Space - The Final Frontier: The Role of GIS in LTBP

by Alan Mills

Estate agents say that the three most important things when buying a house are location, location and location. The same is true of the activities of the Lake Tanganyika Biodiversity Project (LTBP). They are all played out on the world's surface; pollution occurs in the same bays as the fish live and the fishermen work. These activities have both their own absolute location and relate spatially to all other phenomena. We can map all this information and work out these relationships, where there are conflicts and where there are not.

Traditionally, we used maps and charts to plan out or record these activities. These were useful, but rather static representations of the world's surface. Now we use Geographical Information Systems (GIS) to do this. They provide a much more dynamic environment in which data can be organised and spatial problems solved. They tend to be computerised systems consisting of facilities to enter map data (such as digitising), store and manipulate data, and present results in maps, charts or tables.

Data can come in many different forms. It can occur in vector or raster format (see box 'Understanding the Jargon') and all kinds of data can be mapped. These could be common features such as heights above sea level, roads and rivers, or specialist information like surveying data, satellite imagery and even statistics (e.g., district populations).

Many people have the wrong impression of what GIS is or can do. Some believe it is a "black box" that you can throw at a problem and solve all ills. Others believe it is just a computer-mapping package. These are rather simplistic views. GIS also allows you to interact with your data, pan around or zoom into different scales of data. Most importantly, GIS is a toolbox from which you can select individual tools to answer specific questions, such as:

- *What is where?* where you point at a place on a map and find its location, its soil resources, its population.
- *Where is what?* This could be where you want to know all the locations of certain Cichlid fishes. These questions can be more sophisticated and, because GIS contains spatial data, can combine data from disparate sources. (*i.e.*, where *Neolamprologus sexifaciatus* is located on boulders within 50 km of Uvira.)
- *What happens if..?* This is where you might integrate data on slope, land cover and vegetation with rainfall to predict erosion rates, both totally across the catchment and between regions.

LTBP is capitalising on the utility of GIS to assist the project. NRI is assisting in this in several ways. First, we have developed a simple interface to allow people to view, interrogate and present all the data very easily. We call this 'TANGIS'.

GIS is a very powerful tool to answer spatial questions, but it does not work properly without accurate data. The projects' Special Studies are now generating large datasets (e.g. the Biodiversity Survey and Literature Databases, the Pollution monitoring data, the reports from Fishing Practices, the Sedimentation surveys in the lake and rivers). Our second role is to integrate these data with others; maps of administrative boundaries, roads, a digital elevation model, satellite data and socio-economic statistics.

We want people to be able to get access to this data easily, and we catalogue it all using a metadatabase. Metadata are data about data. The metadata we create includes geographical information (the dataset's location in space, its original scale), their attribute

Understanding the Jargon

GIS - Geographical Information Systems - Usually applied to the computer hardware or software, or the entire database system. Sometimes it means the processes used to model spatial data.

Vector - One way in which to store map data in a GIS - it involves identifying features in terms of points (e.g. survey sites or landings), lines (e.g. rivers or roads) or areas (e.g. Lakes or National Parks).

Raster - Another way to store map data in a GIS. It involves dividing up the earth into equal sized squares (called pixels) and assigning data to them. They are useful data layers for satellite information, digital elevation models or other environmental data where information is continuous. These can be useful for data such as soils where every piece of land can be classified.

Digital Elevation Models - these are pixel maps showing height information. They are more useful in a GIS than traditional contours because of the watershed and slope modelling you can do with them (see *Modelling with GIS*).

Pixel - a square in a raster grid that contains data (for example from a satellite image).

Query - Asking questions of the data.

Digitizing - Using an electronic drawing board to transfer vector data from a map to the computer, It is one of the most popular (but time consuming) ways of entering new data into GIS.

Projection - A way of representing the curved surface of the earth on a flat map or GIS screen. The project uses two; Platte Carre which references latitude and longitude as equal distances, and Universal Transverse Mercator, Zone 35, a metre-bases system that is the standard for many maps in the region.

Scale - The relative ratio between the earth's surface and its representation on a map or in a GIS. A scale of 1:50 000 means that one cm on a map equals 50 000 or 0.5 km on the ground. Data from the project are represented at different scales. Some such as rivers cover the whole region (1:1Million or above), some survey data are best represented at a local scale (1:25 000).

Attributes - These are the associated data for each feature in your dataset. For example if a point represents a landing site, the associated attributes might be its daily catch, number of boats, number of fish species, the name of the site.

details, copyright restrictions and size. We publish catalogues of metadata on the LTBP website & CD-ROM, which is updated every 3 months.

As well as the 300 digital datasets stored in TANGIS, we have also catalogued 100 non-digital datasets, such as paper maps held by the project and some references to other sources.

The GIS should not only be seen as a tool to solve spatial problems. Up-to-date data are necessary to support the Strategic Action Plan, and the current GIS framework will make it easy to allow future updates. The datasets and interface will be distributed to key sites in the following months.

How can you help us?
If you know of good sources of data or if you require data, contact Anne Jackson (ja06@greenwich.ac.uk).

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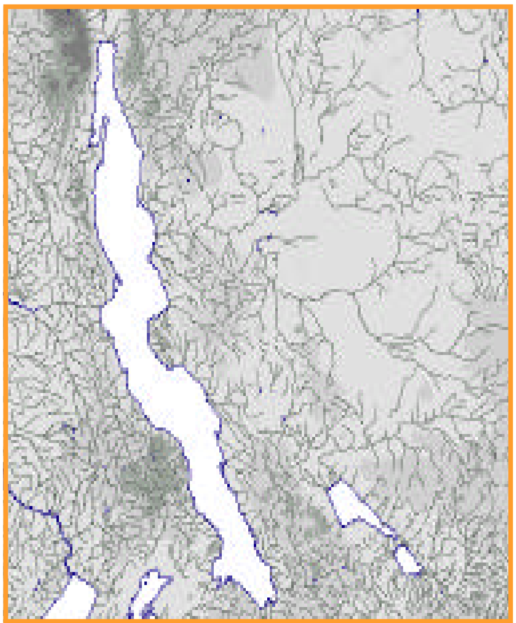

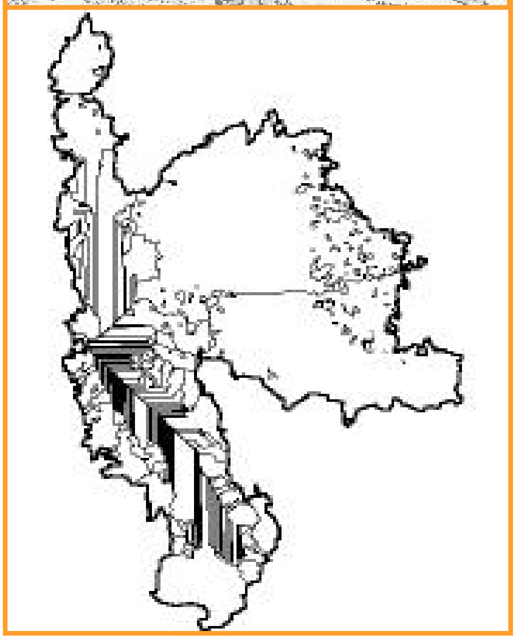

Modelling with GIS

GIS is not just about maps. The three maps above demonstrate how GIS can be used to make new information. The first shows the digital elevation model with heights above sea level (dark = high). The second map shows how GIS has been used to calculate direction of flow from one pixel to another. White areas are where water flows south and grey areas where water flows north. The third map is derived from these two layers. It has automatically defined the lake's sub-catchments, including the straight areas where the water from the rivers "extends" into the lake. The GIS has assisted in defining the lake's true catchment.