stratosphere ceases and the gravitational separation of the different constituents of the air takes place.

For these reasons we have started a world survey of the helium content of the air. The first condition for a successful investigation was the development of a method which allows of the separation and exact measurement of the helium from a small quantity of air; otherwise the collection of representative samples all over the world and from the stratosphere would involve great expense. My laboratory has been interested in the detection of minute quantities of helium for many years, and thanks to the development of the method, mainly by K. Peters, Wm. D. Urry, and E. Glückauf, we are now able to determine the helium content in 1 c.c. of air with an accuracy of about 1%; this means that variations of the helium content of air which amount only to 5×10^{-6}% of the total gases can be detected.

Our preliminary results show that the helium content of the atmosphere in different parts of the earth is not as constant as the oxygen or nitrogen content is supposed to be. It seems that variations of at least 3% occur right on the surface of the earth and sea. A sample of stratosphere air from 21 km. height over England was collected for us by a sounding balloon, thanks to the collaboration of Sir George Simpson, the Director of the Meteorological Office in London, and showed the still higher surplus of 8%, while samples taken at heights of 16 and 18 km. over England contained no more helium than London air.

Interesting though these results are, the information they provide is not yet sufficient to draw any definite conclusions either concerning the origin of the variations observed on the surface of the earth or as to the state of the stratosphere above 20 km. height. A continuation of the researches on a broader basis is clearly indicated, all the more so as it will form the basis of the further investigation as to whether the helium content is constant in time or not. We have been fortunate in securing the collaboration of meteorologists and chemists in different parts of the world who were kind enough to send us samples of air for analysis; some of them have even promised to obtain for us samples from the stratosphere.

It is very gratifying that our appeal has found such generous response and, in concluding this article, it gives me special pleasure to mention that thanks to the kind interest of the Director-General of the Meteorological Office in Poona, a representative collection of air samples from India, including, besides Poona, the stations of Agra, Karachi, Peshawar, Calcutta, Rangoon and Kodaikanal has been promised to me, and that a few of the samples have already arrived. As the result of such collaboration we hope in a year or so to be in a position to answer some of the interesting questions connected with the distribution of helium in the atmosphere.

Air Survey and Reconnaissance of Indian Forests.

By H. G. Champion, M.A., I.F.S.

Silviculturist, Forest Research Institute, Dehra Dun.

ONE of the first requirements for organising the management of a tract of forest to best advantage is a stock map showing the position and extent of the different types of forest with indications as to their content both in quantity and quality of the important timber species. India was not unduly behindhand in using the new instrument of air survey for this purpose as some 300 sq. miles of forest were surveyed in the Irrawaddy Delta[1] in 1923–24, the Burma Forest Department being fortunate in having in Messrs. C. W. Scott and C. R. Robbins, officers with distinguished records in the Royal Air Force, competent observers to interpret the variations in the vegetation as seen from the aeroplane and reproduced on the photographs. This survey which was considered to be most successful for the purposes (primarily topographical) for which it was carried out, was admittedly a relatively simple proposition over absolutely flat country, with an easily recognised network of waterways and better differentiated types than are often encountered. It was followed in 1934–35 by air photography of about 200 sq. miles and an air reconnaissance of 15,000 sq. miles in South Tenasserim.[2]

[1] Irrawaddy.

[2] *Burma Forest Bulletin* No. 13, C. W. Scott and A. R Robbins, Rangoon, 1926.

In the later operation 13 different types of forest were mapped on existing topographical survey maps at a cost of Rs. 5–5–0 per sq. mile as compared with an estimated cost of at least Rs. 15 to obtain comparable results on the ground. Since these surveys were made, nothing further is recorded as having been done in Burma, but several trials have been made in different parts of India.

Two of these trials were effected by seizing the opportunity when Land Settlement work with air survey was in progress near forest tracts. The first was in Bengal in 1926–27 when air photographs and maps for the forests of Chittagong and Cox's Bazar were obtained and utilised for working plan purposes:[3] no account of this work appears to have been published. The other was in the United Provinces in February 1931 when sample portions of North Kheri and Pilibhit divisions were mapped from the air at a cost of Rs. 55 per sq. mile.[4]

A more recent instance is that of an air reconnaissance of a very unhealthy tract in the North Godavery division in Madras[5] which was supplemented by some amateur photographic work the results of which are still under consideration. Some observations have also been published on a flight over the forests of the Andaman Islands.[6]

The result of these surveys is the accumulation of a considerable amount of experience, the application of which would result in much more information of the type required by the forest management officer for a given flying time and expense. The selection of the most suitable season is a matter of great importance as most species of trees tend to differ fairly conspicuously from their associates only at some phase of their annual cycle, whether in flower (teak, *Hopea*), new foliage (*Mesua*), old foliage (*sal, Anogeissus latifolia*). It is fairly obvious that when trees are leafless, the photographs are almost impossible to decipher. The early morning or the evening is the best time for reconnaissance or photography, the longer shadows greatly helping to bring out differences.

In photographic work, the use of the best type of lens and film is of even greater importance for forest survey than for topographical survey. Systematic trials in Canada[7] have demonstrated that as expected highly sensitive panchromatic film with a green filter gives maximum differentiation of colour of vegetation—colour photography still has considerable progress to make before it can be a practical proposition in this field. Most of the work is done at a height of 6,000 ft. or more the photographs obtained being on a scale of about 6″ to 1 mile, but of course there is much variation according to conditions and requirements. The photographs obtained on the forest surveys referred to above have been found to vary greatly in quality, vibration being perhaps the chief cause. The faster films and lenses now available should largely remedy the trouble.

The relative value of oblique photographs with wider field and less cost, calls for consideration, and undoubtedly in reconnaissance work will meet many requirements: they may be particularly useful in combination with a strip of vertical photographs.

It is, of course, now possible to produce very serviceable contour maps from air photographs (the newly constituted Soil Conservation Service of the United States is doing such work on a very big scale) and as a natural corollary, it should be possible to measure the height of trees. The Canadian worker referred to above[7] claims to have done this within 5% as determined by a ground check. Stereoscopic methods are of course largely used in this class of work.

With present appliances, there are distinct limits to the information which can be obtained from aerial reconnaissance or photographs with regard to the composition of our forests, above all for the more luxuriant types such as the moist tropical evergreen. It is too much to expect to be able to distinguish more than a very strictly limited selection of species from among the very large number contributing to the top storey, whilst often nothing can be seen of the lower tiers of vegetation including the younger trees of the important species concerning (which information is essential to the forester). At the same time, in

---

[3] "Working Plan for Chittagong division"—not yet published.

[4] "Air Survey of Forests," F. W. Champion, *Indian Forester*, 1933, 12.

[5] "Aerial Reconnaissance in the Forests of Madras," C. C. Wilson, *Indian Forester*, 1935, 765.

[6] "A Flight over the Andamans," A. D. B., *Indian Forester*, 1932, 469.

[7] "Aerial Photography–method of determining timber species," H. C. Ryker, *Timberman*, 1933, 39.

combination with the always necessary ground survey of representative areas, it can often give a large proportion of the information required more quickly and more cheaply than the usual ground work, and even on occasion[8] reveal features which may easily be overlooked on the ground.

It remains to mention a few other aspects of such work. Air survey may be of great value in detecting epidemic outbreaks of injurious insects, in determining their extent and spread, and in combating them—for this also has been done from the air in Europe and America. It may also be of the greatest value in recording gradual changes in density and nature of vegetation occurring naturally and though the influence of such agencies as fellings, grazing or burning, air photographs being incomparably superior to ground photographs for this purpose.[4]

In the less accessible tracts such as the Chittagong Hills where shifting cultivation is liable to encroach on reserved forests, rapid periodical reconnaissance from the air can save months of travelling.

Finally, the distribution of trees and forests is closely related to that of soil and underlying rock and work in other countries has shewn that air survey is a great help in mapping their distribution also.[9]

---

[8] "Air Reconnaissance of the Forests of S. Tenasserim," W. A. Robertson, *Indian Forester*, 1926, 131.

[9] "Air Survey in relation to Soil Survey," R. Bourne, *Imperial Bureau of Soil Science, Technical Communication*, 1931, **19**.

Obituary.

M. P. Venkatarama Iyer, M.Sc. (1902—1936)

IT is with feelings of deep sorrow that we have to record the death, from typhoid fever, of Mr. M. P. Venkatarama Iyer, Lecturer in Chemistry, Central College, University of Mysore, on 27th April.

Mr. Venkatarama Iyer had a distinguished career as a student of the University of Mysore and took the first rank in the B.Sc. degree examination, 1924. Later, he secured the M.Sc. degree of the Calcutta University, with distinction. He carried out post-graduate research in the General and Organic Chemistry Department of the Indian Institute of Science and was appointed Lecturer in Chemistry at the Central College, Bangalore, in 1927. He was recently elected a Fellow of the Indian Academy of Sciences.

Besides being a very capable teacher, Mr. Iyer was an enthusiastic research worker, his special field of study being colloid chemistry, having been initiated into research first by Prof. F. L. Usher and later by Prof. J. N. Mukherjee. As a teacher he was loved by his students both for his learning and for the charm of his personality. He utilised all his spare time for research and published a number of papers and at the time of his last illness, he was busy preparing his thesis for the Doctorate in Science. His recent work in electrometric studies on the formation and stability of colloids which is awaiting publication throws considerable light on the vexed question of the formation of basic salts. Mr. Iyer was an enthusiast of a rare order, and there was hardly any scientific meeting at Bangalore which he missed. Most unassuming in his bearing, and possessing a critical faculty, his presence was courted by his colleagues at all discussions He was responsible for organising a *study circle* composed of his colleagues in the Central College and in the Indian Institute of Science, for informal and intimate discussion of problems in physical chemistry. Mr. Venkatarama Iyer was keenly interested in *Current Science* and was a regular contributor to the Reviews and Research Notes sections of the Journal. In his untimely death at the very early age of 34, India, in general, and the University of Mysore, in particular, has lost a devoted research worker of great promise.

We regret to record the following deaths:—

SIR RAJENDRA NATH MOOKERJEE, K.C.I.E., K.C.V.O., one of India's foremost industrial magnates, on May 15, at the age of 82.

Mr. CHARLES A. KING, B.SC., M.I.M.E., M.I.E., Principal, Engineering College, and Jodhpur Hardinge Professor of Technology, Benares Hindu University, on May 19.