency can be set if the Fill box is checked. The transparency of the background map cannot be changed.
Chapter 2.7: Adapt Mode

Essential for visualizing Geographical Objects is a background map with world coordinates. The GIS Editor's Map mode offers a convenient way to create such a map, but it is restricted for the use of Google or OSM maps which are present in the web and are providing world coordinates. It would be nice to load scans of e.g. topographical or even historical maps into the working area and use them as background maps, but the problem is how to assign world coordinates to them.

The Adapt mode solves this in an easy way by executing the following steps. As a precondition a background map having world coordinates (e.g. a Google map) must be present which covers the area of interest of the new map to be referenced.

1. Load the new map image using the Load button 📋. The image will be placed top left inside the working area.
2. Select Adapt mode by checking the Adapt radio button. The cursor changes to a pointer symbol 🎯 having a green border when touching the new image and having a red one when touching the background map.
3. Now 3 reference points must be set alternately on background and new map to assign the appropriate locations (e.g. distinctive landmarks like road crossings). The last point can be modified as long as the map is not changed. The cursor always tells you what reference point will be set, according to its color and the number of dots in the middle: 🎯🎯🎯🎯🎯🎯
   Note: It is reasonable to select distant points close to the edges of the new map, because this will give more accurate results.

4. When all reference points have been set and the cursor touches the alternate map, it
The adapted image has been transformed to fit into the current world coordinates of the background map. Now the new map can be added to the sample list by pressing the Add button. When it is finally saved to disk by pressing the Save button, the new assigned world coordinates will be saved, too, in an XML file with the same name (see Save Samples).

Sometimes it is difficult to place the new map and the reference map side by side, because the window is too small, and zooming out would blur the details needed for setting the reference points. If the new map covers the background map, the reference points can be set anyway:

- for the new map by making it opaque with the transparency slider
- for the background map by making the new map transparent (less than 10% opacity) with the slider
Note: The Fill box must be checked to change the transparency of the new map. The background map's transparency cannot be changed.
Chapter 2.8: Load Samples

A background map is required before objects (areas, line strings, points) can be loaded. If no background map is available, the GIS Editor will extract the appropriate area from the sample file data and automatically adjust the map viewer to cover the region. The user is prompted to wait until the map has been established completely:

When loading a shape file, the objects will be displayed at the background map according to their coordinates and added to the Sample List automatically. The GIS Editor is able to read MS-SQL Geo Object files (.shp1), TAB separated text files (.shp2) as well as ArcView Shape Files (.shp).

The assumption of the type of input file is made according to the extension of the file, so e.g. a TAB separated input file of an external source might have to be renamed to .shp2 before it is loaded by the GIS Editor. The input parameters of the first text line are determined, a dialog window will open and show them on the left.

Then you have to assign certain input values to the GIS Editor attributes, which are displayed in the middle of the window. Select an input parameter using the radio button on the left, then assign it to one or more sample attributes by clicking the appropriate checkbox in the middle. The assigned values are shown on the right side of the window. Values in gray are default parameters, which are used if the attribute has not been assigned. There is just one mandatory attribute which has to be set, the Geography Data (SQL Geo Object). If there is no SQL Geo Object available in the input file, a point object will be created automatically when assigning longitude and latitude parameters.
To assign up to 10 input parameters simultaneously to the adjacent 10 sample attributes, just click on the **All** button. This is helpful if the input file has been created with the GIS Editor itself, so the input values are already in the right order.

To remove all assigned values, click on the **None** button.

If the assignment is done, click on the **OK** button to show all geographic objects of the input file according to the assigned parameters. Each object will be added to the list as a separate sample. To put all objects together as one single sample, check the "Save as single sample" box.

Click on the **Cancel** button to cancel the load operation.

The last assignment is saved by the GIS Editor (as long as the application is running) and can be used for the next input file, if it has the same structure as the previous one. Just click on the **Last** button to assign the same input parameters as before.

The GIS Editor supports ArcView Shape Files (.shp) using geographical, UTM or Gauß-Krüger coordinates. The type of the coordinates (Geographic/Gauß-Krüger or UTM) has to be selected first in the **GIS-Editor Settings**, in case of UTM the zone and the hemisphere, too. If an ArcView attribute file (.dbf) is available, a window will open and show the attributes of the first shape. The user may select the attributes which should be used to create the sample descriptions by checking the appropriate boxes. A separator string may be defined to combine the selected attributes to the complete description text. If no attribute is selected, the name of the ArcView file is assigned to the sample descriptions.
To access the dBase attributes file for reading or writing, the Microsoft ACE OLEDB 12.0 driver must be installed on the computer. If it is missing, the attributes cannot be evaluated and a warning will be displayed. The shapes will be loaded properly, anyway, but no description will be added.

When loading an image without world coordinates, it will be displayed top left in the working area. If no background map is loaded yet, the Screen symbol is shown in the status line, followed by the screen coordinates of the current cursor position.

When loading an image with world coordinates and no background reference map exists, it will be displayed top left in the working area. The World symbol is shown in the status line, followed by the screen coordinates and the world coordinates of the current cursor position.

When loading an image with world coordinates having an existing reference map, it will be embedded in the background map according to its coordinates. If the new image does not overlap with the reference map, the image exists virtually in the coordinate system, but possibly could not be seen because it is too far away from the reference map.

When loading an image it is displayed, but not yet added to the Sample List. The user has to add it manually by pressing the Add button. This is because the user should have the opportunity to adapt the image to the background map to be stored later on with applicable coordinates.
Chapter 2.9: Save Samples

To save a background map which is currently displayed in Map mode just press the Save button instead of the Add button. A save file dialog will pop up to name the file, the map and its coordinates will be saved and added to the sample list.

A background map is required before objects and images can be saved. Saving samples means saving their type, attributes and world coordinates in files. When pressing the Save button, it applies to all visible samples on the working area, except the background map. A current sample will be added to the sample list before it is saved.

If objects are visible, a save file dialog will open and a name for the target file(s) must be set. Objects (areas, line strings, points) will be saved in respect to the selected formats of the GIS-Editor Settings:

- If MS-SQL is enabled, all visible objects will be collected and stored in one GIS Editor shape file in ASCII text format (extension .shp). The file contains the objects' attributes and MS-SQL Geo Object definition strings. If altitude calculation is enabled in the GIS-Editor Settings, these values are stored, too.
- If ArcView is enabled, for each object 3 ArcView compatible shape definition files in binary format will be created: A shape file, an index file and a dBase file holding the description (extensions .shp, .shx, .dbf).

If images are in the Sample List, they are already present on disk and will not be saved twice. Instead for each image an XML file will be created with the calculated world coordinates of the image and will be stored under the same location and name as the image. This does not apply to the current background map.

If Save Working Area is enabled in the GIS-Editor Settings, a scan of the complete working area including its objects is made and stored in an image file, which name has been set in the save file dialog.

To save only a part of the working area the Frame box must be checked in the GIS-Editor Settings, too. Then a rectangular frame of the given dimensions is displayed, which defines the part of the working area that will be saved. It can be dragged to the right position using the left mouse button (click, hold and shift), and it can be resized by grabbing and moving the corners of the frame.
Chapter 2.10: Delete Samples

To delete a single object of the Sample List just press the small Delete button left of the Toggle button. The sample will be removed from the list and the working area, the other sample entries will be rearranged.

Pressing the large Delete button in the Control Panel will remove all samples of the Sample List, except the reference map. A warning is shown before:
Chapter 2.11: Print Samples

Pressing the Print button in the Control Panel will open a print dialog to select a printer and adjust the settings. Then it will print the complete working area including all visible objects. This feature is useful e.g. for documentations.
Chapter 2.12: GPS Tracking

When pressing the GPS button in the Control Panel the hardware will be scanned for a GPS device. All available serial ports are opened and checked if they are delivering valid GPS data. This takes 2 seconds. Be sure that the correct baudrate for the GPS device has been set in the Settings menu (standard rate: 9600).

If no device is detected the button will be released. If a device has been found the button changes the color according to the numbers of satellites which have been fixed by the device: Red up to 3 satellites, yellow up to 5 and green if 6 satellites or more are available. The number of satellites, longitude, latitude and altitude delivered from the GPS device are displayed in the info line of the Control Panel beneath the status.

The current position will be shown by a GPS marker if an appropriate background map has been loaded. If GPS Track in the Settings window is checked, the movement of the position will be drawn as a line string on the background map. The color and stroke thickness are similar to the last adjustment for lines. When switching off the GPS button again, the track will be added to the sample list automatically and could be saved for future documentation purposes.
Chapter 2.13: Settings

Pressing the Settings button in the Control Panel will open a dialog to adjust these GIS Editor settings which are not frequently changed:

Setting the file formats for reading ArcView shape files

ArcView is a common Desktop GIS tool and stores its data in binary files. The GIS Editor is able to read these files and display the included geography objects. But because ArcView does not necessarily provide a dedicated information about the GIS format of the contained data, the user has to know and select it in advance.

The GIS Editor currently supports WGS84 geographic coordinates, Gauss-Krüger coordinates (Potsdam datum) and WGS84 UTM coordinates. If "Geographic / GK" is selected, the program will choose the right format by checking the binary values. In case of UTM the user must select the hemisphere (N/S) and the UTM zone (1-60) to ensure that the objects will be displayed at the correct location.

The ArcView data files may contain complex geographic shapes (e.g. polygons or line strings) which are combined by the GIS editor to one multi object (e.g. multipolygon) by default. To split up the shapes into single objects the option "Split shapes into single samples" has to be selected. Then they are placed into the sample list separately. This could be helpful to avoid out-of-memory errors if very large shapes should be converted to SQL geography strings.

Setting the file formats for saving objects

At the moment 3 formats for object files are supported:

- MS-SQL Geo Objects (.shp1)
- TAB separated text files (.shp2)
- ArcView shape files (.shp, .shx, .dbf)

Microsoft SQL Geo Objects are part of a standard for storing geometry and geography data in
an SQL database, as used by the DiversityWorkbench modules. They are a well defined text string containing the geometrical type (e.g. Polygon, Line, Point) and the geographical coordinates (longitude, latitude, optional altitude) of an object. Together with the GIS Editor attributes (e.g. color, transparency) they are stored in a proprietary GIS Editor shape file in ASCII text format. This file can easily be read and changed using a text editor.

TAB separated text files are widely used as an interchange data file format. The content of a file is more or less the same as above, but the parameters of each object are placed in a single text line, separated by tabulator characters. Additionally to the SQL Geo Object the first coordinate (longitude and latitude) is saved separately in the file.

The GIS Editor can also create ArcView compatible files to store the samples, which then may be read from ArcView GIS tools. 3 files are required for each type of shape: A data file with extension ".shp", an index file with extension ".shx" and a description file in dBase format with extension ".dbf".

The advantage of the first format is the transparency and readability of the data file, which is just one single text file. But storing huge samples is time consuming, because they have to be converted to SQL geography strings. If the samples consist of more than 100,000 points, an warning message is shown and the user may decide whether to continue or not:

While saving the shapes, a progress bar will be displayed to indicate the status of the task:

![Progress bar](image)

Using the ArcView format makes the data files compatible with many applications. Huge samples can be stored much faster. But each type of sample requires a separate set of output files, because different types of objects within one file are not supported so far. So a sample list containing 10 objects will produce 30 data files (file name with an appended index, which is incremented for each sample). Furthermore the attributes like color, transparency and stroke thickness will not be saved.

Currently there is just one format supported for storing image coordinates. They are written into an XML file which is also used in DiversityMobile modules. Saving the coordinates in this format is required for the GIS Editor, so it cannot be disabled.

**Saving the working area**

Selecting this check box and later on pressing the Save button will additionally scan the working area including all visible objects and save it as an image file under the name provided in the save file dialog, see [Save Samples](#). This is useful for documentations.

**Note:** There are copyright restrictions on maps or aerial images which are created with the Google maps viewer. Please contact Google before using them for publications to grant a license, or use Open Street Maps captures, which could be used freely under the [Creative Commons Attribution Share Alike license](#) conditions.
When checking the "Frame" box just a rectangular part of the working area is saved. The size (in pixels) of the frame has to be defined in the adjacent "Width" and "Height" fields. This is convenient if the resulting image should have well defined dimensions, e.g. fit the resolution of a smartphone display. This feature is only active when the Save Working Area box is checked. After closing the Settings window a rectangular frame of these dimensions is displayed on the working area which defines the part to be saved.

**GPS Track**

When checking this box the movement of the GPS marker on the background map will be tracked by a line string. After switching off the GPS button the line string will be added to the sample list automatically.

**Altitude for geo objects**

This box applies to MS-SQL Geo Objects only. If checked, the appropriate altitude of the object points (longitude, latitude) will be stored in the file, too. This is not recommended for sample objects with a lot of points or vertices, because for every point the Geonames server has to be contacted to request the associated altitude value. This could slow down the saving procedure immensely.

**Setting the stroke thickness**

The stroke thickness for area, line strings and point symbols can be set by using the appropriate slider. The value of the thickness is shown in the label box left of the slider. Double clicking the slider will reset the thickness to its default value 1.

**Setting the Point symbol**

The symbol for the points can be selected from the drop down menu. The symbol size can be set using the slider below the menu. The point symbol display will change accordingly.

**Setting the GPS baudrate**

It is essential to set a suitable baudrate for a connected GPS device according to its specification. The rate can be selected from the list of the drop down menu. If no GPS device is available, Demo mode could be chosen to see the behaviour of the functionality.

**Setting the Map Mode viewer**

The radio buttons offer the choice of the viewer for creating a background map. Currently Google Maps and Open Street Maps are provided.

**GIS Editor Info**

Clicking the Info button will display a window containing GIS Editor version and license information.
Saving the settings

Finally pressing the OK Button will save the settings, pressing the Cancel button will discard them.
Chapter 2.14: Sample Detection

From GIS Editor version 2.2.3.0 the Sample Detection offers a new convenient tool to digitize sample markers e.g. of a scanned and georeferenced analog paper sheet.

The tool will try to detect “points” on an image according to the detection parameters which can be adjusted in the Sample Detection Parameters window, which will open when clicking the button.

The decision what belongs to a sample and what is just background on the loaded image is made by defining a color range of the object to be found. Looking at the example picture above, we can see that the collector has marked samples using a “black” pen on a reddish scale paper. The points appear as dark grey scatterplots. To detect these points we must define the color range of interest from "mid grey" to "black".
The grey range can be easily set by moving the "Grey" sliders for minimum and maximum values. The sliders for the 3 color channels will move simultaneously, adjusting the channel values in parallel. In the example above we found a range from 0 (black) to 150 (mid grey) which covers the colors of the samples and excludes the background colors. It is visualized in the color boxes for min and max values and as a linear gradient color brush.

If we'd look with a magnifying glass on a single point, we would discover that in fact it is an array of pixels (picture elements) in various shades of grey. To reduce this "cloud" to a single point coordinate the program uses several algorithms. The result can be improved by setting the parameter for the minimum point distance in pixels to an appropriate value (e. g. 4).

The resulting sample points would be displayed as a point collection to be (potentially) edited and added as one sample to the GIS Editor sample list. In contrast, clicking the check box beneath will split up the found sample points into single samples and add them immediately to the sample list including an enumeration. The sample names will then be composed by Identifier and Enumeration (start value, will be incremented) as defined in the text boxes under it. Pressing the OK button will start the detection and deliver the detected points as object markers.

Not only grey points may be detected, but markers of any color tone. The ranges for the red, green and blue color channels can be adjusted individually by moving the sliders for min and max values. The gradient color brush gives you a hint about the resulting color range, but it needs much experience to define a color range properly to get the expected results.