4.21.05 Georeferencing

Concept of Georeferencing

Georeferencing means that coordinates from a known system are assigned to an aerial photo or scanned paper map (both are raster data). Thus, the photo pixels get a geographic location. The procedure is carried out so that the raster datasets can be used with other spatial data.

If the raster data only consists of a scanned map or photo, attributive data needs to be assigned to the picture. A photo or scanned map is often manually *digitized* into vector format features.

What Are the Steps in Georeferencing?

The general steps for georeferencing a scanned map or (aerial) photograph are:

1. **Identifying the reference system of the source data (scanned map)**. In the Philippines, most of the available data as of now is based on the Luzon datum (the old system). For newer and future datasets produced by NAMRIA and DENR the PRS-92 is used.
2. **Import and opening of files in the GIS software.** Open (and add to the work space) the source data and the other datasets/layers that to be used for the georeferencing.
3. **Identification of control points.** Identify the quality of possible control points (at least four). They have to be identifiable in the source data and the coordinates should be estimated. Control points without clear coordinates must be clearly visible in both the source data and in the datasets. The coordinates must come from the reference datasets. Road intersections, buildings and other obvious landmarks can be used as control points.
4. **Rectification.**

Things to Consider In Georeferencing

The georeferencing operation is a crucial step when transforming analogue data to digital data, as well as raster data to vector format data. The quality of the transformed data depends on both the type and properties of the scanned map (or photograph) as well as the vector datasets.

Control Points

Control points should be clearly seen in both the scanned map (photograph) and the reference data sets. One should aim at using the most accurately measured features in the reference data sets.

The approach should also be to distribute the control points evenly over the scanned map. Preferably, the control points should surround the features that are to be analyzed (and/or) digitized. The transformation itself is in general more accurate in

the area that is delimited by the control points than the area outside of the control points.

Figure 1. Control points (red) evenly distributed. To the left, they surround – or cover – the most of the features that are of interest to analyze/digitize (here symbolized by grey area). To the right, those features are outside of the control points, and there is a greater risk that the transformation includes more errors on these features.

Residual Errors on Transformation

A value that will indicate the accuracy of the map transformation is the RMS error. High values indicate that something is wrong with either the scanning or the assessed control points or the both.

If the error is particularly large for a control point, this should be removed and a new point could be assessed instead, hopefully with a better result. If the RMS still is very high and there are only four control points, consider re-scanning the map.

Rectification

The term rectification implies a permanent transformation; i.e. the scanned map will be saved as a new (raster) dataset which is georeferenced. It is always recommended to go ahead and rectify a good transformation. If the software asks for resolution or cell size of the rectified image, make use of the resolution of the original image.