

THE ROLE OF SPATIAL INFORMATION IN NATURAL RESOURCE MANAGEMENT AND SUSTAINABLE AGRICULTURE IN KENYA

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Key words: Monitoring, Impact Assessment, Sustainability, Agriculture, GIS.

ABSTRACT

Spatial information / GIS is a powerful practical tool that can enhance information interchange within a wide spectrum of NRM/agricultural applications. Examples of previous work include the ecological zoning/mapping of Kenya two decades ago that was widely availed in the form of Farm Management and Range Management Handbooks. Advances in remote sensing via satellite and aerial photography as well as progress in software applications (e.g. ArcView/ArcInfo) make good spatial information more readily available. Lessons learned from one pilot site in Kenya are presented as well as an outline of a new project that is implemented by the Kenyan Ministry of Agriculture and Rural Development with the help of German technical assistance by GTZ.

INTRODUCTION

From the early 70's to the late 80's, GTZ in Kenya (Green Sector) had been operating under the auspices of German Agricultural Team (GAT). One of the activities undertaken by GAT was the conception and dissemination of the Farm Management Handbook of Kenya, which was produced in five (5) volumes. This handbook has been dubbed the most stolen document within the Ministry of Agriculture and Rural Development. This is an indication of its value for stakeholders in the agricultural sector.

It contained the following topics:

- Volume I - Labour Requirement Availability and Costs of Mechanisation
- Volume II - Natural Conditions and Farm Management Information of Kenya
 - II/A - Covering West Kenya (Nyanza and Western Provinces)
 - II/B - Covering Central Kenya (Rift Valley and Central Provinces)
 - II/C - Covering Eastern Kenya (Eastern, North Eastern and Coast Provinces)
- Volume III - Farm Management Information Annual Publications
 - III/A - Agriculture Land, Holdings and Farm Statistics
 - III/B - Costs and Prices, Gross Margins Cash Flows and Farm Models
- Volume IV - Production Techniques and Economics of Livestock Enterprises

From the lessons learnt in the process of preparing these volumes, other GTZ projects have had various initiatives at different levels to use Spatial Data / Geographical Information Systems (GIS) as tools for planning, monitoring and evaluation. Some of these projects are Transmara District Development Project and Fertiliser Use Recommendation and Extension Projects. A concerted effort to have a central GIS for all the GTZ projects did not materialise hence the individual effort by different projects. Transmara Development Programme (TDP) has used these tools for Resource Management in planning of the District Development Projects, while the Fertiliser Extension Project used the system for mapping soil samples and fertiliser recommendations in different parts of the country. This paper will concentrate on the resource management experience with the Transmara Project.

DESIGN AND DEVELOPMENT

1. Inception

During the orientation phase of TDP, lack of information of the district's resources was identified as a weak link in the overall development strategy. GIS was identified as a suitable approach to start a data inventory for the Natural Resource Management (NRM) component of the programme.

2. Development

The initial process involved acquisition of satellite SPOT images that were then processed at the UNEP-GRID facilities to produce the initial base maps. Coverage included administrative boundaries, infrastructure, drainage and land use information, i.e. forests, rangeland & agricultural land. Other data were gradually added into the databank such as Participatory Integrated Development (PID) activity clusters, livestock data, demographic data, community resource mapping, field activities undertaken by the Programme and trend analysis maps e.g. forest coverage over a span of 20 years. Methods used in the updating and data input included use of GPS, digitising table, on-screen digitisation and aerial photo scanning.

3. Objective orientation, diverging interests of the unit

The initial objective was to implement the unit as a monitoring tool for the progress of the programme activities. However, it became apparent that this was under-utilising the facility. The need arose to use it as a planning tool of future activities as well. Activities such as identification of wildlife zones and communities that would benefit from wildlife resources were mapped out. The Transmara Regional Development Plan was also done using the already centralised database to produce zonation of planned activities and to identify areas that need more development input, e.g. schools, health centres and roads. However, not all information was welcomed by certain parties. The ethnic composition mapping, for instance, was very classified information due to dynamics which were

predominately politically motivated. Besides this, the deforestation information tends to show encroachment by non-indigenous communities and this is sensitive information. Detailed information on land parcels is also exposing a slew towards discriminate adjudication process, disenfranchising the local indigenous community. At some point there were pointed accusations levelled at the programme on its activities more so in the NRM forestry conservation approach, which was contested by the local council.

4. Intercultural differences and the multidiscipline dilemma

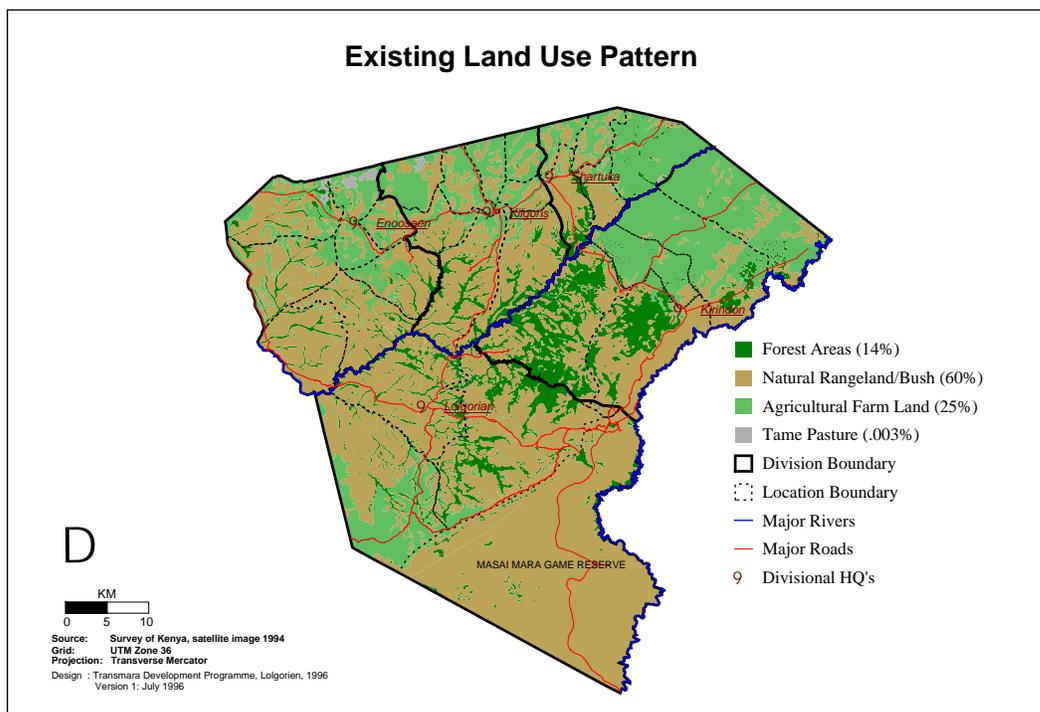
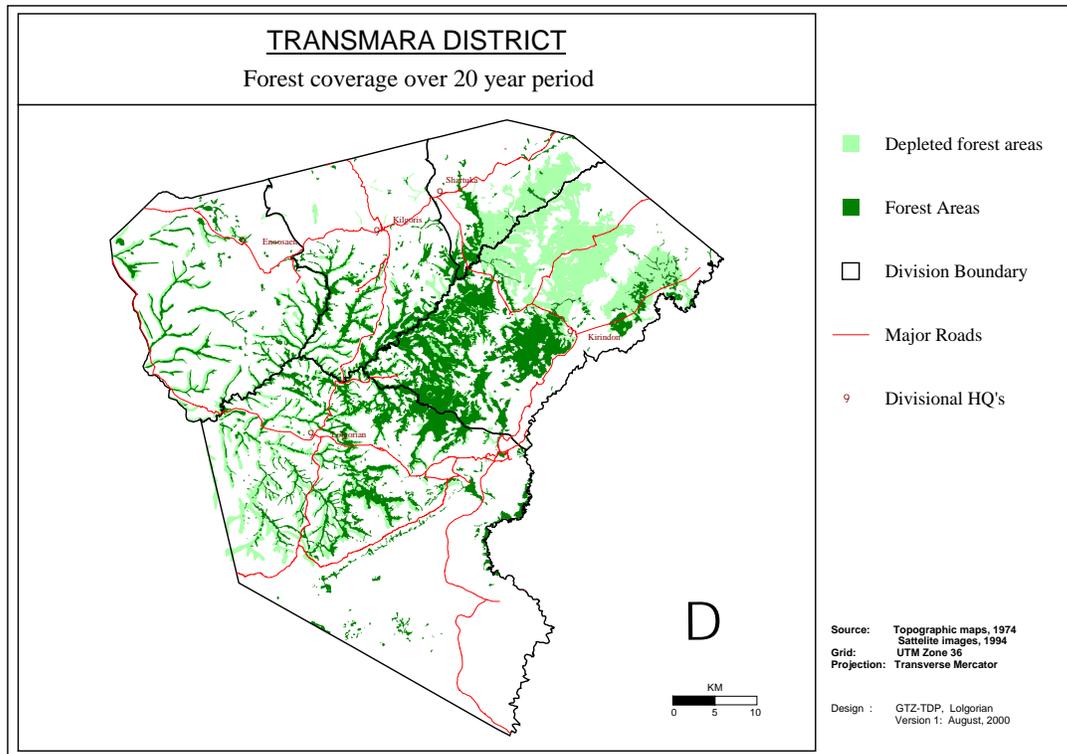
The multidisciplinary approach was also handicapped by lack of involvement in programme activities by other key departments, which felt there was nothing at stake for them. Counterpart approaches were also not captured in the overall GIS strategy due to the exclusive approach of the management then, i.e. activities done by other organisations were not considered for integration within the GIS unit. Awareness on application and use of spatial information was not apparent to all counterparts. Too often information that could be better represented in map form was excluded due to lack of know-how. The management was adverse to external information being processed using their facility and this led to missing out on very important information such as the soil conservation activities and land adjudication information (down to individual parcels). However, the major limitation was the lack of continuity since no counterpart personnel were able to run the GIS unit without some back-up even after training.

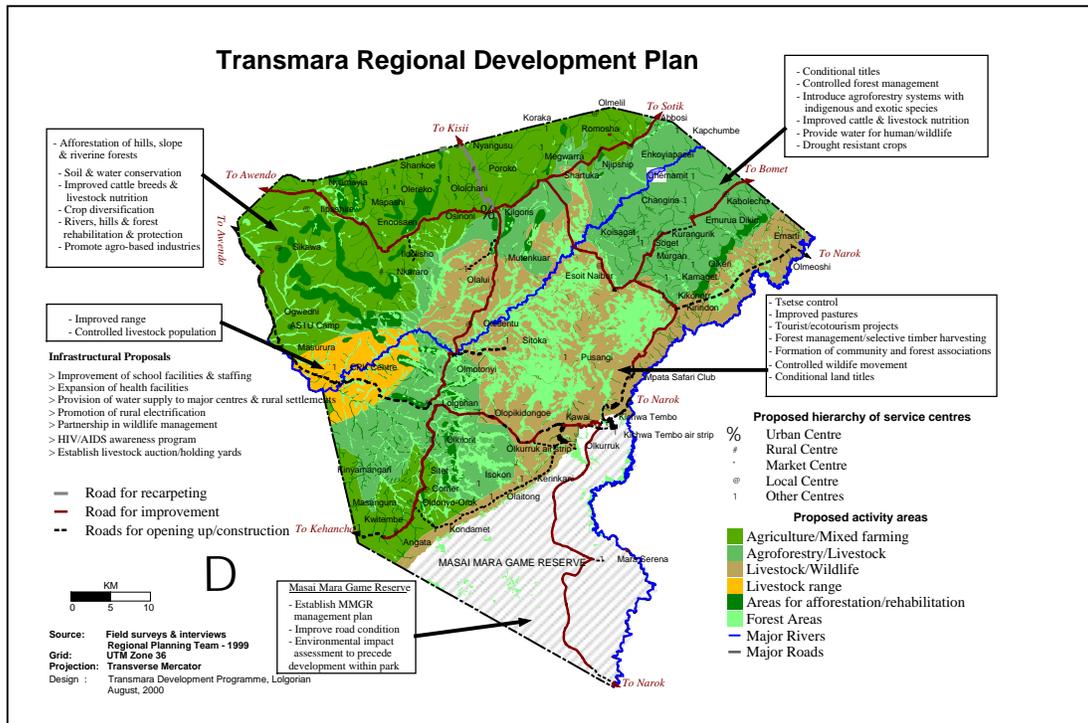
5. Corrective Measures taken

To overcome these constraints, training on GIS was done in key departments. The purpose was to have a GIS unit running within the District Information Documentation Centre (DIDC), which was accessible to all key departments concerned. However, problems arose concerning posting of trained personnel who all left the district due to rotation. The infrastructure was also not in place. Problems included lack of power for long periods (months) due to power cuts in the ministry offices because of non-payment and later a nationwide rationing program resulting from drought. This was temporarily addressed by installing a solar power back-up system. Further training for staff was envisaged and the targeting was to be lowered due to the high turnover of senior staff (departmental heads) to secretarial/ clerical staff that would not be affected by the regular transfers within the Ministry.

6. Findings of the unit

It was however well received in certain areas such as the community mapping exercise, which showed local resources. Other dynamics such as deforestation were also a high point in information dissemination since the locals could now appreciate the need to conserve the forests. Below are some results from the unit.





THE FUTURE OF SPATIAL INFORMATION / GIS IN THE MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT

As seen from the results from the Transmara data, spatial data could be used to the advantage of planning and monitoring in the Agricultural sector.

Spatial information is yet to be fully embraced as a development/information management tool within the Ministry of Agriculture and Rural Development principally because policy and decision makers have yet to appreciate the scope of its application and its potential in information delivery, capture and dissemination. The senior officers in the last decade or so never had information technology skills nor exposure and hence the tendency to stick with what they knew best, namely the archaic top-down management applications. These management skills depended on information gathered from districts in the form of annual reports and other briefs from time to time. However there was no feedback on the same and reports ended up gathering dust on the shelves. Spatial information would quickly reveal trends, statuses and plans without having to spend a good amount of time reading reports. It can be used in strategic fields such as early warning systems, yield prediction & marketing. Spatial information has the advantage that it is also a databank, which can be used for several different information needs.

The Farm and Range Management Handbooks are evidence of the positive impact that the application of spatial information can have within the agricultural sector. Land-use zonation can guide farmers on the potential enterprises to engage in. The important facts of precipitation, soil condition, slope percentage, infrastructure and markets are all priceless details an enterprise needs in order to keep the competitive edge in sustainable agriculture.

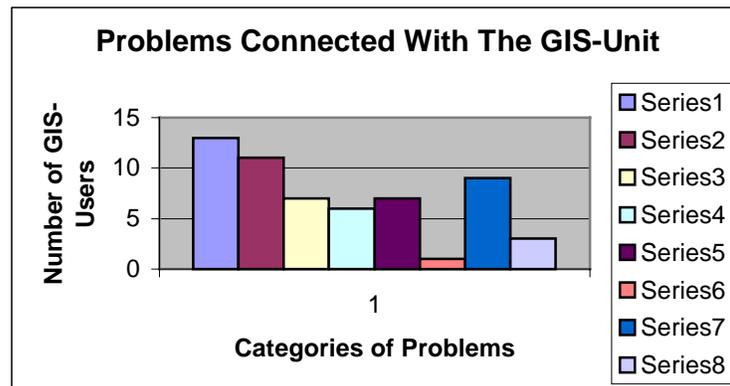
Spatial information can also reveal trends that would give direction in policy matters, e.g. the deforestation that is currently taking place would reveal drop in precipitation, loss of soil condition and other variables that could warn the local inhabitants to safeguard their local resources in order to secure their livelihoods and farming practices.

An earlier survey done on spatial information / GIS users in Nairobi gave the KASIM project a clearer indication on the direction to take. The survey covered a wide range of issues. In this paper the issue discussed is:

- Problems connected with the use of spatial information / GIS and suggestions for improvement

PROBLEMS CONNECTED WITH THE USE OF SPATIAL INFORMATION / GIS AND SUGGESTIONS FOR IMPROVEMENT

- Spatial information / GIS-analysis is a time consuming task, which results in the fact that getting spatial information / GIS-results takes a long time.
- Converting data into spatial information / GIS-format is cumbersome.
- Spatial information / GIS-unit is not efficiently used as the equipment is outdated. This is caused by decision makers not being aware of the usefulness of the tool and they therefore do not invest in better equipment which is necessary for the realization of more efficient and professional work.



- 1) Data Reliability and Availability
- 2) Insufficient Exchange and Cooperation With other Institutions
- 3) Insufficient Transparency of Already Existing Survey Results and Data Bases
- 4) Insufficient Knowledge of Data Sources
- 5) Cost-Recovery
- 6) Electricity
- 7) Frequent Change of Personnel
- 8) Others:

Results take too long,
 Spatial information / GIS not efficiently used as the equipment is too old,
 Transfer of data into spatial information / GIS format takes too long

Source: Report on Kenya GIS Users Analysis – A. Unterpertinger- Msc GIS Student

Looking at the results for the pre-formulated answer-categories, the majority of the spatial information / GIS-users stated that data reliability as well as data availability is a serious problem connected with the use of spatial information / GIS. The fact that more than 50% of the users state this shows that data reliability is a pressing problem. There is the need to develop data-quality standards in the future and create channels that make data easily available or at least tell users where certain data can be found. The problem of data reliability and availability is closely followed by the problem of insufficient exchange and cooperation with other institutions. Insufficient exchange and cooperation is a hindering factor for efficient work. The link-up of spatial information / GIS-users to support the exchange with each other would decrease work time and save money spend on surveys to collect data that another organization may already have.

Another problem, which is not to be underestimated, is the frequent change of trained personnel and thereby the loss of capacity. Training in spatial information / GIS is a cost-intensive and time-consuming task and the loss of personnel means repeating investment into the build-up of capacity and loss of capital. This fact, in some cases, might also lead to the end of a spatial information / GIS-unit. Especially governmental agencies are affected by this problem. This is true for reasons of underpayment. Training governmental officers in spatial information / GIS leads into an over-qualification relative to job-picture and payment. This results in staff departures into the free market economy and often also into the breakdown of a governmental spatial information / GIS-unit. Adequate payment may prevent the leaving of qualified personnel.

Also, insufficient transparency of already existing results and databases is an often-addressed problem. Often times, time and money are invested in the search for data and data collection. The development of a nationwide database or at least meta-database would save a lot of time and money and also support the development of data standards and improvement of data quality.

Directly connected to this point is the problem of the insufficient knowledge of data sources. Again, development of a nationwide database or meta-database may solve this difficulty.

The inclusion of spatially-assisted information management initiatives was initially focussed but during the last one and a half decades became scattered. Initiatives will now be re-focussed under the auspices of a new Kenyan-German project that is facilitated by GTZ.

KENYA AGRICULTURAL SECTOR INFORMATION MANAGEMENT PROJECT (KASIM)

Project Goal and Purpose

The project goal is that Stakeholders (e.g. Rural Households) in the Agricultural Sector use available resources more efficiently, while the purpose of the project is: Stakeholders in the

Agricultural Sector (public and private) increasingly exchange and utilize good quality information

Portfolio of KASIM in the line Ministry (MoA&RD)

One of the core functions of the Ministry of Agriculture and Rural Development is Information Management for the Agricultural Sector. Under this function one of the project results is:

“Appropriate and sustainable Management Information Systems (MIS) for the agricultural sector are developed”

Use of spatial information encompassed with Geographical Information Systems has been included as a main component of an MIS for the Ministry of Agriculture and Rural Development.

The Approach

In its activities, KASIM sources data from existing organisations with very well researched and detailed information and avails this to stakeholders within the agricultural sector, e.g. policy makers down to farmer level. KASIM has established a GIS unit, which has the capability of up to A0 scanning and A1 printing in colour. Plans are underway to ensure packaging of digital data (maps) can be done within the project for future reference. Linkages have been established with Food and Agriculture Organisation, United States Agency for International Development, Inter-Governmental Authorities in Development, etc., with the aim of disseminating information from these institutions to benefit stakeholders.

KASIM intends to use spatial data / GIS as an entry point for information dissemination, e.g. ecological zoning, mapping of crop potential, rainfall patterns, soil patterns, livestock movement in pastoral areas and ranching opportunities, as done in the **‘Farm Management and Range Management Handbooks of Kenya’**. To overcome the information bottleneck, the spatial information/GIS unit will crisscross within all the departments of the Ministry to compile and disseminate information, unlike previous endeavours which covered only the Range Management and the Farm Management Divisions

The Methodology

Centralisation of spatial information coupled with GIS has helped overcome the networking blind spot of utilisation, since having a spatial information specialist in the hub of sector activities enables access to a broad spectrum of information which could then be disseminated across the sectors, e.g. to help agricultural producers identify suitable expansion areas, or to assist Public Works (Roads) identify isolated health care facilities in need of infrastructure. All the sectors involved are in one way or another concerned with agricultural production and rural development. Constraints of compatibility of both

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software and data have been observed, since diverse approaches are used within the Kenyan scenario. KASIM aims to address this hitch by adopting a platform across which different approaches can be bridged centrally. The issue of sustainability is also being addressed by proposing to have spatial information activities incorporated in the recurrent budget estimates of the core Ministry activities.

Private and Public Sector roles in spatial information

Bridging of private sector and public sector approaches also needs enhancement. Spatial information tends to be very sector specific in the private sector. However the same information used in a broader context of public sector could have very positive impact in either status analysis or monitoring. For instance periodic aerial photos taken over towns/settlements for planning purposes could be used to illustrate other aspects such as deforestation/erosion/human settlements, early warning systems, etc.

KASIM intends to use this unit to disseminate information with the aim of assisting policy makers in both the private and public sectors in providing adequate advice to investors, farmers and other actors in the agricultural sector.

Expected Constraints

- Acquisition/Information flow from the various actors
- Interpretation of the information by the users
- Accuracy of the information acquired
- Non-willingness by the various actors to cooperate (information kingdoms)
- Funding to enable wide coverage

Suggested Solutions

- Provide incentives for the data providers
- Provide training to enable proper interpretation by users
- Source for funding from other interested parties
- Proper networking of actors
- Clear cut needs should be defined by the various actors to enable precise and accurate provision of information
- Both initiators and end user of the data collection/ consumption cycle have feedback channels to enhance accuracy and reliability of data.
- Accurate, timely and reliable data is used within the system.
- Appreciation of GIS, i.e. the information & data generated actually gets used in the planning, monitoring, informing and decision making process.

CONCLUSION

Spatial information/GIS is a powerful practical tool that can enhance information interchange within a wide spectrum of applications. Information interchange is inhibited by wieldy reports and critical decision-making personnel are hard pressed for time to peruse and make decisions based on reports, charts, etc. GIS offers a simpler summary of

geographically related information. The array of fields to which GIS can be applied is wide, e.g. staff deployment, planning, monitoring & evaluation, modelling, target setting, etc.

BIOGRAPHICAL NOTES

George Awinyo is a GIS Expert who has worked in the field for over 6 years. He is the GIS specialist in the project charged with running the unit. Antony Mbandi is an IT specialist who has worked in the Information field for over 7 years. He is charged with running the IT unit project. Prof. Werner von der Ohe has worked in the agricultural sector in Kenya for the last 7 years as a coordinator in different projects. He is the Team Leader of the project charged with Technical and Administrative Coordination.

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