The Netherlands and Technical Assistance

On March 23 and 24, 1953, the traditional "Tropical Agriculture Session", organized by the Netherlands Society for Agricultural Science was held at Wageningen. This time, the lectures were devoted to the topic "The Netherlands and Technical Assistance to underdeveloped Countries".

A number of Dutch experts who during the past few years were sent to various countries which had been asking for technical assistance in the agricultural field, were invited to give their ideas on the work and the situations they met with in those countries. As the viewpoints and the conclusions of these experts may be of some interest to our readers abroad we planned to publish in this and in the next number of our journal some of the papers either in full or in abstract.

The Editors.

THE ROLE OF AERIAL PHOTOGRAPHY WHEN DRAFTING SCHEMES FOR UNDERDEVELOPED COUNTRIES [1])

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For the development of certain areas a large number of data must first of all be available regarding for instance the climate, the soil conditions, the water supply, the topography, the vegetation and the land use. Then investigations as to the development possibilities and their realization must be carried out, after which certain projects can be started. The difficulty, however, is how to collect in a short time the greatest possible volume of data on which to base the plans and the execution of various projects. Unfortunately it still happens but too often that plans for future land use are made and carried out without sufficient basic data being available. The results usually are disappointments and the loss of millions of guilders.

The role which aerial photography plays at present in the development of certain territories is that of providing many – though not all – data of primary importance. These data may become available at short notice, have often a great degree of accuracy and greatly simplify and accelerate the field work. Thus results are obtained more cheaply than if no aerial photographs were available. These advantages are so great that it would be irresponsible not to use aerial photographs.

We shall here discuss briefly the most important applications of aerial photography. During recent years the application of aerial photographs in many spheres has made great progress. For various purposes special techniques have been developed which have greatly increased these possibilities. For instance, the production of maps from aerial photographs requires so much knowledge and experience that only experts trained in this technique can achieve accept-

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able results. Many other possibilities of application have been and still are being developed by means of investigations carried out by various branches of science using aerial photography as an expedient for collecting information.

These experts have usually had a short training of a few months in the operation of some instruments and the application of some special interpretation methods. Usually persons who start to work with aerial photography easily overestimate its possibilities. It should be borne in mind that the use of aerial photographs is also subject to limitations.

Aerial photographs are in the first place used for the production of cadastral, topographic and military maps. In photogrammetry many problems arise. These are mainly due to the fact that the aerial photograph shows all kinds of distortions, for instance as a consequence of its projection, small deviations of the aeroplane and of the camera. With the aid of complicated and expensive apparatus, however, it is possible to produce very accurate maps. From a good photograph on a scale of 1 : 20.000 it is possible to draw maps which are still accurate on a scale of 1 : 2.000. Contour lines can also be measured on the aerial photograph and transferred to the map. Usually these are contour lines with an interval of a few metres. From aerial photographs on a scale of maximum 1 : 6500 contour lines with an interval of 0.5 m can be drawn. We have given some examples in order to demonstrate on the one hand the great possibilities, but also to show the limitations imposed by this kind of photograph. As the cost of a detailed aerial survey is many times greater than of small-scale photography it is advisable always to determine what kind of photographs are desired. Mostly photographs on a scale of 1 : 15.000 to 1 : 40.000 are made. For certain technical projects, such as irrigation or drainage projects, more detailed maps, for instance on a scale of 1 : 5.000 or 10.000 are needed; these can also be produced photogrammetrically. When planning a development scheme, first maps are required on a small scale, giving a survey of the whole area, whereas at a later stage various detail maps will become necessary.

The degree of accuracy obtainable in photogrammetry is very high; the maps can become available at fairly short notice and the cost is very much lower than of maps produced in the old-fashioned way by measurement in the field.

The photogrammetric maps discussed above are needed when planning and executing schemes, while other data such as land use, vegetation and soil conditions can also be indicated on them.

The aerial photo gives a picture of the earth's surface and its forms, of the vegetation, the rivers, lakes, swamps, roads, etc. Aerial photos are also of great assistance for any work in connection with the physical conditions of the earth's surface.

The forester uses aerial photographs to deduce from them the type and density of the vegetation, the height and crown diameter of the trees. A classification of this may be indicated on photos or on a map and the wood volume may be roughly computed. Its usefulness for forest inventarization, forest exploration and forest conservation is quite evident. Work with aerial photographs must be combined with field work which consists mainly of a precise control of a number of sample areas. No less important is the fact that on aerial photographs the most favourable route of a forest tour may be exactly indicated which, especially in tropical forests, is of the utmost significance.

When producing land use maps a similar method is applied. General land use maps with only broad use groups (for instance arable land, grass land, forest, uncultivated land, etc.) as well as detailed maps with various vegetation types or groups of vegetation types can be compiled. In the latter case aerial photos must be of a much higher quality.

Another map with important basic data is the soil map. The soil expert can deduce from aerial photographs many data which are important for the compilation of a soil map, for instance geomorphological data, topography, hydrology and the parent material. As the soil is usually covered with vegetation, all kinds of data of the aerial photo will serve the soil expert to arrive at conclusions about the soil conditions. Furthermore, he will be able to indicate directly on the aerial photograph a large number of soil boundaries. By combining soil mapping in the field – supplemented by soil sample research in the laboratory – with aerial photo-interpretation, the work is greatly simplified, the duration of the survey much shortened and the result will be much better and more exact than without the use of aerial photographs. So far the aerial photograph in soil survey is merely used as a basic map according to which the field work can be carried out. The real pedological interpretation is still in its infancy. According to our viewpoint most possibilities in pedology are to be found in the establishment of the first schematic soil maps on a small scale (1 : 100.000 and smaller) and in the following stage of survey, for instance maps on a scale of 1 : 50.000. For the more detailed soil maps field work is more important than interpretation.

Irrigation and drainage plans require different data, part of which may also be found in the aerial photograph. We would mention relief, watershed, position and run of rivers and brooks, occurrence of sources etc. If the aforementioned data of vegetation, land use and soil conditions are also utilized, one disposes already of a considerable basis for the projection of various hydrological works like dams, artificial lakes, canals, etc.

The problems of salinity and soil erosion cannot be studied without disposing of a concise account regarding the occurrence, the importance and distribution of these phenomena. Here again the aerial photograph represents an important expedient for the furnishing of the necessary information.

When setting up development schemes, geological data may be of great importance. In stratigraphy, petrology, sedimentology and mineralogy aerial photographs are used. The results obtained from the geological interpretation are not only important for prospecting for oil and ores; they are also useful when solving other problems, for instance in soil science, soil conservation and irrigation.

In order to obtain statistical data, aerial photographs have repeatedly been used. Land use has already been mentioned. Aerial photographs, made at the right time and on the proper scale, offer the possibility to determine the acreage of certain crops after which estimates of the fields may be made. In Java, for instance, this was done after the war with rice. Rough inventarizations of cattle were also carried out, while for totally unknown territories a census has also sometimes been taken by means of aerial photography. When determining the damage done by insect plagues, forest fires or inundations, aerial photographs may be very useful.

We hope that this short and certainly not complete exposition will suffice

to demonstrate the role which the aerial photograph can play in the development of new territories.

Summarizing we may state that in the first place the aerial photograph provides us with all kinds of maps which as such are already very important; furthermore they can be used for indicating all kinds of information. Besides all this the contents of the aerial photograph may be studied, analysed and interpreted for very different purposes. This will eventually lead to various forms of land classification. The land is divided into a number of classes according to various purposes and the distribution of the land units is indicated on maps. The final purpose is to set up a development scheme in which the most economic land use is projected; this will only be possible if sufficient data is available. The simplest form of land classification is obtained if aerial photographs are used to find out whether a certain kind of vegetation or soil or a certain geological phenomenon occurs in the photographed area. The result is of considerable importance because then the investigation may be restricted to this area only.

It is obvious that the setting up of an economic land use plan consists of various phases. In each phase one must have certain kind of data at one's disposal. At first these are mostly of a general character and refer to a large area. In later phases those parts of the area which offer most possibilities are of more importance. This requires more detailed information.

When considering the use of aerial photographs in the consecutive phases of such a land use plan, it appears that especially in the beginning much work can be done with data emanating from the aerial photograph. This must be followed by some field work as a check. The more details are required in later phases for certain parts of the area, the more important field work becomes. Nevertheless the aerial photograph remains interesting, as it still contains many details and because it has to serve as a basic map for the indication of boundaries of land classes etc.

One important particular viz. the climate, is not to be found on the aerial photograph. It is impossible to prepare a development scheme without climatological data which must cover at least a score of years. However, for many projects these climatological data are completely missing. Yet nobody wants to wait 20 years or so in order to be able to collect these data first. As, however, the vegetation is determined by natural climate and soil conditions, it may conversely also be possible to deduce from these data the climatological conditions, though the result always remains doubtful. Large and therefore important climatological deviations can, however, always be analyzed; in a large area regions with different climatological conditions can always be indicated by means of photo interpretation. In any case the result is of a certain value, especially if nothing at all is known. The result also opens the possibility to project the meteorological stations to be erected in the territory in such a way that a maximum result can be expected.

It should not be supposed that the aerial photograph can fulfil every expectation. Much depends for instance on the quality and the scale of the photographs and on the ability of the person who has to work with them. There are many possibilities but also many limitations. Knowledge of the latter is more important than of the first.

In photogrammetry the results greatly surpass the maps obtained in the old way. The same applies to the extraction of those data which are clearly

indicated on the photograph. As soon as the field of the actual photo-interpretation is concerned, where from all photographed objects other data not directly indicated on the aerial photograph are deduced, this photograph becomes only an expedient, though quite an important one. The result obtained here also depends on the field work which may be executed as a check or an amplification.

When viewing the possibilities of application, there are many. Aerial photographs may be considered as a collection of many maps from which investigators of many a branch of science may each for himself produce a map containing the data which are of importance to him.

It still happens very often that aerial photographs are not fully exploited. This is due to the fact that the users have not sufficient knowledge of how to work with aerial photographs and of what can be achieved with them. At some universities in the U.S. and Canada it is now possible to qualify in photo-interpretation. Since 1951 there exists in Delft an International Training Centre for Aerial Survey of which Prof. Dr W. SCHERMERHORN is the Dean. The purpose of this institute is to give to experts in certain branches of science and from various countries a complementary training in photogrammetry and photo-interpretation. It is established by the Technical University of Delft and the Agricultural University of Wageningen; it closely collaborates with the FAO of the UN.

The extensiveness of photo-interpretation not only depends on the ability of the user, but also on the scale and the quality of the photos. With this is closely connected the method and time of photography as well as the quality of the instruments used. It is very important that experts establish precisely how, when and with what type of airplane, film-material and camera the photography should be carried out. Various countries have already found to their detriment that also in this field a bad bargain is dear at a farthing.

In every country where aerial photographs will be used as an aid for the planning and execution of schemes for underdeveloped countries, three groups of problems arise, viz.:

1 the determination of the requirements to which the aerial photographs must conform in such a way that the photos to be made can serve for as many purposes as possible;
2 the establishment of a few organizations which must carry out the cartographic elaboration and the interpretation of aerial photographs for various purposes;
3 the setting up of some instruction program in order to train the experts of different branches of science in photo interpretation.

The Training Centre in Delft lends its assistance especially for these problems.

It will be clear from the above that aerial photography has created many new possibilities. The use of aerial photographs in various fields is already in an advanced phase but in other spheres it is still in its infancy. However, it is obvious that in future the role of aerial photography will grow more important; this not only applies to the development of new territories, but also to the further development of older countries.