CREATION OF CARTOGRAPHIC DATA BASES FOR LAND ASSESSMENT AND MANAGEMENT

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ABSTRACT:

The cartographic tools have evolved with the time. Today the use of electronic devices and the communication means give cartographers infinite possibilities of a variety of maps. The aim of this work is to solve the problem of creating cartographic databases of FENZHENZING for land management and the environment protection. Our study is to achieve a piece of work integrating several aspects of Geo-information production; FENZHENZING is situated in BABANKI region; this area is straddle over the Western and North West provinces of Cameroon. It extend from 10°00'OO''E to 10°20'00''E longitude and from 5°30'00''N to 6°00'00''N latitude. During the decade 1990-2000 people of BABANKI undertook many projects on irrigation by gravity (water is brought to farms by its own weight) which enabled them to grow counter season crops. These projects have brought many changes in this area and have been contributing a lot of poverty alleviation among the grassroots. Yet water used for the irrigation in this steep sloped area is one of the major soil degradation agents. We choose one of the irrigation sites (lying on the foot of the hill locally called (FENZHENZING) due to the possible landslide and field surveyed it for study. The following methodology was adopted: data capture (acquisition of hard copy map ground survey), data processing using topographic and CAD software, data integration and creation of data bases with GIS software, information retrieval for cartographic presentation, analysis and conclusion. These cartographic databases are for limited use now, since they do not integrate many aspects of geo-spatial data for instance. The liability of the information retrieved for such databases depends on many factors: the updating policy of the databases, the scale and the quality of data captured. If is true that data is scale less in a database, is not the same at the level of data acquisition. This simply means that the scale of data to acquire must match the purposes of the databases, the slopes map could be for great support in erosion control. It can also be for suitable civil defence programme in case of landslide. The topographic map helps for detailed reconnaissance for good planification of land management. The night paddocks are closes places in the area where cattle spend night and their droppings are used latter as manure. The villagers have notice that the conservation of crops grew with chemicals is more difficult than that of crops grew with biologic fertiliser. This knowledge contributes a lot to low level pollution of the environment.

1. INTRODUCTION

The thematic maps could be derived from the cartographic database create on the site for many purposes. This work could provide the basic framework for geographic investigations. This study has good understanding of non-spatial databases but we could hardly link them to geo-spatial databases. The Geo-information production and the environment management (with its powerful tools: CAD, GIS, Desktop mapping software ect.) in which we have been working has made it possible to address the problem geographically. Today the level of information technology is so high and it give cartography a new look and offer cartographers sophisticated means of making quality and dynamic maps[1]. This is subsequent of the rapid growth of the world population whose day to day increase pressure on resources appeals for more consideration to its management. We are taking a lot from our environment for our welfare, but we must also think of that of the future generations. Maps allow for resources inventory, the sustainable development can't be effective without the use of the maps for the decision taking. The cartographic database that is not continuously updated becomes quickly obsolete for the environment management changing. This study achieves a piece of work integrating several aspects of Geo-information production for the environment protection.

2. OBJECTIVES

The main objectives of this work were:

To create databases for the management modalities and repartition of the FENHENZING land on various types of crops, irrigation protection for soil degradation, creation of farm tracks and grazing field for cattle, rank all data collected to date and create a slope map for suitable support civil defence programme in case of landslide.

3. MEHODOLOGY

To solve this problem the following methodology was adopted:

data capture (acquisition of hard copy map ground survey), data processing using topographic and CAD software, data integration and creation of data bases with GIS software, information's retrieval for cartographic presentation, to scale and the quality of data captured, updating policy of the databases analysis and conclusion.

4. DATA COLLECTION

The two databases to be created in this study are:

A hard copy map at scale 1/200000 obtained by photogrammetric restitution of 1963-64 aerial photographs, this map is named "BAFOUSSAM NB-32-XI" and published in 1978 using UTM projection zone 32 and Klark 1880 spheroid, map obtained from "Cameroon National Institute of Cartography", field survey: traversing, levelling and locating all the visible natural and man made features in the area of interest and oral queries one which we obtain informations about some crops and the area they are grown

5. DATA PROCESSING

1) The hard copy map of the 1/200000 was scanned, enhancement it of the raster maps, geo-referencing it, resembling it and exportation of the raster map to AutoCAD for drawing;

2) The Ground survey was carry out follow by the computation of traverses, check of discrepancies and adjustment, computation of X and Y and Z of feature measured, creation of contour lines, plotting of pints, creation of contour lines into AutoCAD.[4]

6. CREATION OF DATABASES

The database to be created now can be queried for limited purposes because it is populated with few data. From the raster image mentioned above, the following layers were created: rivers, lakes vegetation, settlement, main roads, secondary roads, others roads, foot paths, relief, names and boundaries, these layers were obtained by digitising the layers give at the small scale the global view of the region while at a large scale; the vector data from CAD will provide detail information on a given area. From the following layers were created: rivers, roads, houses, paddocks, raphia, coffee plantation, names, contour lines, main irrigation canals and derived irrigation canals, provided that the data bases are continuously updated if queried, it could deliver useful informations for decision making. Those could be made: a topographic map, a DTM, Thematic maps, (soils map, slopes map, hill shade map etc).

7. DATABASE DESIGN

At the heart of GIS is the spatial database. The process design such a database is called data modelling (not to be confused with the modelling performing during query and spatial analysis, to answer "what if "questions). Obtaining GIS database requires two main phases: the design phase and the implementation phase.[4]

*** Reality:** phenomena as they actually exist, including all aspects which may or may not be perceived by individuals. The view really is the mental abstraction of the reality for a particular application or group of applications. Eg; view for cadastral application, topographic application etc.

*** Conceptual data modelling and design:** here we must decide how the view of reality will be represented in a simplified manner but still satisfy the information requirement of the organisation concerned. The conceptual model chosen to represent the features is Vector, Geo-relational is the data structure (Logical Design) adopted and The Arc view GIS 3.2 software was chosen for the creation and management of the databases. It is based on dual architecture. It was Handles two databases: geometric (graphic) database and attribute database (relational). Spatial data handled by Arc View may be of the shape point, line or polygon. Features of the same geometry and characteristics (roads, rivers, settlements, farms etc…) are structured in a shape file to which a table of attributes is attached. In the table, an entity (duple) has a shape and identified. An attribute (or field) has a name, a type, a width or decimal. It may be of the type number, string, Boolean or date. After processing of data, the databases were scheduled in many files[3].

8. FLOWCHART

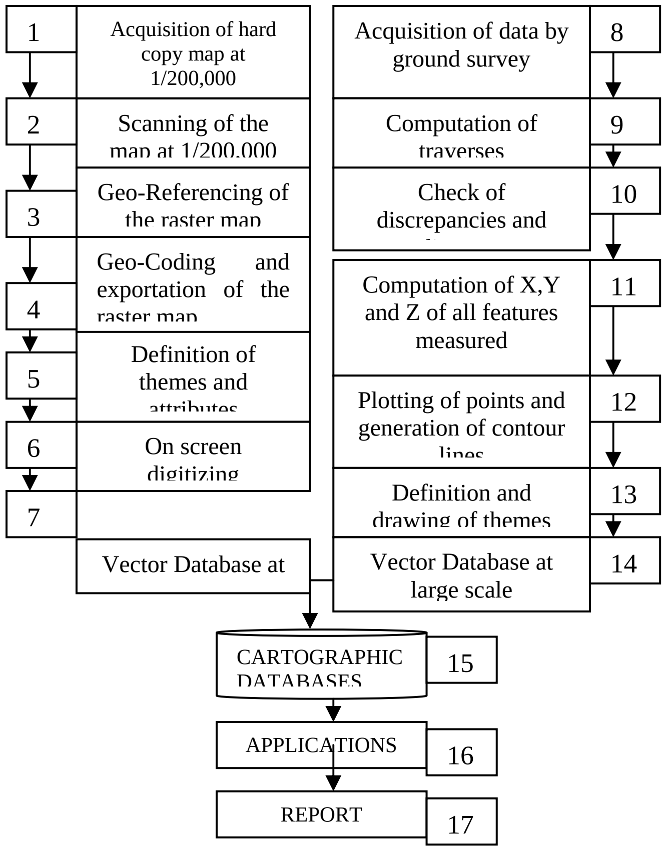

Figure 1. Procedure used for the creation of cartographic

9. RESULTS

In this project, some features have been digitised in AutoCAD and others in Arc View. Linear features have been digitised in the former while area features and point features have been digitised in the latter. In AutoCAD, themes are organised in layers. In Arc View, the AutoCAD drawing is imported as a single shape file as for the first database map. For the second database map the software Topo2000 has been used for the computation of the coordinates X, Y and Z of all the features measured on the field. The software Topos has been used for the plotting to scale 1/1,000 of the computed features and a dxf file made ready for AutoCAD. The software Tpl has been used for the generation of the contour lines by interpolation in a TIN (Triangulated Irregular Network). A second dxf file was also made ready for AutoCAD. Imported and merged in AutoCAD, the two dxf files gave the following results: database 1 which is: topographic map, database 2 which is: slope map.

Figure 2: Topographic map of Fenzhenzing

Figure 3: Slopes map of Fenzhenzing

Despite the importance and diversity of the data sources, field works confirm the exact locations of the sites and evaluate the quality of their environments. Each region presents typical features and different types of landform, the impact can be quantified using the results of the detailed evaluation of geomorphologic sites.

We do this work for period of one year. The study and practise work on the field are starting from October 2004 and end to September 2005.

10. USING THE RESULTS OF EIA

EIA is a complex process, involving numerous diverse fields: flora, fauna, pedology, water quality, air quality, geomorphology…etc.

It is difficult to measure qualitatively the impact on a landscape; however, a quantitative method to measure the impact would reduce subjectivity. Impact can be quantified using the results of the detailed evaluation of geomorphologic sites and a simple method proposed by Panizza and Marcchetti alternative in the context of a project can then be compared and the solution least detrimental to the assets selected.[6,7] A geomorphologic map of FENZHENZING affected by erosion from irrigation in this steep sloped area is one of the major soil degradation agents of the site (figure 3) Then by using the results of the general assessment, the estimated volume of deposits and the degree of degradation induced by building the irrigation canal through the area and the deposits, the direct impact on the site could be calculated as follow:

Direct impact = Vs-(Vs X D) = Vs (1-D) 5
Where:
Vs=scientific value of the asset (total number of points in the general evaluation)
D=level of degradation of the site (D= 1, no damage, well conserved; D=0.75, some destruction with loss of minor elements; D= 0.5, deterioration, partly hiding features, through some human activities; D= 0.25, numerous human activities which have deteriorated landscape characteristics; D= 0, characteristics of the landform destroyed.

The direct impact on the site can be calculated with this equation; to obtain the total impact, it is necessary to sum all the results:

Total direct impact = $\sum_{i=1}^{n} Ii$ 8

A final result cannot be compared using a universal scale with universal thresholds. This quantification can be use only to compare alternatives for the same project.

11. CONCLUSION

Topos, Tpl software combined with AutoCAD had generated multiple point shape files. Graphic of such shape files are not editable in Arc View GIS 3.2.

We have built two databases populated with data from two different sources. We believe that there are scales at data capture level. A map at 1/200,000 was the source of the first database we built. At this scale, objects measuring less than 20m x 20m (400m²) could not be represented due to the generalisation of the map. The data of the second database were captured by ground survey. This database is really scale less. Yet it lacks lot of information. There is a need for consulting specialists in each field in order to build a database capable of providing liable information. Giving that the environment is continuously changing, the liability of retrieved informations depends on the policy of updating the data bases.

12. RECOMMANDATIONS

Topographic map will help for repartition of the FENHENZING land on various types of crops, creation of farm tracks and grazing field for cattle (figure 2).

Modification of the canalisation will reduce the erosion effect and increase crops production due to the fact that the fertile soil are made by the droppings of cattle from the night paddocks which are used latter as manure. This value is significant only for this example, several options should be consider during impact assessment in order to give meaning to the score. The slope map can also be for suitable civil defence programme in case of landslide by planting eucalyptus tree on the franc of the valley to reduce landslide (figure 3).

13. PERSPECTIVES

Further works will focus on the lag time from the precipitation crops comparing to irrigation crops. An event to the occurrence of the vegetation green up, analysis of the relation of FPAR (photosynthetic ally Active Radiation) values absorbed by the vegetation with a spatial resolution of 1km and is updated each ten day throughout the calendar year. The grass field health will also be investigated as this, is and important factor for and area highly dependent on local precipitation event. This future work can provide a basic data for managers of the grass field and livestock and can provide valuable input into a system for local time management of the grass field resources.

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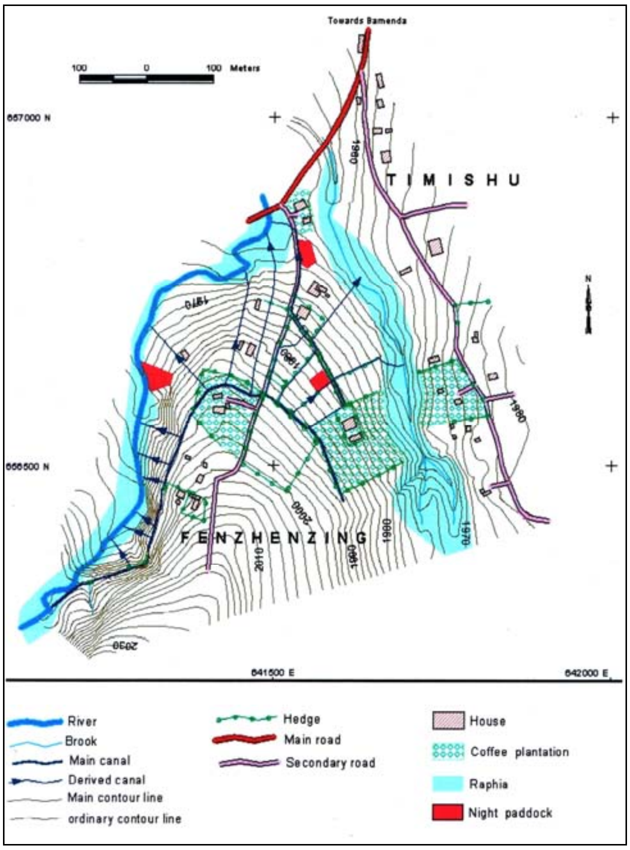

Figure 2. Topographic map of FENZHENZING

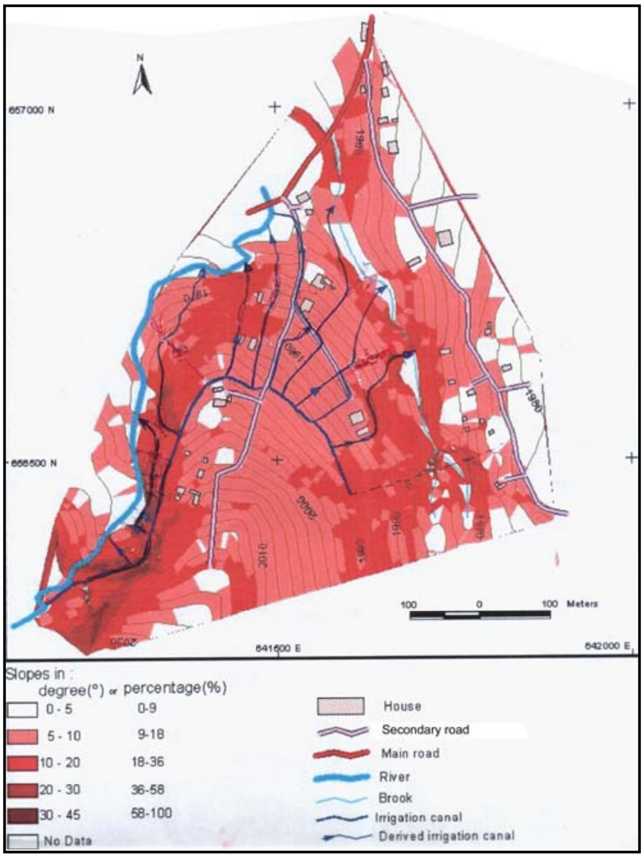

Figure 3. Slope map of FENZHENZING