conditions a notable fixation of atmospheric nitrogen. Indeed, in tropical countries where sugar-cane is cultivated, molasses are sometimes actually added to the soil for this purpose. The action of the sugar is not entirely simple, however, and Peck has shown that in Hawaii it may actually do harm by bringing about a marked decomposition of the nitrates (Bull. No. 39, Hawaiian Sugar Planters' Association).

It is, however, now realised that soil fertility is not wholly a matter of plant food, but may be limited by the presence of harmful substances in the soil. This phase of the problem is being investigated by Schreiner and Skinner, who have recently published (Bull. No. 77, Bureau of Soils, U.S. Dept. of Agriculture) a detailed account of the action of coumarin, vanillin, and quinone on plant growth. The general research of which this forms part consists in isolating from the soil such organic compounds as can be identified, and then trying their effect on plant growth.

It would be a mistake to suppose that the medium on which the soil organisms live and which is in contact with the plant roots is the inert mineral matter that constitutes the bulk of the soil. Recent investigations have brought into prominence the colloidal constituents that occur in notable quantity and appear to be distributed over the surfaces of the particles, and apparently impart to the soil many of its characteristic properties. On general grounds, it might be expected that these colloids would be much altered by the addition of small quantities of soluble salts, and the experiments of R. O. E. Davis (Bull. No. 82, Bureau of Soils) have justified this view, and have shown in what way the changes affect the physical properties.

The re-establishment of vegetation on devastated areas presents many important problems, and much interest attaches to a paper by W. N. Sands on the return of vegetation and the revival of agriculture in the area devastated by the Soufrière eruption in St. Vincent, 1902–3. The paper is published in the West Indian Bulletin, vol. xii., No. 1, and is well illustrated. Vegetation now flourishes wherever the old soil remains, even when a considerable admixture of ash has taken place. The ash itself, however, is unsuited to vegetation, and where no soil is present vegetation is very scanty. Once, however, plants begin to get a footing improvement speedily takes place, as the substances formed on their decay furnish supplies of plant food. In dealing with the agriculture, it is noted that yields are now in some cases higher than formerly; this result is attributed to the heating of the soil by the lava, and is discussed in the light of recent work at Rothamsted.

E. J. R.

UPPER AIR INVESTIGATIONS.

WITH the beginning of this year the Meteorological Service of Belgium completed its hundredth international balloon ascent, and the director, M. Vincent, considered this to be a suitable occasion for communicating to the Royal Academy (*Bulletin de la Classe des Sciences*, 1912, No. 6) some of the data deduced therefrom. The complete results are included with those obtained in other countries in a special publication compiled by the president of the International Commission for Scientific Aëronautics and elsewhere.

The recording apparatus used is the Bosch-Hergesell baro-thermo-hygrograph, and this is suspended to the smaller of two rubber balloons, coupled in tandem and inflated with hydrogen gas. The larger balloon bursts at a variable height, and the rapidity of the fall of the apparatus is slackened by the smaller balloon. This remains floating as soon as the apparatus reaches the ground, and serves as a signal to its whereabouts. After making allowance for accidents, ninety-two of the records obtained remained available for examination. The highest altitude reached was 32,430 metres (determined from the pressure and temperature curves by means of Laplace's formula) on June 9, 1911. The lowest level of the principal inversion was recorded at 6890 m. on November 3, 1910, and the highest at 13,760 m. on August 2, 1906. The lowest temperature, −73·5° C., was registered on February 2, 1911, at 10,390 m., at the level of the inversion.

M. Vincent distinguishes three regions in the atmosphere accessible to instrumental observation:—(1) An upper one, which has been called the stratosphere, where the decrease of temperature is nil, or replaced by an increase; (2) an intermediate zone, where the decrease is at the rate of 0·7° C. per 100 metres, whether the conditions be cyclonic or anticyclonic; (3) a lower stratum of variable depth, where the decrease is less than 0·7°, and is frequently negative; some remarkable inversions are quoted in this portion of the atmosphere. These two lower zones are known as the troposphere. The conditions obtaining in the stratosphere are essentially different from those in the lower regions; the strata are nearly in statical equilibrium, the wind velocity usually weakens, and the direction is uncertain, but the author shows that there are important exceptions to this rule. The trajectories of some of the highest ascents determined by means of a special theodolite designed by M. de Quervain have been discussed.

The Royal Observatory of Batavia has recently published an important contribution to our knowledge of the upper air, including observations made (1) with kites and captive balloon at Batavia between November, 1909, and September, 1910; (2) with kites in the Java and South China seas in January, 1910; and (3) with manned balloon in the years 1910 and 1911. It was during the descent of a balloon on August 5, 1911, that the leader, Lieut. A. E. Rambaldo, unfortunately lost his life. A preliminary report upon these investigations was published in the Proc. Amsterdam Acad., June 25, 1910, and referred to in NATURE of November 3 of that year. Among the results of the kite observations we note that the amount of aqueous vapour per cubic metre over Batavia decreases with height, even in the lowest strata. The decrease of temperature with height, up to 1000 metres, is less in the west than in the east monsoon; between 1000 and 2000 metres it is about equal. Over the ocean the decrease is considerable between 0 and 200 metres and exceeds 1° C. in the first 100 metres; above 500 metres it is less than at Batavia. Above 1400 m. the temperature is higher than at Batavia, and the difference probably increases at heights beyond 3000 m. The diurnal change of the vertical temperature gradient differs over land and sea.

THE Supplement to the Monthly Weather Review of the Canadian Meteorological Service for 1911 contains a preliminary account of the results of the investigation of the upper air over Ontario by means of balloons and kites commenced during that year; a full description of the apparatus and methods employed, together with a more complete discussion, is reserved until a longer series of observations has been obtained. Registering balloons were liberated on the evenings preceding the "international" days, and the results are given for each 0·5 km. of height, with intermediate points if there were any noteworthy

features. The greatest height reached was 20·2 km. on September 9; pressure 43 mm.; temperature −59° C. The lowest temperature, −62°, was recorded at 14·1 km. All the balloons travelled easterly, but as several were lost owing to the proximity of lake or forest, the station had to be moved from Toronto to Woodstock, about eighty miles to the westward. The kite station is at Agincourt, about fourteen miles from Toronto; Dines's kite and meteorographs were used, and good records of pressure, temperature, humidity, and wind direction have been obtained; the highest flight was 7900 ft. above sea-level.

BIRD NOTES.

IN the November number of *The Zoologist* Mr. Harvie-Brown, in completing his account of the southern extension of the breeding range of the fulmar which has been in progress for many years, points out that these essentially Arctic birds had established themselves in St. Kilda at least 250 years ago. In 1838 or 1837 they were observed for the first time in the Faroes, nesting on the cliffs of Qualboe in Suderoe, and by 1849 they had colonised Skuor and Great Dimon. From these islands the fumar has invaded, as a breeding species, the Shetlands, the Scottish mainland, and the west coast of Ireland.

To Notes from the Leyden Museum, vol. xxxiv., Nos. 3 and 4, Dr. Van Oort contributes further records of the recapture of birds marked in Holland during 1911 and 1912. Among the species mentioned is the spoonbill, of which one example was taken at Reculvers, Kent, while four others were killed in north-western France. The total number of birds ringed in 1912 is considerably in excess of those marked in 1911.

An article on the haunts of the spotted bower-bird (*Chlamydodera maculata*), contributed by Mr. S. W. Jackson to the October number of *The Emu*, is illustrated by excellent photographs of the "runs," nests, and eggs of these birds. In addition to certain implements purloined from the writer's camp, the objects in one of the bowers included ribs and vertebræ of sheep, toe-bones of emus, fragments of coloured glass, stoppers of sauce-bottles, metal clippings, screws, metal bottle-capsules, a cartridge-case, and numerous pods and seeds. The birds nest high up in leafy trees, but select as look-out stations leafless branches or trees.

In vol. ii., No. 1, of the University of California Publications in Zoology Mr. H. C. Bryant bears testimony to the utility of birds as destroyers of grasshoppers. In July last it appears that grasshoppers were doing considerable damage to alfalfa and vegetables at Los Banos, Merced County, California. An average of about fifteen grasshoppers to a square yard is harmful, but in this instance there were from twenty to thirty. Several kinds of birds were observed to be feeding on the insects, and it was noticed that the local contingent of the former was reinforced from the neighbourhood. The author is led to conclude that although birds cannot be regarded as a trustworthy means for controlling all infestations of grasshoppers, yet they are efficient in preventing many. They can be depended on to protect crops by their war against the grasshoppers. "The failure of birds to check an insect outbreak is evident to all. Their success in preventing insects from becoming abnormally abundant is not so apparent but is no less real." Many birds in this particular case changed their normal feeding habits, and took to preying on grasshoppers, and species usually considered harmful to the agriculturist were commended for their utility.

The food of the pheasant in the Scottish grouse moors forms the subject of a note by Mr. P. H. Grimshaw in *The Scottish Naturalist* for November. Examination of the contents of the crop of a bird killed in Argyllshire, where the heather-beetle (*Lochmoea suturalis*) was unusually abundant during the summer, showed that these consisted chiefly of insects. These included 2286 flies (*Bibio lepidus*), 508 heather-beetles, and six other insects. This leads to the conclusion that the pheasant, like the blackcock, may be reckoned of importance in checking the ravages of the heather-beetle.

Another paper on the food of birds is published as Bulletin No. 44 of the Biological Survey of the U.S. Department of Agriculture. This report, which is drawn up by Mr. F. E. L. Beal, relates to the fly-catching species of North America, referable to the genera Sayornis, Empidonax, Muscivora, Myiarchus, Tyrannus, &c. The contents of the stomachs, or crops, of seventeen species were examined, and it was found that "of thirteen of these species Hymenoptera are the largest element in the diet. Of one species Orthoptera (grasshoppers and crickets) are the leading food; in another Lepidoptera (moths and caterpillars) are the favourites; and in two others Diptera (flies) stand at the head. Hemiptera (bugs) are eaten extensively by some, but naturally the ones taken are the larger flying species. Plant-lice and scales [Coccidæ] have not yet been found in the stomach of any fly-catcher, though one bird was shot on a plant covered with lice, with which its bill was filled."

Several of these birds have been charged with devouring honey-bees, but the accusation is not sustained by the examination of their food; comparatively few of these insects being devoured, and those chiefly drones. The real harm done by these birds is the destruction of predaceous and parasitic Hymenoptera which wage war on injurious insects. R. L.

STOCK DISEASES AND THEIR SUPPRESSION IN SOUTH AFRICA.[1]

MODERN knowledge of trypanosome disease and others of a similar nature can be usefully applied to some of the problems which are in my particular line of research, viz. to diseases of our domesticated animals. I shall mention but two, known probably to you all, and which are of great economical importance—horse-sickness in equines, and blue-tongue in sheep. Long before any expert came in contact with him, the observant farmer quite rightly classed these two diseases in one group. He even went so far as to say they were identical, but here is an opinion which we are not able to support. There are, nevertheless, more similarities than differences in the two; they resemble each other in nature of the cause, both being due to micro-organisms of infinitesimal minuteness, so small that none of our modern microscopes can detect them.

The theory of our modern microscope teaches us that there is a limit to visibility beyond which objects can no longer be recognised. The so-called ultra-microscope, which makes use of a different principle of illumination, and allows the detection of objects varying in the magnitude of a molecule, has in these two diseases failed to enable us to demonstrate an organism so far. It must be there, nevertheless, and we conclude this from the experiment that we are able to transmit the disease by inoculation with blood from a sick to a healthy animal, in which latter, after a definite incubation time, it appears, thus showing

[1] From the Presidential Address delivered before the South African Association for the Advancement of Science, at Port Elizabeth, on July 2, by Dr. Arnold Theiler, C.M.G.