Need for a Soil Survey of India.

A DISCUSSION on the need for A Soil Survey of India was held during the Indian Science Congress Week at Hyderabad (Jan. 1937), Rao Bahadur B. Viswa Nath presiding.

In introducing the subject the President stated that the answer to such a general proposition as " the need for a Soil Survey ", would undoubtedly be in the affirmative : but the point for consideration was about the type of Survey. In arriving at an answer to this question, it would be necessary (1) to consider the objects of a soil survey, (2) to ascertain what had already been done in India and what was being done and (3) to define what was wanted. A soil survey could be carried out for one or more of many purposes. For example, it could be carried out for settling new land. It could be carried out for ascertaining the physical and chemical characteristics of the soil with reference to manurial treatment, and irrigation projects. In regard to the first point there were about 150 million acres of cultivable waste land. All this land was, however, not situated in one compact block but was scattered in small patches all over India. It was necessary, therefore, in the first instance to ascertain the nature and the disposition of the waste land and this would perhaps form a subject of enquiry by the Departments in the Provinces. During the past quarter of a century soil surveys were in progress in the different parts of the country to ascertain the manurial and fertiliser requirements of the soils. As a result, a considerable amount of valuable data were obtained and these were being used in advising on manurial programmes and fertility projects. In recent years, enquiries had been commenced in connection with irrigation and drainage problems with a view to ascertain the most suitable alignment for irrigation and drainage channels. There remained, therefore, the survey for the classification of soils so that the information obtained would be useful in interpreting the response to manurial treatments and for research and advisory work. They had, therefore, to consider carefully what methods of survey were needed for this purpose.

In England the basis of classification in the early days was geological, the assumption being that each geologisal variation gave rise to its own type of soil. Subsequently this was not found to answer the purpose, as the effect of climate, altitude, topography and other factors was considerable, so that soils formed from the same geological parent material varied considerably. Then there was the Russian and American methods of classification which were chiefly based on the study of the soil profile.

The soils of India could be very broadly classified into the Indo-Gangetic alluvium covering about 300,000 sq. miles : the tract of black soils covering a total area of about 200,000 sq. miles, and a red soil tract including laterite soils of 150,000 sq. miles. The black soils, although derived from different basic materials, possessed common agricultural characteristics and a silica alumina ratio between 3 and 4. The large tract of Indo-Gangetic alluvium was almost alluvial in nature. The soil profile in this case did not appear to be so important as it was elsewhere, but surely it should be possible to differentiate profiles even in this huge block of alluvium with reference to the relative intensities of rainfall, evaporation and temperature. The ratio of rainfall to temperature for the different parts of India varied from 0·10 to 1·5. A broad classification of areas might be made into

North-east India,
North-west India,
North Central Alluvial India, and
Peninsular India,

which again could be subdivided on the ratio basis and classified with respect to texture and composition.

He would be glad if speakers would kindly bear in mind these points and confine their remarks to the methods of survey that might be considered necessary on an All-India basis.

Messrs. Wadia and Roy spoke emphasising the geological aspect of soil survey. Dr. Puri discussed the means of approach to the problem and the methods to be employed and suggested that a committee of people engaged in soil survey should draw up an agreed programme of work and co-ordinate results. Mr. Wad said that valuable data are available from Settlement Surveys and that they should be examined and utilised. He gave data collected by him in Central India. Rao Saheb Bal spoke with reference to the soils of the Central Provinces and Dr. Kasinath on the soils of the Madras Presidency.

In the course of his address SIR JOHN RUSSELL said that he would confine himself to indicating various directions in which local surveys can profitably be made.

In regard to the cultivable wastes of 150 million acres mentioned by Mr. Viswa Nath, one cannot help feeling that there is a good deal of it that could even in present conditions be brought into cultivation, and one advantage of a survey will undoubtedly be that it will enable us to ascertain which are the most promising areas for reclamation.

In regard to manurial experiments a good deal of information had already been obtained and this will be extended now that modern methods are so widely being used. A soil survey in relation to the area served by the experimental station affords an effective method of showing how far the experimental results are likely to be applicable in practice.

Further, there is the problem of Irrigation. I attach great importance to making a proper survey of any region that it is proposed to irrigate. Trouble from water-logging is likely to follow irrigation unless the scheme has been planned as guided by a previous soil survey. I could give instances from different parts of the world which I have visited where the scheme considered from the engineering point of view has been admirable, but from the soil point of view it was bad.

Coming now to the important problem of classification, several methods have been used. The earliest was textural. Then came the geological

basis: then climatic, then the profile basis. All are useful, but objection can be taken to all of them. Geological data, however, are invaluable for providing information in respect to water-supply, where it is essential to know the nature and position of the various strata, their permeability and their relation to the ultimate supplies of water. Studies of this kind would be useful in famine areas.

Other problems of soil survey arise in connection with forestry. Forest conservation is an effective way of reducing or even preventing soil erosion.

Problems connected with laterite soil and black cotton soils offer exceptional scope for study in India.

One of the modern methods of soil survey is to have it on the soil profile. Unfortunately, most of the Indian soils I have seen have no very marked profile such as can be seen in other parts of the world. A good deal of soil work is being done in India and it would undoubtedly be a great advantage to put all local surveys on to a uniform basis so that the results can be collated and brought together. It is not necessary to adopt any one basis of classification. Soil investigators are by no means agreed on the matter, and numerous systems have been proposed. The important point at the present time is that the soils should be fully described and that the same methods of description should be used by all Indian workers. Dr. Puri's suggestion is sound that the Indian soil workers should constitute a committee to draw up an agreed basis for describing the soils and should indicate the methods of examination to be adopted. It would further be necessary to arrange for some central body or for some institution to collate the results and prepare the maps and so to put data on record that will be useful to all concerned with soil management and with agriculture.

Mr. Champion read a note prepared by Dr. Gorre with reference to plant cover and said that before deforesting soils for agricultural purposes, sufficient consideration should be paid to the soils, protective and water storage aspects of the natural plant cover.

Practically all sloping grounds in the drier parts of India are of some importance as a source of water to the plains dwellers either for irrigation, town water or electric power, and its efficiency in catching and storing water depends very largely on how for the natural soil profile has been maintained and developed by preserving the natural plant cover.

I submit that any form of soil survey which may be taken up should cater for this method of land use. The survey should register the relative efficiency of the existing plant cover in maintaining the optimum soil profile, and it should also indicate whatever changes are taking place in the building up or degradation of the existing profile. The view-point which regards soils *in situ* as entirely static and permanent will fail to give a record of permanent value because in many areas the soil profile is being rapidly destroyed through bad agricultural and pastoral practices. The soil survey must take cognisance of this fact and one member of each mapping party should be sufficiently erosion-conscious to be able to record obvious tendencies of this nature. The cumulative denudation which is taking place in many parts of the western provinces is leading inevitably to desiccation. By this I do not infer that the total rainfall is being appreciably reduced, but that the ground is being rendered less capable of absorbing the available rainfall.

Blood Substitutes.

THE blood of Vertebrates remains one of the most baffling of animal fluids. While its constitution is fairly definitely known, it has as yet been impossible to simulate it or provide an efficient substitute for it. And seeing that almost every day the need for an adequate substitute for blood is felt by the doctor, by the physiologist and by the biologist, it appears that our efforts to provide them with a successful blood substitute need to be intensisfied.

The literature on the subject is vast and extensive. With a view to find a working substitute for blood because of its great importance in clinical practice, biologists, chemists and medical men have been trying for a long time to systhesise a substance which may take the place of this fluid in the Vertebrate body. History goes back to the middle of the last century when the first attempts were made to replace the blood of frogs by salt solution. Since then the accumalation of literature has become very extensive; W. R. Amberson[1] has recently provided an illuminating review on the subject.

The first and foremost point of importance to be remembered in the study is that there has to this day been no complete substitute for bloods. In all the substitutes so far known some constituent of normal blood must be present. Nor is it possible to imagine,—let alone make,—a substitute for hæmoglobin. All our efforts must therefore rest in an attempt to make but the vehicle in which must be present hæmoglobin, either in a state of suspension or in the form of red cells.

A variety of conditions are to be fulfilled if a substitute for blood can be practicable, the most important of which are the ability to maintain an adequate pressure and volume and a tendency of the materials constituting the fluid not to leave the blood stream. These two are indeed the prime difficulties in the making of any fluid substitute for blood, for in many of them, either the required volume and pressure are not maintained or else, the materials of the fluid tend to leave the blood stream quickly,—very often in the course of a few hours.

Red cells are not a necessary constituent of blood but hæmoglobin in solution must be present; then, blood will be performing the dual function of maintaining the osmotic pressure and carrying oxygen,—a duality not found in any vertebrate,

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[1] *Biol. Rev.*, January 1937, **12**, No. 1. 48.