LAND USE SURVEYS : WHAT IS INVOLVED ?

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INTRODUCTION

As stated in an earlier article on the Role of the Land Utilisation Section (HARVEST 6 (1): 23-26), most of the land use surveys carried out in Papua New Guinea are of the semi-detailed type. In this article, the work involved in this type of survey is described in order to show the time and cost involved. Provincial Planners and Rural Development Officers often ask for surveys of extremely large areas but make no arrangements for financing the work.

Briefly, a soil survey team consisting of a senior soil scientist and technical back-up staff will take approximately 1 month to survey 2,000 ha at a cost of between K2.50 and K4.50 per ha depending on distance travelled.

I. PRE-FIELD OPERATIONS

Four main tasks are involved in this stage of the work.

1) Study of existing data

This involves collecting as much existing background information as possible on such topics as the climate, geology, topography and vegetation of the area.

2) General field reconnaissance

A senior officer and the person who will lead the field survey team visit the area to plan the field work. At the same time, they collect as much information as possible on the land so that they can allow for extra time needed for steep hills, swamps or other difficulties.

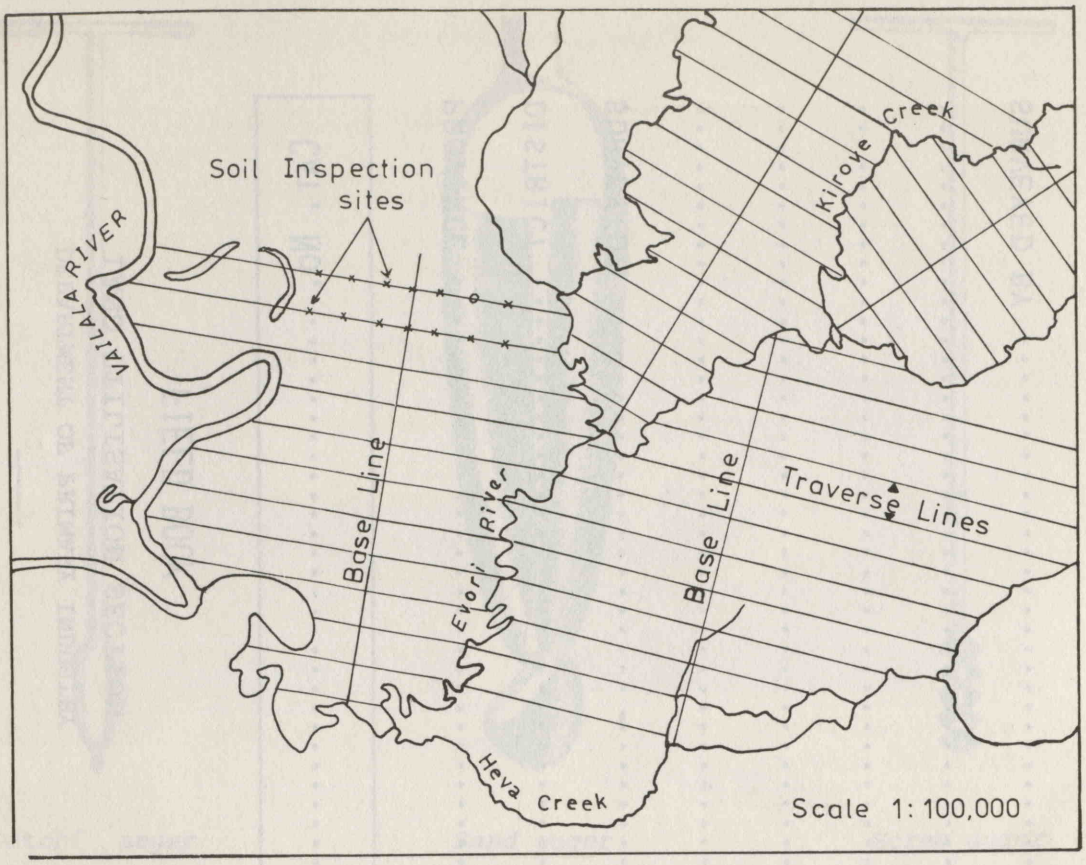
3) Acquisition and interpretation of aerial photography

Where suitable photographs are already available, this phase might be completed in about a month but when new photographs must be taken, delays of more than one year can be expected. Using the photographs, a working base map is drawn up with such features as hill masses, plains, swampy areas, etc. marked in.

4) Designing and planning the field survey

This includes deciding what order the various areas will be covered in and working out where to put some or all of the traverse lines. These are the lines along which the surveyors will work over the ground.

Typical aerial photograph interpretation



A grid system as used for semi - detailed soil surveys

II. FIELD SURVEY

1) Soil Mapping

This phase can be subdivided into 4 activities:-

(i) Traverse cutting. The traverse lines are cut (marked out with the aid of a compass to find their direction). Care must be taken that the lines can be found on the map. In this way a network of lines at regular intervals is established giving what is known as a grid system.

(ii) Chaining. The traverse lines are measured and markers are set up at regular intervals, usually 50 m, along these. Landscape features, such as slope, stoniness, pattern of drainage channels, etc. are noted, as is vegetation type, height and density.

(iii) Soil observation. A 'Dutch' auger is used to make soil descriptions at regular intervals along the traverse lines. Soil features, such as depth and thickness of different soil layers, and their colour, texture, etc. are recorded, a separate card being used at each observation site. Using this information, the soil surveyor is now able to identify the different soil types and to mark uniform areas on the map. These areas are called mapping units.

(iv) Representative profile description. A number of pits are dug within each soil type or mapping unit.

From the walls of these pits, the soil layers or horizons of soil are easily seen. Thorough descriptions are made of the soil at each pit including such features as horizon depth and thickness, colour, degree of

PAPUA NEW GUINEA

DEPARTMENT OF PRIMARY INDUSTRY

LAND UTILISATION SECTION

FIELD BOOK

CAT. No. .....

PROVINCE .....

DISTRICT .....

SURVEY OF .....

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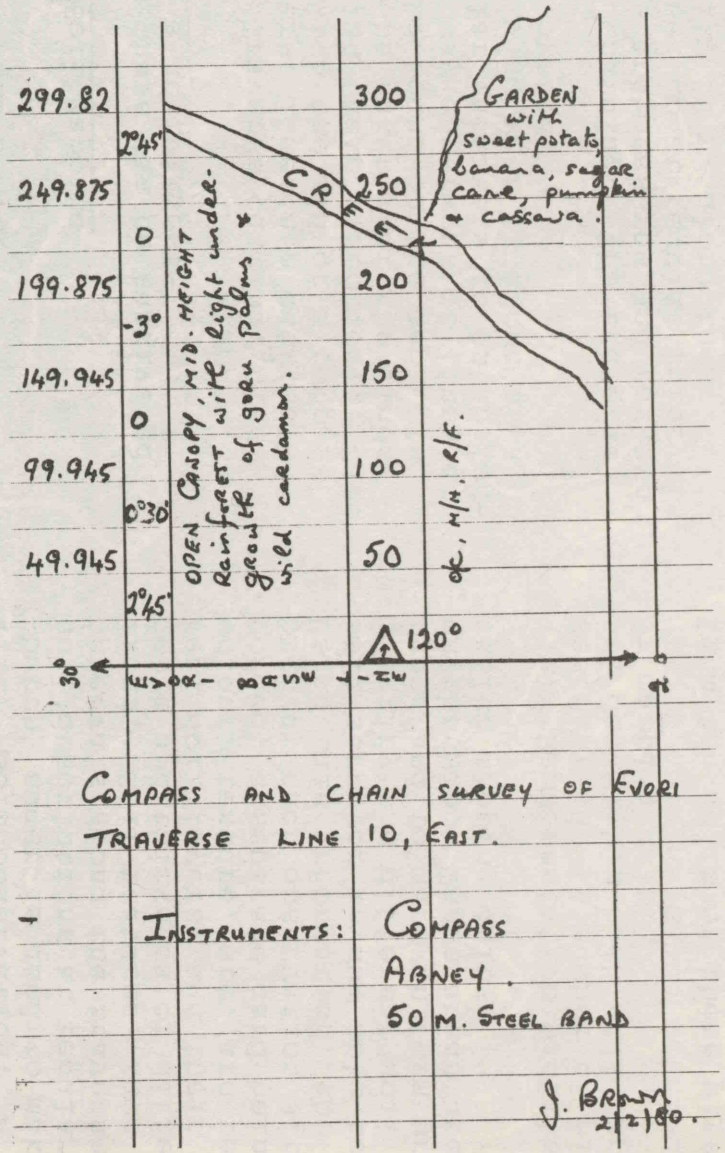
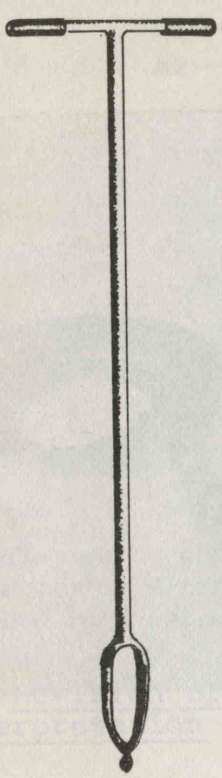
SURVEYED BY .....

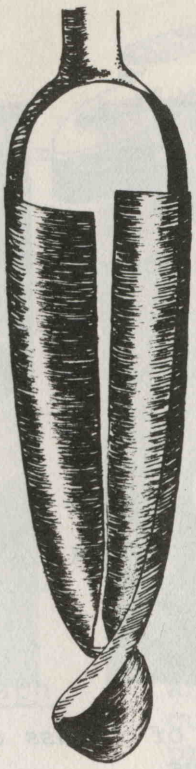
DATE OF COMPLETION .....



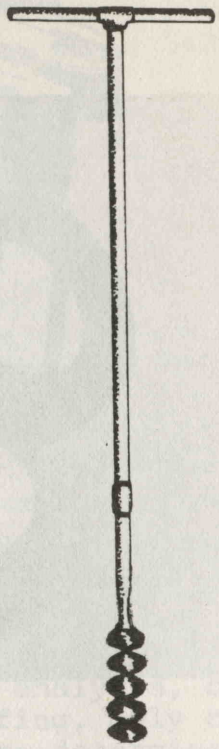
Front cover and first page of a Land Surveyor's field book



'Dutch' auger



Sand auger



Screw auger

mottling, texture, consistency, porosity, structure, degree and depth of rooting, extent of animal activity and any other items of interest. A soil sample is also collected from each horizon.

2) Crop Survey

Under ideal circumstances, a soil survey should provide planners and other users with estimates of the productive potential of each type of soil. Three levels of crop management are taken into account.

(i) Traditional farming. Information in this area is easiest to gather and simply involves recording what crops are grown in subsistence gardens and other village plantings, and either measuring or estimating yeild.

(ii) Improved Management. If there are any plantations in the area on similar soils, information on crop productivity under improved management is generally readily available. However, often there are no plantations nearby.

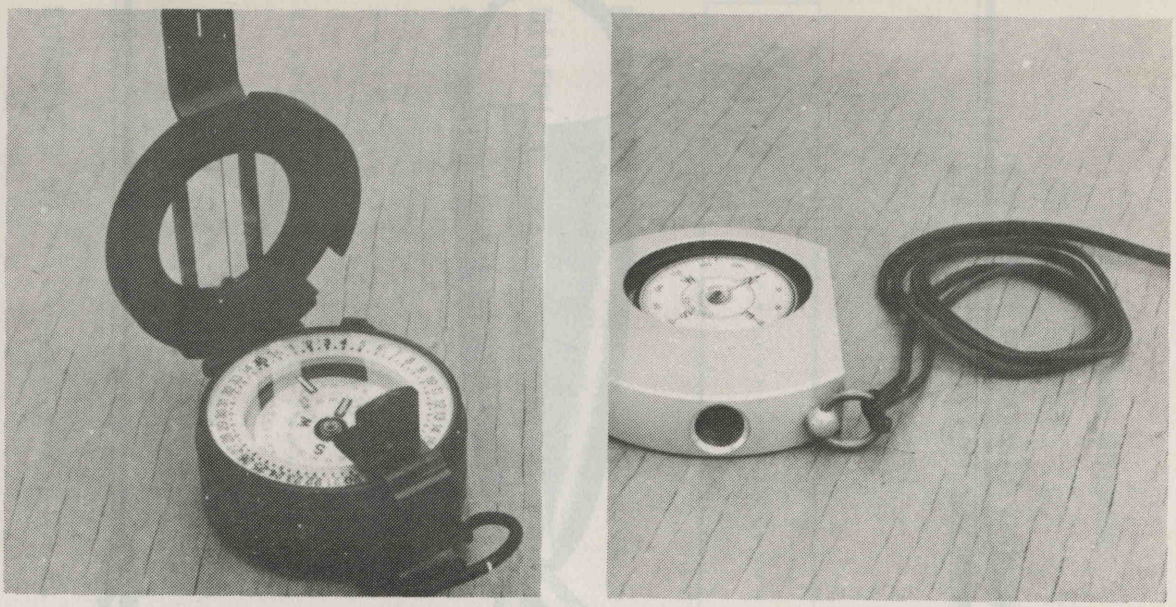
(iii) Advanced technology. Information on crop productivity under advanced technology as used on experiment stations is seldom available.

III. POST-FIELD OPERATIONS

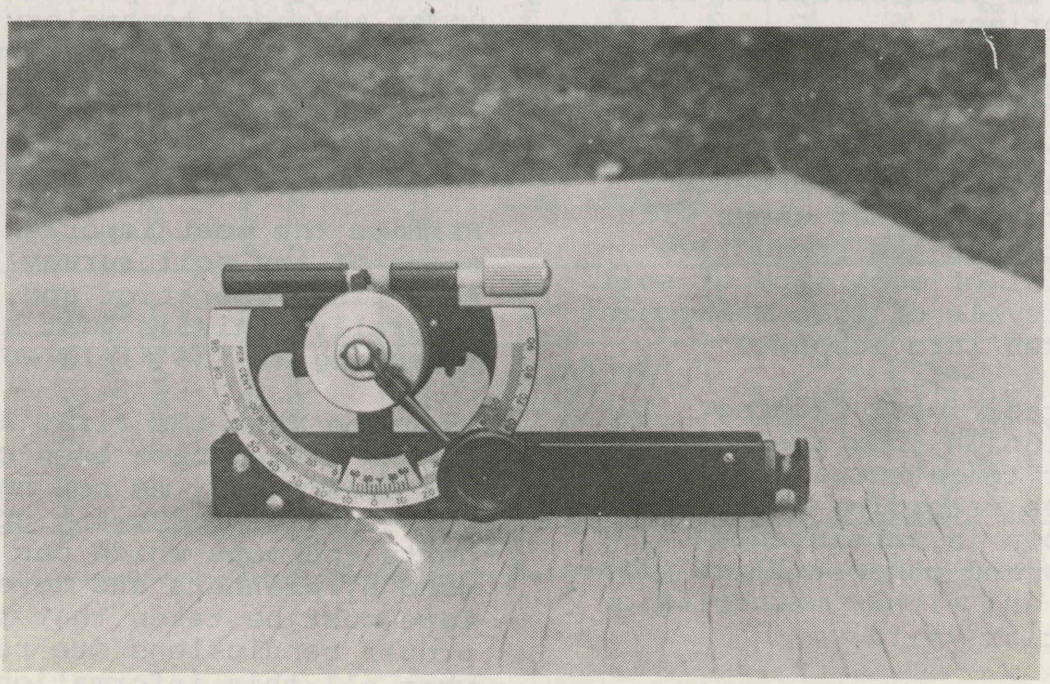
Perhaps the most important stage of any soil survey is this final operation and, generally, this is just as time consuming as the field work.

Assuming that the first and second stages have been carried out accurately, we now have the basic data for drawing up reports and maps which can be used by planners and developers. Care must be taken that the proper conclusions are reached when all this information is drawn together into the report.

Four main operations are involved in this part of the work.

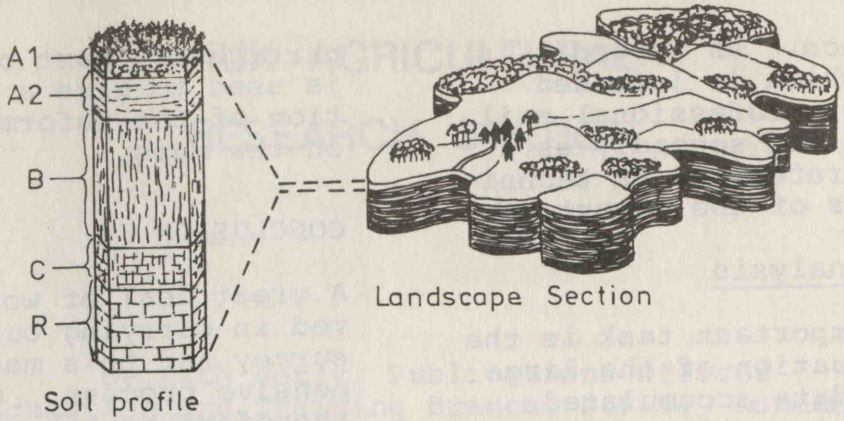


Two types of compass used in land use surveys.



Abney level, an instrument for measuring slope

Photographs by J.W.J. Wankowski



Soil forms the surface layer of the earth's crust.

The diagram on the left shows a soil profile - A1, A2 and B are soil horizons or layers of different types of soil; C is a layer of parent material and R is the bed rock below the soil.

1) Revision of Air Photograph Interpretation

At this stage, the mapping units set down before field work started are revised in the light of new information collected. Several of the original boundaries will survive, such as boundaries of hill areas and poorly drained valley floors, but some changes to others may be needed.

For example, one of the original mapping units may have been found to contain two or more soil types. In this case, the photographs will have to be re-examined to see if any differences in vegetation or other features are associated with soil types. If so, new boundaries are put in using these features as a guide. If not, the new boundaries are drawn using the points of field observation. The accuracy of the map will then depend largely on how close together the sites of field observations were.

2) Laboratory Analysis of Soil Samples

Idealy, these investigations should include both physical and chemical analysis, but with current staffing, only chemical properties are determined in the laboratory. This work is carried out by the Agricultural Chemistry Section and often the soil fertility section of the report is written by the soil chemist.

Routine analyses include measurements of pH, Specific Conductivity, total soluble salts, phosphorus, exchangeable bases (Ca^{++}, Mg^{++}, K^{+}, Na^{+}), cation exchange capacity, organic carbon, nitrogen and the presence or absence of free carbonates. These tests indicate the acidity or alkalinity of the soil, the levels of major nutrients and their availability to plants.

In certain cases, when extra data is required for classification purposes, further tests are done. These include those for free iron oxides and total manganese.

As far as possible, the main body of the report uses a minimum of technical terms since it is written for economists, planners and administrators who have no specialist knowledge of

soil science. An appendix is included which is intended firstly for professional soil scientists and secondly as a source of reference on technical aspects of the report.

3) Data Analysis

The most important task is the final evaluation of the large volume of data accumulated. While a variety of methods of doing this are available from F.A.O. and other organisations, we use the system of Haantjens (1969) which was developed specifically for Papua New Guinea. In this system a total of seventeen factors are used to assess the productivity of each soil or land type. Fourteen of these relate to the soil physical characteristics and three to soil chemical status.

This evaluation is combined with climatic and agronomic data to give an overall value for land use potential or capability.

4) Presentation

(i) Maps. These normally include a soil or soil landform map together with one or more evaluation maps, such as an overall land capability map or individual capability maps for different crop types (tree crops, arable crops, etc.).

The interpretation of the information on the soil map requires a qualified scientist or engineer. However, the land capability map can be used by most planners or project managers. At a production scale of 1:50,000 these maps are a useful tool in project planning.

(ii) Report. The set of maps and the report are both essential parts of the presentation and are used together. In particular, part of the report is used to give a full explanation of the information shown on the maps.

CONCLUSION

A great deal of work is involved in carrying out a soil survey and this makes it an expensive process. Care must therefore be taken in deciding which areas should be surveyed and in making sure that sufficient funding is available.

It is also very important to make sure that the data obtained from a survey are used properly when projects are planned for an area. Project planning teams should therefore have a wide range of expertise and as much knowledge of the area itself as possible. One way to achieve this is to include in the team the soil scientist who carried out the survey.