We feel sure that agreement will soon be reached in these matters, as there are no serious difficulties in meeting the requirements of both sides in the controversy. The forester of to-day has been trained to realize the amenity and biological aspects of the handling of forests equally with the timber-getting and economic aspects. The New Zealand Forest Service is fully competent to apply the agreed policy to this important forest and is the obvious authority to do so: its research staff is expanding, and though the problems presented by this exceptionally interesting tree are perhaps complex, they should be quite capable of solution in a few years. Meanwhile, it is as well that keen interest should be taken in the preservation for future generations of one of the most remarkable trees of the world. H. G. CHAMPION

ELECTRICAL PROPERTIES OF SOIL AND WATER AT CENTIMETRE WAVE-LENGTHS

THE electrical properties of the materials forming the earth's surface have always been of interest to the radio physicist and communication engineer, since the propagation of long and medium waves is markedly dependent upon the absorbing effect of the ground. At shorter wave-lengths, for which the radiation can be transmitted more freely through the lower or upper atmosphere, the reflexion coefficient of the earth's surface plays an important part in the propagation of the waves. More recently, the varying reflexion coefficient due to the different electrical properties of the different portions of the earth's surface has been used with conspicuous success in a radar method of navigation.

At moderate radio frequencies, the appropriate properties of soil and water can be determined by placing samples of the material in question in a condenser of suitable size and shape; and the results of many measurements made in this way at frequencies up to 100 Mc/s. have been described by R. L. Smith-Rose[1]. A laboratory method of measuring the electrical properties of salt-water solutions has also been used by R. Cooper[2] at frequencies up to more than 4,000 Mc./s., corresponding to wave-lengths down to 7 cm. Alternatively, the reflexion coefficient of the surface of the ground can be measured directly, for example, by the standing-wave method developed by J. S. McPetrie[3], who with J. A. Saxton[4] has used this technique at various frequencies up to about 600 Mc./s. (wave-length 50 cm.). At the still higher frequencies of 3,300 Mc./s., corresponding to a wave-length of 9 cm., L. H. Ford and R. Oliver[5] have investigated the direct reflexion of radio waves from a wide range of surfaces including bare ground, both level and in ridges, ground covered with vegetation, fresh water and salt water approximating in composition to sea water. More recently, this free radiation technique has been extended by J. A. Saxton and J. A. Lane[6] to the experimental determination of the dielectric properties of water for wave-lengths of 1·24 and 1·58 cm.

With the growth and development of radar techniques in recent years, the above-mentioned British work has been supplemented by the work of other investigators, notably in the United States, some of whom have paid particular attention to the measurement of the reflexion coefficient of sea water at the small grazing angles met with in radar practice.

A report, which has recently been submitted to *Nature*, describes measurements of the dielectric properties of soils and water at a wave-length of 3·2 cm. (frequency 9,400 Mc./s.) carried out at the University of Texas as part of the programme of the United States Office of Naval Research. The report is by Prof. A. W. Straiton and C. W. Tolbert, and is of interest in so far as particular attention was devoted to the measurement of the properties of the dry, sandy soil found in Arizona where the Navy Electronics Laboratory had a site for special radio experiments. The measurements were made by placing samples of the material in a wave-guide or other suitable circuit arrangement, and measuring the phase-difference and attenuation caused by transmission through different thicknesses of the material. From such observations the dielectric constant and conductivity of the dry Arizona soil were found to be 3·2 and 10^9 E.S.U. respectively. (A conductivity of 10^{10} E.S.U. corresponds to 1·1 Mhos/metre.) Similar measurements made on dry sandy loam taken from near the University Laboratory in Texas gave values for the dielectric constant of 2·8 and $0{\cdot}7 \times 10^8$ E.S.U. for the conductivity. The authors of the report point out that the Arizona soil shows a conductivity of about three times as high as that obtained by Ford and Oliver[5] for very dry sandy loam in Great Britain, while the value for the Texas soil is much smaller. It is suggested that the considerable iron content of the Arizona soil may account for the higher conductivity in this case. This is scarcely consistent, however, with the results of further measurements made by the authors on samples of the Arizona soil sifted through screens of various sizes of mesh. The samples of smallest size of particle contained no free iron, but showed the highest conductivity. Furthermore, measurements made on the sample of medium-size particles varied from 6×10^8 E.S.U. when loosely packed into the container to more than 10×10^8 E.S.U. when very tightly packed. As was the case for measurements made by earlier investigators, the conductivity of the soils from both Arizona and Texas was found to increase several times when the samples were moistened with fresh water.

In a somewhat similar way, measurements were made under the same conditions on distilled water, and on a sample of sea water from the Gulf of Mexico. For the fresh water, at a temperature of 23° C., the dielectric constant was found to be 67 and the conductivity about 10^{11} E.S.U. (12 Mhos/metre); while for the sea water, which had a salt content of 2·2 per cent, the values obtained were 65 and 15×10^{10} E.S.U. (16 Mhos/metre) respectively for a temperature of 28° C. These values are in reasonably good agreement with the values deduced by Saxton[7] from a theoretical study of the anomalous dispersion of water combined with the results of measurements made at shorter wave-lengths than those used by Straiton and Tolbert. This recent work thus appears to form a useful extension of our knowledge of the electrical properties of soil and water at the frequencies corresponding to very short radio wave-lengths.

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