**Peri-urban project Kumasi Ghana**
**Development of methods of peri-urban natural resource information collection, storage, access and management**

**A Review of some of the RRA/PRA literature pertaining to the research project**

The literature on Rapid Rural Appraisal (RRA) / Participatory Rural Appraisal (PRA) is quite extensive. The major source of bibliographic information and references are the PRA Bibliography held by the Institute of Development Studies in Sussex University (http://www.ids.ac.uk/eldis/pra) and the International Institute for Environment and Development which produce PLA (Participatory Learning and Action) Notes.
This review is selective and addresses the areas of RRA/PRA methodologies with reference to the use of aerial photography, remote sensing, GIS and participatory planning methodologies.

The paper concludes with a number of hypotheses developed as a result of the review which could be used to guide the approach to the Peri-urban project, Kumasi

**The Use of aerial photography in rural development planning**

***Robert Chambers*** in notes for a lecture ***Rapid and Participatory Rural appraisal and Remote Sensing*** **(1990)** emphasizes that at first sight PRA and remote sensing are opposite ends of the continuum of knowledge management. PRA stresses rural people's knowledge which is owned and used by them to investigate, analyse, plan and implement projects and programmes. Remote sensing, on the other hand, is 'high' tech and remote, it is large scale and uses the "analytical categories of normal science."
In answer to the question "Can PRA be of use to remote sensing?" he identifies that the local people can act as ground control and, provided the local 'experts' are located, they are able to interpret remote sensing data. Care must be taken that the visual imagery is readable. The easiest being true colour images the hardest is the false colour images with the black and white images being acceptable.
The question "Can remote sensing be of use to PRA?" is answered by reference to the Participatory Mapping and Modelling (PMM) carried out in India by MYRADA in Bangalore and the Aga Khan Rural Support Programme in Gujarat. The strengths of the two approaches were established as follows

| | **Aerial photographs** | **Participatory mapping and modelling** |
|---|---|---|
| correspondence with people's mental maps | not very close | very close |
| spatial accuracy | very high | less |
| ease of interpretation | high (true colour and B & W) | very high |
| up-to-dateness | variable | very high |
| detail | the visible only at first<br><br>more complete | the social and political as well selective |
| ease of correction | moderate/low | high, using ground or chalk |
| accessibility to a group of rural people | only a few can see, check and analyse together | many can see, check and analyse at a time |
| durability/permanence | high | low, unless on paper |
| enhancing creativity and empowering rural people | moderate | high |
| acceptability to outsider professionals and ease of use by them | high | moderate to high |
| cost | very high | moderate to high |
| accessibility | nil or very difficult | universally easy |

Chambers closes his paper with a query as to whether aerial photographs will be used in participatory local-level resource planning, development and management

This same dilemma is reflected in ***Richard Ford's*** paper ***Scaling up from Village level PRA to Region-wide Participatory Resource Management planning (1991)*** which was articulated as: central planners working at the macrodata level with authority; technology and development resources but lacking microdata. This compares with the community leaders and local institutions which possess significant knowledge about needs and opportunities within the community but lack adequate funds and technical inputs to implement solutions. Richard Ford from Clark University using IDRISI worked with Francis Lelo at Egerton University in an attempt to combine the two analytical tools of Geographic Information Systems (GIS) and Participatory Rural Appraisal (PRA). The stupy project included a regional reconnaissance which determined micro zones within the study area. The value placed upon the reconnaissance was seen as:

- the micro zones were based upon the perceptions of the land users
- it identified zones from which to select locations for pilot PRAs to gather micro data
- zoning yielded a preliminary list of problems
- the reconnaissance provides preliminary and division-wide data on land use, infrastructure, population and terrain
- it can up-date information that is frequently out of date on existing topographical or other base map sources. The updating can take several forms including confirming locations and their characteristics, through use of Global Positioning System (GPS); development of LANDSAT or SPOT imagery as representations of landscapes; or creating (or amending) land use maps from remotely sensed data and confirming the information via ground truthing

Two parallel actions followed the reconnaissance. One set began with the problems and solutions which the villagers described and which pointed to the macrodata required to assess the needs of the locally determined priorities. The other set addressed the particular needs in the micro zones. Pilot village plans were developed within the micro zones and simultaneously data was integrated into a GIS data base. This latter data base was used to scale up a list of options which were available to the villages as they addressed their particular problems. This GIS analysis was also able to assess the population settlement patterns, distance, physical factors (i.e. rainfall and soil type) and socio-economic conditions. The assessment also considered the technical and social feasibility of any proposed intervention. A division (or District) plan was derived from all the information that was accumulated.

The preliminary conclusions reached as a result of the exercise was that more and better insights were required on

- selection of PRA communities within micro zones that will represent much of the micro zone
- entering micro data in the GIS macro data base
- gearing regional planners to be part of the whole process
- amending PRA to fit the needs of macro planners
- testing feasibility of micro projects
- keeping options open for alternative means to scale up.

"GIS has no monopoly on scaling up micro data. Other means which also need to be explored, both complementary to as well as independent of GIS. The important point to keep in mind here is that GIS and PRA are analytical tools to accomplish a task - data analysis and devising plans. If other tools such as DBASE systems, modelling, simulations, and statistical assessments can be used to scale up, they should be employed.

Ford himself through a personal E-mail in June 1997 states
"That paper from 1991 was a probing exercise and has not materialised into any action. However, with our GIS efforts in local development, we are developing quite a number of activities. As I am sure you know, there are a number of modules in IDRISI that lend themselves to local planning and we rely heavily on those things. We
are also using PRA and GIS in a national park in Madagascar"

Robert Chambers in his comments on the scaling-up study identified eight hypothesis that need to be tested

- that PRA communities are representative of microzones
- that data generated by PRAs in the representative communities are used in GIS
- that the resulting GIS data sets are used for divisional planning
- that the GIS data sets make a difference to the plan
- that the difference to the plan makes a difference to implementation (real events on the ground)
- that the difference in real events on the ground are beneficial compared with what would have happened without GIS
- that benefits outweigh costs compared with alternatives ( Benefits here would include good plans implemented with participation, sustainability etc. and costs would include staff time, loss of participation, etc.)
- that benefit outweigh costs if and when the approach is replicated

[Chambers expects that the first seven of the above could be tested on a small scale and the basis for a modest research project. It may be useful to address these issues in the Kumasi Peri-urban Project.]

Aerial photography provided a bridge between planners and non-literate villagers, when discussing plans for their area in a very practical example from Nepal. ***Brian Carson*** describes this approach in his paper ***Appraisal of Rural Resources using Aerial Photography: An example from a remote hill region in Nepal (1987)***
Carson claimed that the advantages of using 1:5,000 aerial photography were that:- once the negatives are available. printing aerial photographs is cheaper and more rapid than making large scale topographic base maps; rural Nepalese were adept at interpreting aerial photographs without any formal training. (Carson states that this ability is not common to all peasants; but as Nepalese often look from ridges into valleys, they are used to observing landscape in the same manner as present in aerial photography); the information available to even semi-skilled interpreters can form the basis for a well conceived field survey and map production. The conclusion reached is that there are obvious benefits from using aerial photography as a base to organise information.
In essence Carson had developed the process whereby human and land resource data can be presented on an aerial photograph thus integrating what would normally be unwieldy data. The process involved

1. Selecting a site by collecting all available information
2. Providing the photographic base (ideally 1:20,000 enlarged to 1:5,000 - 2,500
3. Mapping the natural resource and local infrastructure to include soils, land use, cropping patterns, forest type, extent of degradation and hydrology, major trails, canals, villages and individual houses etc.
4. Identify the land tenure pattern. Land ownership to be identified using RRA
5. Presenting the dynamics of land management (How people interact with their environment) Activities to be recorded are :- fetching water; composting fields; cutting fodder; collecting firewood; ploughing planting, weeding and harvesting crops, herding cattle and other livestock. These activities to recorded daily, weekly or monthly.
6. Identify the village economy. Record of the numbers of rich or poor by reference to number of livestock, amount of land, educational level, amount of off-farm income etc.
7. Record the impact of cultural, religious and traditional values upon the land-use planning. The sense of community to be elicited along with the interpretation of land management problems as cultural issues
8. Establish the village politics

The culmination of the activity being the presentation of a preliminary village management plan. "By understanding the land resources and how man is using them, the planner is in a better position to suggest improvements at the village level. The ultimate development decisions, however must come from, or be approved by the villagers themselves. Without their support, projects have little hope of success."

The purpose of a paper produced in 1993 by ***C.F.Hutchinson and J. Toledano*** called ***Guidelines for demonstrating geographical information systems based on participatory development*** was to examine some of the elements of technology transfer as

they condition the sustainable application and adoption of GIS technology to problems in agriculture and natural resource management. The authors then offer guidelines for demonstrating GIS technology based on their experiences in India. The principles of which were drawn from participatory development that incorporate the end-users in the design, implementation, and evaluation of the demonstrations.
The guidelines included:

- incorporation of the client in the process
- activity should address directly the solution of a resource management or development problem rather than a problem defined by the technology itself.
- methodology of the activity should be spelled out in detail
- activities must deal with a relatively small geographical area
- products which the activity is likely to yield (e.g. models for prescribing alternative land-use options) should be identified and some explanation must be given as to how they contribute to solving the identified problem.

Aerial photography was used for land use planning on a settlement site in Ethiopia as described by *R.Sandford (1989)*. A preliminary test which was run with a few farmers using a 1:5,000 mosaic showed that:

- the settlers immediately recognised that this was a photograph of their land
- they could without difficulty indicate the boundaries of their land
- they had no difficulty in recognising features such as ponds, swamps, woods, their own huts, thrashing floors, tracks, areas under crop etc.
- they could take one to any spot on their land shown to them on a mosaic
- they could identify on the mosaic their position at any point of a walk round the land.

Sandford's summary of outcomes:
"Aerial photography helps technical staff who do not know an area well to identify its superficial characteristics and to visualise development options. It does not help a farmer who does know his land well, including details that cannot be shown on an aerial photograph, to make better plans for its use. It was, however, shown to be a valuable tool whereby farmers could illustrate their knowledge and ideas to others, i.e. developers, and enable developers to extract information of useful accuracy, for example this side or that of a path, without having to walk every part of the land. It provided a visual medium of mutual recognition, the farmers transferring their knowledge of the land onto a representation of it that they could recognise and explain to developers who could visualise what was being told to them through their greater or less ability to interpret photography.
[An application of this concept to a RRA/PRA exercise would be that a transect walk could take place across a map as effectivelly as a physical walk on the ground. Referred to a "Yellow Pages" approach "Let your fingers do the walking"]

***Dewees P (1989). Aerial photography and household studies in Kenya.*** describes how he took aerial photographs and used them to help him collect land-use data for individual households. He concludes that the photographs helped to reduce spatial biases, such as the tendency for field workers to walk along the contours and along ridges. They also seemed to "confirm what made sense intuitively" in terms of land use options. During household interviews, people seemed happy interpreting the photographs though they were mostly literate and had seen aerial photographs before. He concludes
"In some respects, the taking of aerial photographs poses a number of contradictions for Rapid Rural Appraisal practitioners. It was not exactly cheap. It took time to get a good set of photographs. It is about as hands-off as one can get. But coupled with a reasonable field technique and interviewing practices, I have found them to be invaluable; where field workers have the resources and the time to acquire photos, I think they could be especially useful

***Robin Mearns (1989)*** in his paper ***Aerial Photographs in Rapid Land Resource Appraisal, Papua New Guinea*** identified the overlap between RRA methods and "conventional" methods which included an agro-ecological survey using aerial photographs in a fairly conventional mapping procedure. He was able to use the photographs as an aid to mapping boundaries and as a focus for discussion in interviews. Clan elders and others had no difficulty in using hard copy B&W photographs.

## Visual Literacy

PRA practitioners using charts, diagrams, maps and pictures rely on the assumption that even non-literate participants have the ability to create and interpret visual representations of their world. Influence upon these processes could come from cross-cultural communication, including how interpretation of visual representations varies according to culture and experience. There appears to be a Western ethnocentric bias of much research in this area and it is suggested that it may be possible for field workers to respond to local ideas by developing the villagers visual literacy. Diagrams, maps and charts are commonly assumed to be 'value-free' (unlike words) and therefore not culturally- specific. Studies in Nepal have shown how rural people 'read' development pictures and that this skill can be developed through teaching particular artistic conventions such as perspective

## Mental Maps, Physical and Social mapping

In their book ***Mental Maps Gould and White*** **(1986)**examine 'the ways in which people form images of other places and how these images influence many decisions. Examples are given of how people's mental maps reveal their perceptions and beliefs about the world. They refer to Terrance Lee's research which examined social space as it applies to a basic neighbourhood unit. He discovered that social space and physical space are so tightly linked that most people simply do not distinguish between the two. People do not therefore think of their neighbourhoods in terms of number of people, as planners often do, but only as comfortable and familiar space around them.

***Anna Robinson-Plant*** in her paper ***PRA: A New Literacy?(1995)*** articulated the assumptions that are made about people's visual and numerical literacy by PRA practitioners. With regard to the process of mapping and in particular social mapping. She quotes Chambers who states that "in general rural people in the South have more extensive and detailed mental maps than the urban people in the North" She also refers to Fulesang's comment that "people in oral societies easily construct mental maps" and comments that the step necessary to make a mental map into a physical map seems remarkably straightforward. Fulesang's further observation was that people "expect pictures to contain what they know about the objects, nor only what the see of the objects" Robinson-Plant states that "Research on visual literacy has found that people had problems interpreting pictorial space only when it became a matter of representing three dimensions in a two dimensional medium **(Walker , 1979; McBean, 1989)** Relating these findings to PRA mapping, we can see that people are being encouraged to represent what they know rather than what they see - social aspects such as caste, number of members in a household and gender, can be illustrated on the map as well as the usual physical features. Similarly when making transects, participants can illustrate what they know is important about the land as well as what is visible. A quote from Fulesang that "all observers are not led by the same physical evidence to the same picture of reality" leads the author to suggest that this is the reason for PRA practitioners encouraging people to make maps in groups according to their gender, age or social background. These maps can be related to the findings of **White and Siegal (1984)** who describe " dual level maps" prepared by children - first they start by showing the "home" map, then build this up with "route" maps, according to how far they had ventured from the home environment.

"The importance of facilitators entering the villager's viewpoint, rather than vice versa, perhaps links to the idea of local literacies and using existing conventions for representing their reality. The emphasis of PRA on "free visualisation and continual improvisation contrasts with other approaches using pre-determined diagrams mechanically **(Chambers and Guijt 1995)** " Extending this further, we could look also at how language influences our visual representations "culture can affect in subtle ways the hierarchy of spatial orientation that is realised in language structure" **(Hill, n.d.)**

"Our own assumptions - whether shaped by our literacy practices or our spoken language - can therefore influence which conventions are used for visually representing space and time

## Hypotheses to be tested

***Hypothesis Number 1 Aerial photography can be used to speed up the process, and increase the number, of transects which are carried out in an RRA or PRA exercise. This follows the "Yellow Pages" process (Let your fingers do the walking)***

***Hypothesis Number 2 Aerial photography as a tool for village level natural resource planning is as effective in Ghana (Kumasi) as it is in Nepal*** (Replication of the work of Carson 1987)

Carson developed the process whereby human and land resource data can be presented on an aerial photograph thus integrating what would normally be unwieldy data. The process involved
Selecting a site
Providing the photographic base
Mapping the natural resource and local infrastructure
Identify the land tenure pattern
Present the dynamics of land management (How people interact with their environment)
Identify the village economy
Record the impact of cultural, religious and traditional values upon the land-use planning
Establish the village politics

***Hypothesis Number 3 A laptop can be used to provide a vehicle for overlaying natural and socio-economic resource data onto a physical aerial photograph as an aid to participatory village resource planning.***

***Hypothesis Number 4 "Social" or "Mental" maps developed by individual members of a village enables the natural resource data reflected on the aerial photograph to be interpreted more accurately***

***Hypothesis Number 5 A positive relationship can be developed between GIS and PRA. A series of hypotheses developed by Robert Chambers can be incorporated into a small research project.***

- that PRA communities are representative of microzones
- that data generated by PRAs in the representative communities are used in GIS
- that the resulting GIS data sets are used for divisional planning
- that the GIS data sets make a difference to the plan
- That the difference to the plan makes a difference to implementation (real events on the ground)
- that the difference in real events on the ground are beneficial compared with what would have happened without GIS
- that benefits outweigh costs compared with alternatives ( Benefits here would include good plans implemented with participation, sustainability etc. and costs would include staff time, loss of participation, etc.)
- that benefit outweigh costs if and when the approach is replicated

**Assumptions**
The above hypotheses will be dependent upon the following assumptions

- Ghanaians can interpret aerial photography as easily as the Nepalese
- Aerial photographs may have to be enhanced to remove extraneous detracting data to enable ease of interpretation
- Aerial photographs enable village decision-makers to elicit the human activities which influence natural resource management. e.g. fetching water, collecting firewood, cutting fodder, ploughing, planting etc.
- A "social" "mental" map provides more information for development purposes than a "physical" map

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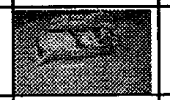
| and RRA data collection techniques | | BASIC PRODUCT PROFESSIONALLY PRODUCED | | | | |
|---|---|---|---|---|---|---|
| |  | Two dimensional symbolic representation produced with the aid of aerial photography | Represents one year old cassava | | | |
| |  | Add coordinates | Represents Mr Mensah's one year old cassava | | | |
| | | ADDING INDIGENEOUS LOCAL KNOWLEDGE | | | | |
| |  | Add social information | | How far is the field from home? (mobility patterns)<br>Which family members work on the land?<br>Does the land indicate wealth, status and prestige?<br>Is the user the owner, tenant or share cropper? | | |
| |  | Add crop husbandry information | | When was the land cleared?<br>When was the cassava planted?<br>What fertilisers, pesticides were used?<br>What was the yield | | |
| |  | Add economic information | | What were the costs of the inputs?<br>What were the returns from the outputs? | | |
| | | Area frame sampling of one year old cassava land | | | Up scaling data to district and regional levels | |
| | | Digitize the information collected | | | | Place in KUMINFO |

ıcreasing cost of
ıformation collection,
torage and retrieval

Adding value and complexity to the original product

*Who needs the enhanced product? Who has access to the enhanced product? Who will pay for the enhanced product?*

**Development of methods of Peri-Urban Natural Resource Information Collection, Storage, Access and Management.**

Context
What are the socio-economic impact of urbanisation on the microzones (village entities) in the peri-urban environs of Kumasi.

Background
Social indicators quoted by Horn have been described as :-

- *being needed to find pathways through the maze of society's interconnections*
- *tracing out the topography of the human landscape.*

Social indicators listed by OECD - included :- length of life; healthfulness of life; education and learning; employment; time/leisure; command over goods and services, income and wealth; physical environment, housing, services; social environment and personal safety.
The World Bank identified four main elements which should be the focus of a sociological appraisal of a project:-

- the sociocultural and demographic characteristics of local beneficiaries, including groups that may be adversely affected
- the social organisation of productive activities of the population in the project area
- the cultural acceptability of the project and its compatibility with the needs of the intended beneficiaries
- the social strategy for project implementation and operation needed to elicit and sustain beneficiaries participation.

Cochrane identified the following criteria for a national inventory of cultural resources which will aid in improving the management of projects:-

- identification of groups - seeking the identification and location of social groups
- social organisation - describing types of indigenous social organisation
- belief system - evaluating the significance of ideological consideration of natural resource management
- wealth forms - describing the types of wealth people try to accumulate, and their function
- patterns of mobility - seeking the establishment of patterns of movement for inhabitants
- access to basic human needs - creating and analytical description of the poorest together with an assessment of causes of extreme poverty.

The following analytical model has been developed mainly out of Cochrane's approach.
The model entails answering a number of questions in order to get a clearer understanding of how the participants perceive the issues raised. This qualitative data will help to clarify the quantitative physical data presented via GIS

**Social Analytical Model (SAM)**
**Questions to be answered to build up a picture of the socio-economic issues that are present in the microzones under discussion.**

**1. What effect has encroaching urbanisation had upon the cultural groups?**

What was the traditional ethnic, religious, political grouping?

What has changed?

In terms of access to and use of natural resources does any particular grouping have more power?

Are there social classes?

Have the class composition changed as a result of urban encroachment?

Are certain groups within the microzone more modern in approach as a result of urban encroachment?

**2. Is urban encroachment affecting inheritance and/or partibility (break up of family/group property)? (Assumption that natural resource use will be affected)**

Is the family the farming unit?

Are traditional lineage's or tribal structures strong?

What forms of work associations are common?

Is the organisation of and co-operation in production and distribution of goods and services based on kinship, religious affiliation, or membership of political parties

How have these systems changed as a result of the urban encroachment.

What happens at the markets?

How are goods produced?

How are proceeds of sales distributed?

How are capital assets created?

How are mosques. churches, clinics, schools etc. constructed?

**3 How does the belief systems that are operating influence the acquisition and use of natural resources?**

Is the belief system strong?

Is it based on Christianity, Islam, Animism?

What affect does it have upon :-

the relationship between the sexes regarding natural resource use?

the approach to modernisation (accepting / rejecting)

family size which may indicate modernisation (small) or traditional "insurance" policy (large)

What is the attitude towards health and food patterns?

Is disease the "intrusion of spirits"?

What foods and food preparation practices are taboo?

What criteria used for intrafamily food distribution?

Do portions increase with age and seniority or with size?

Is food given for goods or services?
How much food is given to other families, to traders, etc.?
When and why do they sell their production?

**4 What do the people value? What are the symbols of wealth? (understanding these factors will help to appreciate the motivation towards the use of natural resources)**

How is income distributed with respect to variables such as ethnicity, social class, education, aptitude, geographic location etc.?

Are their sets of religious, ethical or political rules that govern who should get what and why?

What things actually affect the well being of very poor people other than in the market place e.g. social or community solidarity, parent-child relationships, religious attitudes, performance of rituals interpreted as income.

What wealth forms are valued in the community? (food, drink, personal articles, household equipment, clothes, bicycle, transport, school fees, investment in house or farm, money)

What is the composition of the family income?
What are the reasons for income?

**5. What effect is urban encroachment having upon the patterns of mobility?**

What are the human movement intra-; into and out of the microzone?
Are they seasonal?
What is the purpose? (agricultural, market, household chores etc.)
What transport movements are there and for what purpose?
What is the flow of money and in particular credit?

**6 What effect does urban encroachment have upon the poorest?**

How is poverty defined?
Who are the poorest? Where are they? How many are there?
What access to basic human needs do they have now?
Has it changed as a result of urban encroachment?
Is access to natural resource a key factor?
Is the availability of income-earning opportunities an important consideration?
Is there access to food and shelter?
Are there sufficient education and health services?

**Application of the above analytical model in the context of the PUDSI project.**

In discussion with village participants certain critical issues will be identified which are as result of the urban encroachment.
The presentation of physical data (GIS etc.) will aid the decision makers address the issues.
The interpretation of the physical data presented will be modified in the light of information collected by SAM above.

An example would be that if the issue was water use. It would be necessary to identify whether water use was controlled by certain groupings within the village, religious, political or ethnic and has the traditional stable patterns of control broken down as a result of urban encroachment. (Question 1)
A second issue would be whether family water use is influenced by the family work systems (Question 2)
Any religious or food taboos on the collection and use of water would be identified by answers to question 3.
Access to and use of water may be identified as a form of wealth (not likely but possibly under the influences of modernisation) Question 4 would be used to tease out this issue.
Urban encroachment may have influenced the movements of people to collect and use the water (Question 5)
Question 6 will aid in helping to identify the distribution of this valuable resource and whether all parts of the community have access.

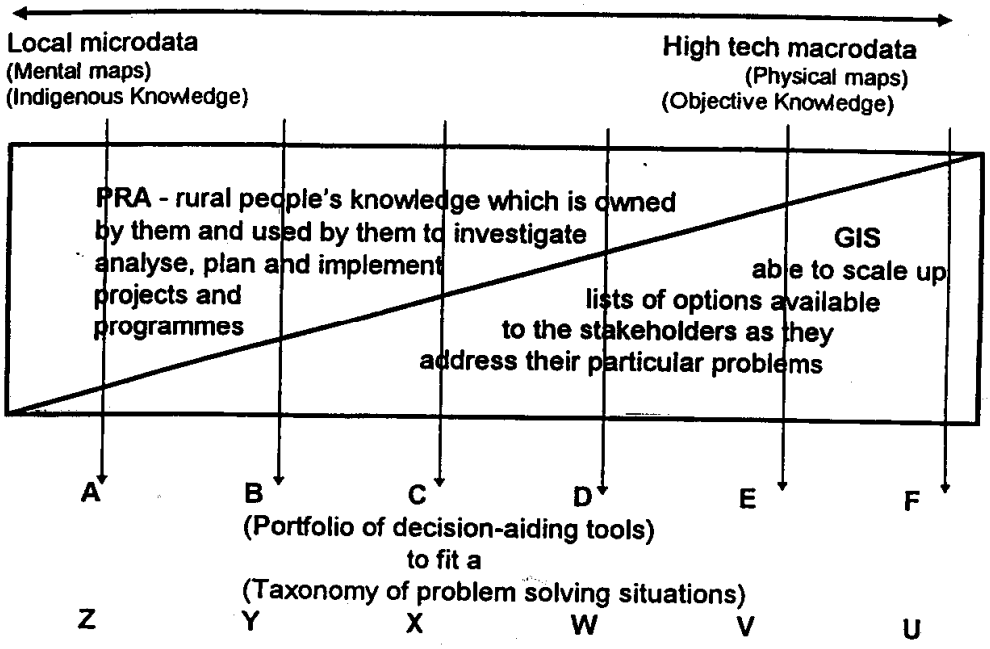
***Approach to using indigenous knowledge, remote sensing and GIS for sustainable development by Tabor and Hutchinson.***

**Indigenous knowledge and classification system** by the local knowledge managers
**Remote sensing and satellite navigation** by the specialists
**Geographic Information Systems** by the specialists

- Local resource managers possess a detailed understanding of resource values and management practices. A large part of this understanding is contained in the classification systems they use to describe resources
- Unlike objectives classification systems, indigenous systems embody local values and management systems as well as the relationship among other resources (e.g. soil/vegetation association). Moreover, because they are derived from local terminology, they provide a common language for exchanging information.
- There may be disparities between indigenous and objective classification systems. Yet because physical properties of the resource ultimately determine its potential uses, these divergences tend to be superficial from a classification perspective. Because of their inherent similarity, it is possible to move among systems - indigenous and objective drawing on the different knowledge contained in each.
- In addition, the differences in classification criteria provide insight into local values and management practices.
- Finally, development policy that unknowingly undermines or contradicts viable indigenous resource management strategies is unlikely to be sustainable.
- Aerial sampling, aerial photography, aerial video and a satellite images are tools for producing conventional objective resource survey maps.
- Because indigenous systems of resource classification are based on observable characteristics, remote sensing can play a useful role.
- The designation of the units to be mapped comes from the local resource manager rather than the remote sensing specialist.

**See attached diagram of the overview of the data collection process**

The output of the research will be the construction of a portfolio of decision-aiding tools prepared which can be used to respond to a particular situation that occurs as stakeholders address particular natural resource management problems




We have to identify which tool to use in which situation

The first step to do this is to test the hypotheses:-

***Hypothesis Number 1*** ***Aerial photography can be used to speed up the process, and increase the number, of transects which are carried out in an RRA or PRA exercise. This follows the "Yellow Pages" process (Let your fingers do the walking)***

***Hypothesis Number 2*** ***Aerial photography as a tool for village level natural resource planning is as effective in Ghana (Kumasi) as it is in Nepal*** (Replication of the work of Carson 1987)

Carson developed the process whereby human and land resource data can be presented on an aerial photograph thus integrating what would normally be unwieldy data. The process involved
Selecting a site
Providing the photographic base
Mapping the natural resource and local infrastructure
Identify the land tenure pattern

Present the dynamics of land management (How people interact with their environment)
Identify the village economy
Record the impact of cultural, religious and traditional values upon the land-use planning
Establish the village politics

***Hypothesis Number 3*** ***A laptop can be used to provide a vehicle for overlaying natural and socio-economic resource data onto a physical aerial photograph as an aid to participatory village resource planning.***

***Hypothesis Number 4*** ***"Social" or "Mental" maps developed by individual members of a village enables the natural resource data reflected on the aerial photograph to be interpreted more accurately***

***Hypothesis Number 5 A positive relationship can be developed between GIS and PRA.***
***A series of hypotheses developed by Robert Chambers can be incorporated into a small research project.***

- that PRA communities are representative of microzones
- that data generated by PRAs in the representative communities are used in GIS
- that the resulting GIS data sets are used for divisional planning
- that the GIS data sets make a difference to the plan
- That the difference to the plan makes a difference to implementation (real events on the ground)
- that the difference in real events on the ground are beneficial compared with what would have happened without GIS
- that benefits outweigh costs compared with alternatives ( Benefits here would include good plans implemented with participation, sustainability etc. and costs would include staff time, loss of participation, etc.)
- that benefit outweigh costs if and when the approach is replicated

**Assumptions**
The above hypotheses will be dependent upon the following assumptions

- Ghanaians can interpret aerial photography as easily as the Nepalese
- Aerial photographs may have to be enhanced to remove extraneous detracting data to enable ease of interpretation
- Aerial photographs enable village decision-makers to elicit the human activities which influence natural resource management. e.g. fetching water, collecting firewood, cutting fodder, ploughing, planting etc.
- A "social" "mental" map provides more information for development purposes than a "physical" map

## Overview of the data collection process