Geographical Information System (GIS) - Garden Route National Park (GRNP)

GIS in Scientific Services, Knysna, GRNP

The GIS function in the GRNP lies with Scientific Services, centered in Knysna, South Africa. The GIS was started and planned initially to use in a Conservation Forestry environment as a planning, management and decision-making tool. The GIS is a one man show with its main functions to develop and maintain data, supply and analyse data, and do mapping, mainly for the terrestrial area of the park. The main clients of the GIS are park management (colleagues on the ground), Scientific Services, Specialist Scientist, Planning, Working for Water, People and Conservation and the Communication section.

Data and maps are also supplied by the GIS section to Knysna Municipality, Knysna SAPS, State Departments, Provincial institutes and public where functions overlap or where it is in the interest of the Park.

Short History of GRNP GIS

The current GIS function was first visualized (± 1996) to be a CAD driven program. After dabbling in Caddie (a Computer Aided Design program) it was decided that proper GIS software will be needed.

Hand drawn maps were available for the forestry areas that were used for management of the indigenous forests. These maps were digitized, 'heads down', using Arc Info, on a digitizing tablet. The initial digitizing was done in ± 1999 by a contractor, using sheets prepared by Forestry personnel, specifically for this purpose.

This initial process included digitizing of Compartments (polygons), Roads and Rivers. The contractor stopped before proper cleaning of the data when money ran out and before attributes were allocated to the datasets. The development of the GIS floated between different staff members and eventually became the responsibility of the author. At that stage (± 2001- 2002) ArcView3 was used as the ArcInfo copy had disappeared. Round about 2003 we entered the era of ArcGIS and georeferenced colour images. The entrance of orthorectified colour images revolutionized local GIS and all further digitizing were done 'heads up' (on-screen digitizing).

What the GIS covers

In extent, the GIS covers the Garden Route National Park's (GRNP) area. Some areas adjacent to the park are also included in the GIS for effective management. However, many datasets are national datasets (e.g. roads or SA Vegetation) and will cover outside of the GRNP as well. Layers like Species of Conservation Concern, Herbarium Collections and park planning datasets, stretch outside the park as conservation (and gene movement) does not stop on the park boundary.

The GIS tries to cover all possible subject areas, i.e. from issues that are only of interest to scientists, to data needed by park managers to assist in their management, or planners planning for conservation outcomes. The GIS development tries to pre-empt possible questions that can be answered by the GIS.

Figure 1 shows the basic, but still variable layout of the GRNP.

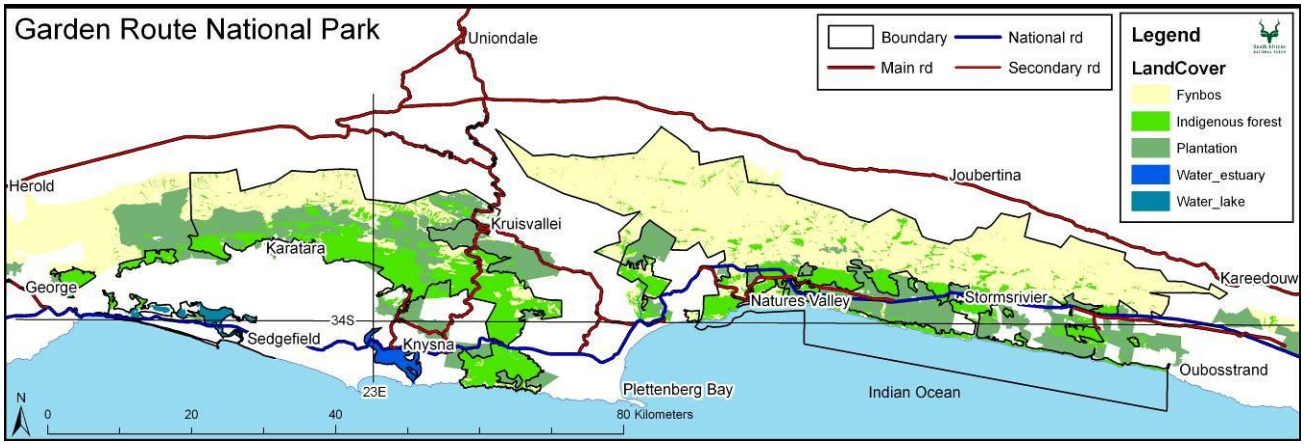

Figure 1: Garden Route National Park location and land cover.

What the GIS personnel do

Development and maintenance of GIS
GIS development and maintenance are continuous tasks. Data gets developed either to pre-empt needs or to satisfy a need that arises. Entities captured in GIS change. E.g. a piece of land may be under plantation, is clear felled, and transferred to SANParks. In this case the ownership, management class, land cover and possibly the shape, will change. These changes may change the relevant polygon's area, as well as those of the areas adjacent. This scenario plays itself off over many data sets and quite regularly as the GRNP is a new park and still in a development and transitional phase.

Continuous improvements in accuracy adhering to typology rules (see link to dictionary) have to be made.

Data Capture
Data capture often results from development needs or from work done. Data capture may be via GPS and then integrated into the GIS, or via the CyberTracker system (see Links) where data is collected in-field with coordinates, then integrated into current or new datasets. The most common way to capture data is by digitizing new data, either from imagery or georectified scanned images. A new and popular way to capture data by personnel is to digitize onscreen in Google Earth and save as .kml files which can be imported into the GIS and converted to .shp files.

Attribute data can be either imported via Excel or typed directly into the appropriate table.

Analyses
GIS is used to answer questions and make decisions. Deriving data from spatial datasets is really where GIS excels and the most satisfying and challenging of GIS tasks. Recent interesting analyses were to determine vegetation age and fire return period in fynbos from fire history polygons, and to determine alien plant densities.

Mapping
Although a laborious task, mapping is the single most used product from GIS. Maps may even be perceived by some as the main product from GIS. Producing maps take many forms, both in size, complexity, colour and media. A map product can either be 'hard copy' (on paper) or digital (often .jpg, .tif, or .pdf). Paper maps' size may vary from A4 to A0, or even A0 width to many meters in length. The biggest mapping challenge is to depict a large physical area on a small paper area (e.g. the GRNP (150km wide), on A4 portrait layout (±18cm).

Why should you use GIS?

The following is often quoted as the top four benefits of GIS: cost savings and increased efficiency, better decision making, improved communication and better recordkeeping (see http://www.gis.com/content/top-five-benefits-gis).

Geographic Information Systems have a number of advantages compared to the traditional mapping systems. Traditional maps are static, with fixed projection, scale and coordinate systems; it is difficult to combine multiple map sheets and overlays are restricted. They are difficult to copy and share between many users. GIS makes this simple. It is easy to update data in GIS, analyse spatial data and convert to new scale or coordinate systems. Maps can be easily combined and overlaid, offering various types of information. This includes both data within the organisation and data acquired from outside of the organisation.

Densities, quantities and patterns of a specific item in a specific area can be easily derived and terrain models can be generated to aid 3D visualization.

Simultaneous and multiple user access are available in GIS, and can help organizing data, making it easy to share and be accessed by multiple users. This can ensure that organizations and single users use the most up to date information and therefore make better and less time consuming decisions. This assumes that the data is available over a server and that software for these purposes is available and used.

Geospatial data is better maintained and easier to search, analyze and represent leading to more added value products. Data is digitally organized in a GIS, so the user has no need to store numerous maps, datasheets and charts.

Interactive maps provide information about how geographical features interact with each other. Users can point to location and retrieve information, perform editing and analysis and discover new relationships between objects. Access to geographic information is easy and there is a range of tools which give the capability to interact with the map contents.

In short it could be said that GIS allows you to find where things are, work out quantities and densities, find what's inside a certain area, find what features are nearby and record or map change over time.

Dataset availability

Many of the datasets that we use are in the public domain and are either freely available to the public or may be ordered for a small fee from Surveys and Mapping, Department of Land Affairs. These are typically 'national datasets' of roads, rivers, towns, cadastral data, colour imagery (aerial photos) and topocadastral (similar to 1: 50 000 paper sheets) imagery. These are well suited for small scale mapping (e.g. 1:100 000) but lacks accuracy that can be seen on large scale maps (e.g. 1:10 000).

Most datasets that are used for day to day management and decision making, however, are locally produced and either digitized from orthorectified aerial photos or GPSed and integrated into the GIS. Some datasets are derived by geoprocessing (analyzing single or different datasets to come to a new answer), typically from monitoring or research data. This data is the intellectual property of South African National Parks (SANParks) and not generally available outside the organisation unless by pre-arranged agreement, e.g. a research application / permit. Some datasets, e.g. on Species of Conservation Concern and Cultural Heritage Sites, may be confidential due to the possibility of abuse.

The backbone of the GIS is the Land (landcover/landuse) dataset. It covers the park area and consists of more than 4000 polygons with attributes. This dataset shows information on management class (i.e., what management practices are allowed), land cover (e.g. vegetation cover) or land use (e.g. if it is a village, an office complex, etc), ownership, area (in ha), and more.

The second most important data set is a road cover. The road dataset covers the park area as well as the immediate surrounds. This helps with showing access to the park. The road attributes allow that roads can be classified into different use types (e.g. roads open to public, management roads, foot paths, etc). A column of attributes allows identifying which roads are used for recreation e.g. hiking trails, mountain bike trails or horse rides and these can be extracted when needed.

All Rivers in the park are digitized and are in a GeoDatabase with Landcover and Roads.

The GRNP GIS datasets are too many to mention all. Some datasets that are often used are: recreation facilities, various datasets to show place or town names, cadastral data (also boundaries of municipalities, provinces) and many more. All infrastructure e.g. buildings, power- and telephone lines, water lines and radio / telecommunication towers will be in the GIS by end 2012. More specialized data e.g. on cultural assets, herbarium collections, species of conservation concern locations are also used via the GIS. Layers for park planning includes Development control areas, Protected Environments, Zoning, Ecological Support Areas, Critical Biodiversity Areas, etc. Fire History is recorded in the GIS. Various vegetation cover layers are available. These are but some of the data developed by or recorded in the GIS.

A complete coverage of colour orthorectified imagery is available for the park area (of various years) as well as rectified 1: 50 000 and 1: 250 000 topocadastral maps. Various other raster datasets are used as well. We have a 10m digital elevation model (DEM) for the park area.

Scientific Services, GRNP does not sell any GIS data and there are constraints in giving out data to the public.

Software

Arc Editor 9.2, Spatial Analyst, XTools, Edit Tools
Arc View 3.3 (yes… this still used for certain functions)

Links

GIS Dictionary:	http://support.esri.com/en/knowledgebase/Gisdictionary/browse
GIS Glossaries:	http://www.gis.com/content/gis-glossaries
CyberTracker:	http://cybertracker.org/

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