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Aerial photographs

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· Aerial photography and household studies in Kenya

Background

I have been working in Murang'a District in Kenya on problems of capital and labour utilization and their relationship to on-farm tree growing. Some of my research depends on the collection of land-use data for individual households. Aerial photography, coupled with ground truthing, seemed the best way to get this type of information. I also wanted to use photographs during household interviews as the focus of discussions about land-use practices and changes which have involved trees. I had been thinking that low-level aerial photography would have been ideal for providing high resolution images of smallholdings. Larger format approaches, particularly high altitude photography and satellite imagery, would have been ill-suited for household work because of their relatively poor resolution. They are best suited for identifying gross landform features and land-use characteristics.

I had originally planned to use what I had thought was an existing set of low-level aerial photographs of the study area which had been taken in 1985. Long after I had made a commitment to carry out research in Murang'a, it became clear that aerial photos would not be available. Even so, I thought I should at least try to get some photos taken of the study area. This note is intended to offer some guidance for others who might try to do the same thing. It was surprising how relatively inexpensive aerial photography could be (if the costs of early mistakes are excluded), although this may simply be a function of the Kenyan context, and may not be applicable elsewhere. with a little planning though, I would think that aerial photographs could be taken and incorporated into many Rapid Appraisal types of exercises at relatively low cost.

The study area, Murang'a District, covers a wide range of agroecological zones. The altitude ranges from around 600 metres in the east to over 3,000 metres in the west, and the topography is made up of an extensive ridge/valley system. Rivers generally run from west to east. Land-use practices are especially variable, depending on the agroecological zone and altitude. The population density is similarly widely variable: on average, it is around 250 people per km, but in some areas is as many as 1,000 per km.

Taking the photos

A primary concern was that the photographs could be used for identifying specific and complete smallholdings on the ground. It was also concluded that sampling within a narrower agroclimatic range would be more appropriate than broad sampling across the district. Using earlier survey work which had been carried out in the area for guidance, the transitional tea/dairy and coffee/tea zone was chosen as the area to be photographed. This zone roughly follows the 1800 metre contour.

Topographic maps at a scale of 1:50,000 were used for planning flight lines. The 1800 metre contour was first outlined on these maps and then 15 east/west transects were drawn across the contour, at 2 km north/south intervals. By limiting the transects to 5 km in length (instead of the earlier 15 km), the study area was logistically far more manageable.

A Nikon FG camera with a 50mm lens was clamp-mounted out the open window of a Cessna 152 and pointed vertically. The clamp

Source: RRA Notes (1989), Issue 7, pp.9–14, IIED London

was nothing special, and was picked up in a photo supply shop in the U.S. for around $30.00. One had to make sure, of course, that it was tightly fixed to the plane's window frame. I tied a safety cord to the whole apparatus to keep from losing it all together.

Flying at an altitude of 2,000 feet above ground level allowed a photographic ground coverage of about 12 ha per photograph. Flying at a speed of about 80 knots and taking exposures at 7 second intervals gave photographs at a scale of around 1:12,000 with around 30 percent overlap. Enough photographs could be taken with a roll of 36 exposures to easily cover the 5 km transect. In all, it took about 10 hours of flying time to get a satisfactory set of photos.

There were a number of drawbacks. I tried to fly at a constant altitude which, on average, was around 2,000 feet above the ground. Without a means of determining the changing altitude above ground level and because the landscape changed quite dramatically over short stretches, the scale of the photographs varied between 1:10,000 and 1:15,000. I will have eventually to calibrate the photos from ground measurements. If some sort of sample were to be set up, the varying scale would introduce problems of error: the photographic coverage was greatest where the air-to-ground altitude was the greatest, introducing a bias toward the lower agroclimatic zones.

Other drawbacks were a function of the need to fly particularly accurate transects. There are a few major landmarks in Murang'a District to ease this task, and flying and photographing for lengthy periods of time was extremely exhausting. Even using 1:50,000 topographic maps, the regularity of some features of the landscape (particularly Murang'a's endless series of ridges and valleys) made it very difficult to get proper bearings.

Once a full set of satisfactory slides had been taken, ground locations were plotted on 1:50,000 topographic maps. The fine detail of the maps, and the good resolution of the low level photography enabled the plotting of ground locations to within less than 100 metres. The number of each photograph was marked at its corresponding location in the map. Working copies of the original transparencies were prepared as colour print enlargements (5"x7") - a scale of about 1:2000.

Using the photos

To begin with, I have found the photos especially useful for thinking about different land-use processes, particularly those which would not be immediately evident from the ground. The spatial arrangement of the shamba becomes really clear from the air, and regular land-use patterns which are common amongst smallholdings stand out. For instance, most buildings are built close to the road. Arable crops are planted on the flattest land, while permanent crops are planted on more steeply sloping fields. Trees in woodlots are generally planted on the most steep sites. Particular trees are often left or planted in fields. Many smallholdings are demarcated with trees and hedges. Valley bottoms are riddled with small drainage canals, and these areas are intensively cultivated as well. Most of this I suppose seems to make a lot of intuitive sense, and that's where the photos are a tremendous help -in confirming what seems to make sense.

The photos also tend to reduce spatial biases which even the most intrepid field worker can encounter on the ground. There is a tendency, for instance, to walk along the contours and along the ridges where there are paths, rather than longitudinally from one ridge into a valley, across the river and to the next ridge. The photos enable one to identify specific features of land-use which are of interest, and then to find them on the ground. In this sense, the search through the photos for the extremes - the smallest holdings, the largest holdings, the most heavily tree-covered holdings, the most barren holdings, and so on - can be especially enlightening when one has a chance to interview farmers. By walking the photographed transect, one can prepare sketch maps of changing land-uses, and the agro-climatic features which have contributed to these changes. This process as well helps to identify holdings where land-uses do not seem to be intuitive (for instance, where someone has planted trees where you would expect them to plant coffee), and can help to identify how households respond to resource constraints.

Source: RRA Notes (1989), Issue 7, pp.9–14, IIED London

In household interviews, people seem quite comfortable with interpreting the photos. There is seldom a perceptual gap, and the thought of looking down on a shamba seems quite natural. People in the area are generally literate and in many cases have seen aerial photos before. During the land tenure reform programmes of the early 1960s, aerial photos were used to identify and register consolidated land holdings. During household interviews, I have been using transparent sheets held over the photos, to mark out and record the boundaries of the holding, and to make a note of specific land-use practices which are of interest. Interviewing has been essential to identify which boundaries belong to whom because, although they are often well-marked, even since the early 19605 there has been some fragmentation as a result of inheritance and sale, and it is seldom evident from the photos whose boundaries are whose.

In some respects, the taking of aerial photographs poses a number of contradictions for Rapid Appraisal practitioners. It was not exactly cheap. It took time to get a good set of photos. It is about as hands-off as one could 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.

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· Aerial photographs in Rapid Land Resource Appraisal, Papua New Guinea

Background

The Southern Highlands Rural Development Project (SHRDP) (1978-85) was a World Bank funded IRDP in Papua New Guinea with programme activities costed at over US$30 million. In one of its study areas, Upper Mendi, the first part of a formal, FAO-type land evaluation was carried out by SHRDP to identify land mapping units (LMUs) as a basis for agricultural and rural development planning in the area. The next stage, never carried through, would have been to use this physical inventory as the basis for classifying the LMUs according to their suitability for specific types of land use.

My objective was to evaluate this technical land resource inventory in terms of how farmers resident in the area used and valued their land resources: in short, to identify the social overlay on the physical resource base which governs who has access to what land. The fundamental unit of social organisation in the area is the clan. The study took 3 months in total (including archival work), based on 6 local clans. It occurred towards the end of the funding period of the SHRDP. In this brief summary I hope to show how aerial photographs were used alongside a range of both RRA and more conventional research methods.

RRA methods used

The following methods were all carried out in the field by a team of three:

- **walking clan boundaries** with clan elders, using aerial photos in the field for boundary mapping;
- **semi-structured interviewing** with groups of men and women, separately;
- **direct matrix ranking** of land resource preferences for particular types of land use (sweet potato cultivation, vegetable cultivation, pig foraging, collection of minor forest products e.g. karuka nuts), using both local names and LMUs (i.e. did the difference in the category used itself affect the ranking/criteria in any way?);
- **diagramming** of inter-clan linkages and land disputes;
- **story-telling and oral histories**; and,
- **local calendars.**

Complementarities between RRA and 'conventional' methods

There is an overlap between some of these techniques as 'RRA' and what are in effect more conventional anthropological approaches based on investigation of inter-clan linkages (taking anthropological literature based on local fieldwork as a point of departure) and oral history. Other methods included an agro-ecological survey using aerial photographs in a fairly conventional mapping procedure.

Source: RRA Notes (1989), Issue 7, pp.9–14, IIED London

Aerial photography

The aerial photos were a major asset as a tool for use in the field as well as for the more conventional mapping and analysis stages in the field office. The photographs had been flown by the Office of Forests in 1982, and were high quality B&W 10" x 10" prints at an approximate scale of 1:4000. Their two main field uses can be summarised as follows:

- **as aids for mapping clan boundaries**. Clan elders and others who took part in the extensive walks to map clan boundaries and indicate disputed land had little difficulty in using the hard copy B&W photographs themselves, orienting them as necessary in order to get their bearings, to point out features of interest. We used chinagraph pencils to draw directly onto the photos, double-checking with clan members as we went. Boundaries that separated continuous lands of neighbouring clans were walked twice, once each with groups from the two clans.

- **as a focus for discussion in interviews**. When carrying out direct matrix ranking of crop varieties, etc., RRA practitioners have found it best to use actual seeds in the ranking exercise. With land resources this is more difficult! Although we had a 'topographical advantage' in the rugged highlands of PNG, and ensured that all such interviews were conducted on ridge-tops overlooking the areas of land in question, we also needed something more immediate for both interviewees and interviewers to use as a reference in distinguishing between land types. The aerial photos again proved to be invaluable for this purpose, as they did in discussions about land disputes (see below).

Clan linkages and access to valued land resources

The formerly flexible practice of 'multilocal residence' in the area has been steadily tightening up with the provision of rural services and great incentives and government requirements for people to stay in one place. Thus gardens are cropped much less frequently in areas further afield than a few hours' walk than they would have been a decade or two ago. This means that clans are more constrained by the land resources they customarily own in the immediate locality.

For clans without sufficient land of particularly valued types, in relation to their existing endowments, the major form of access to the land they need is through their ability to exploit the linkages they may have with neighbouring clans. These linkages take different forms and are constantly changing. For those clans without sufficiently strong linkages with nearby clans, it is hypothesised, disputes over particular parcels of land are more likely to occur. This hypothesis was formed during the course of discussions with members of local clans, when the nature of the linkages was 'triangulated' by asking each clan about all the others.

The diagram below attempts to represent in stylised form the linkages between the clans (the bolder the line, the stronger the links) and the rate of incidence of land disputes between 1977 and 1985 (from the District Land Disputes Register and verified in group discussion in the field). In the broad view it does appear to show that the incidence of disputes *is* low between clans that are more strongly linked, and high between clans with relatively few links with neighbouring clans (e.g. Samarip clan). Thus the extent of land disputes may be used as a rough secondary indicator of problems in access to valued land resources at the clan level.

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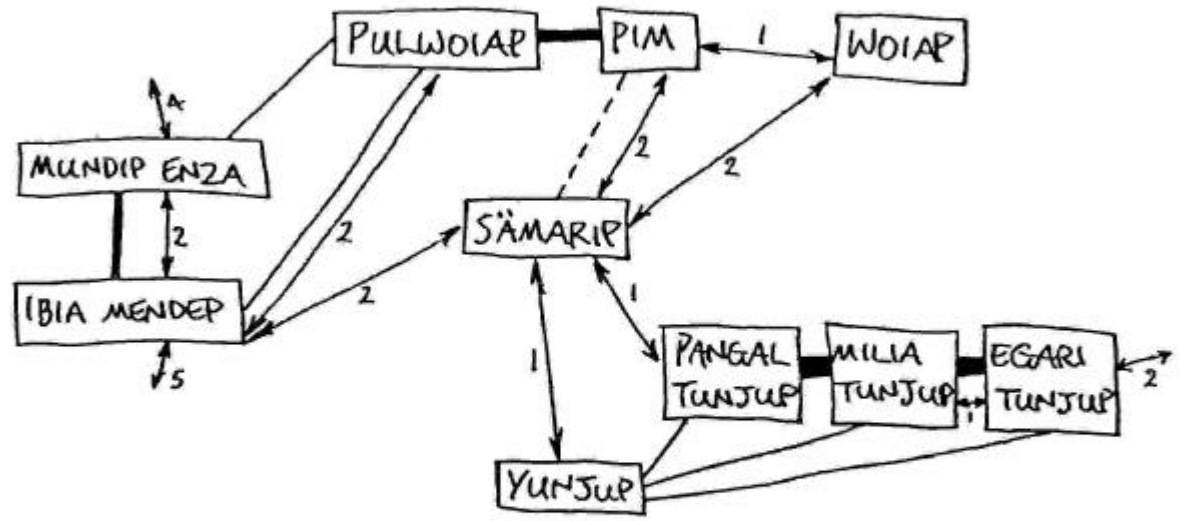
Source: RRA Notes (1989), Issue 7, pp.9–14, IIED London

INTER-CLAN LINKAGES & LAND DISPUTES
BETWEEN UPPER MENDI CLANS, PNG



KEY

INTER-CLAN LINKAGES (BOLDER LINE MEANS 'STRONGER' LINK)

LAND DISPUTES (NUMBER, 1977-85)

Source: RRA Notes (1989), Issue 7, pp.9–14, IIED London