PLANT LIFE IN ICELAND AND CYPRUS.

(1) *The Botany of Iceland.* Edited by Dr. L. K. Rosenvinge and Dr. E. Warming. Part I. 2. An Account of the Physical Geography of Iceland, with special reference to the Plant Life. By Prof. Th. Thoroddsen. Pp. 191–343. (Copenhagen: J. Frimodt; London: J. Wheldon and Co., 1914.)

(2) *Bergens Museums Skrifter. Ny Raekke.* Bind i., No. 2. Studies on the Vegetation of Cyprus. Based upon Researches during the Spring and Summer, 1905. By Jens Holmboe. Pp. 344. (Bergen: John Griegs, 1914.)

(1) THE present instalment of "The Botany of Iceland," by Prof. Thoroddsen contains five chapters. The first chapter deals with general topography and geology. The island is a continuous table-land with an average height of 700–1000 metres above sea-level, excepting narrow borders of coastal land, valleys which cut into the table-land on all sides, and a few small areas of level land towards the south and west. More than two-thirds of the entire area is at so great a height above sea-level that almost no vegetation can thrive there. The sandy and stony deserts of the interior plateau, the lava tracts, and the glaciers are not fit dwelling-places for man, and it is almost exclusively, therefore, the coasts and valleys which are inhabited. The volcanic element is the most striking feature in the geology, and is treated at some length.

The second chapter deals with conditions of surface and soil. Basalt is the fundamental rock; the tuffs and breccias are for the most part basalt split and pulverised, and the mineralogical and chemical component is essentially the same throughout the island. The climate, discussed in chapter iii., is; owing to oceanic currents, much milder than would be expected from the position of the island. Evidence of the Gulf Stream is found in the drift material, which includes sugar-cane and seeds of *Entada* and other West Indian beans. The winter is long, but generally not severe; the summer is comparatively short and cold and the weather usually changeable and damp.

The general distribution of plant life and a sketch of the chief plant-formations form the subjects of the remaining two chapters. Only a small part of Iceland bears a continuous carpet of vegetation. The number of species of flowering plants and ferns is from 400 to 450, as compared with 380 in Greenland and about 1450 in Denmark. Of these eighty-four are grasses and sedges. Man, with his sheep and cattle, has exercised considerable influence on the vegetation. The coppice woods of birch (*Betula odorata*) which were once extensive are rapidly disappearing, and their destruction has affected the general vegetation. The nature of the country and the vegetation are well illustrated by a number of photographic figures.

(2) The detailed study of the botany of Cyprus is the result of a desire on the part of a Norwegian botanist to compare with the flora of his own country that of an area in which there had been no glacial epoch. The author gives a brief sketch of the topography, geology, and climate of the island, and a short history of our knowledge of the flora, including a list of plants mentioned by authors before 1787. The main part of the volume is devoted to a carefully annotated systematic list of the vascular plants hitherto observed spontaneously growing in Cyprus, and some remarks on the most important plant-societies of the island. During his seven months' stay the author was able to add considerably to the number of plants previously recorded, and also to study critically various elements of the flora. The cedar of the island he regards as a distinct endemic sub-species, with affinities partly with the cedar of Lebanon and partly with that of the Atlas range. Several new species of flowering plants are described, and these as well as many others of special interest are illustrated by excellent plates and text-figures.

Large deposits of calcareous tufa were discovered containing excellent leaf-impressions consisting mainly of *Laurus nobilis* and *Platanus orientalis*, with fragments of *Ficus carica*, *Smilax aspera*, and *Rhamnus oleoides*, all of which are represented in the present-day flora. The account of the plant-societies, though not exhaustive, is a valuable contribution, greatly enhanced by a number of photographic reproductions. There are also short chapters on the means of distribution of some of the plants and on the affinities and history of the flora; also a list of topographical names derived from plant names, and a bibliography.

PRIME NUMBERS AND THE COMPLEX VARIABLE.

(1) *List of Prime Numbers from 1 to 10,006,721.* By D. N. Lehmer. Pp. xv + 133. (Washington, D.C.: Carnegie Institution of Washington, 1914.) Price 5 dollars.

(2) *Functions of a Complex Variable.* By Prof. J. Pierpont. Pp. xiv + 583. (London: Ginn and Co., 1914.) Price 20*s.* net.

(1) THE table is similar in form to Mr. Lehmer's previously published factor-table (see NATURE, August 10, 1911, p. 178), and the same elaborate precautions have been taken to avoid error. Thanks to the work of Glaisher and

© 1915 Nature Publishing Group

his predecessors, we may now be fairly confident that the primes in the first nine millions have been correctly determined; the introduction to the present table describes the checks used for the tenth million, and contains other very interesting matter. First we have an account of Kulik's remarkable work, which, although not accurate, has been found to be of great value as a check, and actually goes beyond 100,000,000; unfortunately the second of the eight MS. volumes is missing. Then we have an admirable summary of the work done in the theory of the distribution of primes, ending with Gram's series, which is a transformation of Riemann's celebrated formula. Finally we have a table, at steps of 50,000, giving comparisons of the actual count with the values found from the formulæ of Legendre, Tchébicheff, and Riemann respectively.

The superiority of the last-named becomes more and more evident the further we go; the errors fluctuate in sign, and their ratios to the true value diminish in a most remarkable manner. The error is actually zero for a table going from 1 to 9,050,000; and for 10,000,000 it is only +87, the number of primes, as counted, being 664,580. The errors in the other two calculated values are always in excess and Legendre's value is less accurate than the other; but the comparative smallness of the errors is noteworthy, being only 560 and 338 respectively for a ten-million table. Perhaps there may be a simple modification of Legendre's formula which would bring it into closer agreement with Gram's.

The liberality of the Carnegie Institution of Washington has made it possible to publish this table at a price which is remarkably low, considering the labour involved. We hope that English universities and colleges will provide themselves with copies, and make an announcement that they have done so; this would be a great benefit to scattered arithmeticians, who now and then wish to know whether a particular number is prime or not, and may not be able to afford even a sovereign for the luxury of possessing this work. The same thing may be said, with greater emphasis, about the factor-table.

(2) Prof. Pierpont's treatise on the complex variable is very good, and a judicious mean between elaborate works addressed to the expert and specious outlines which ignore all difficult points, and tempt the reader to draw all sorts of false conclusions. The method is practically that of Cauchy, as developed by Briot and Bouquet, and Hermite, no use being made of Riemann surfaces. On the whole, we think this is the preferable course, because, although in simple cases the Riemann surface provides a visual image of great simplicity, and is invaluable for purposes of research, we cannot *construct* it until we have worked out the analytical theory of the algebraic functions we are considering, and this comes to discussing a system of Cauchy loops.

Readers of Dedekind and Weber's memoir on algebraic functions will remember that the authors laid great stress on the precise meaning of "a point on a Riemann surface"; this is the main crux of the whole theory, and another way of putting it is to determine the complete characteristics of a singular point on a given algebraic curve. This last way was that of H. J. S. Smith and Halphen. The present writer is no doubt prejudiced; but he ventures to say that in his opinion Dedekind's notion of algebraic divisors, as expounded, for instance, in Hensel and Landsberg's treatise on algebraic functions, is the best way to express the analytical facts in a concise symbolical form. For one thing, it brings into prominence the idea of a compound modulus, which is bound to lead eventually to a great simplification of the theory of algebraic functions.

A good feature of the treatise is that special functions such as those of Legendre and Bessel, and the hypergeometric function and elliptic functions, are treated in the light of the general theory.

There are two points about which the author might have written differently with advantage. It is not correct to say that the argument (amplitude) of $x+yi$ is $\tan^{-1}y/x$; otherwise we should have $\arg(x+yi)=\arg(-x-yi)$. The author does not say this, but (p. 11) he invites this false conclusion. The correct statement may be written—

$$\arg(x+yi)=(\sin,\cos)^{-1}(y/r,\ x/r),$$

where $r=+\sqrt{(x^2+y^2)}$, and $(\sin,\cos)^{-1}(a,b)$ means an angle of which a is the sine and b is the cosine.

Thus $\arg(x+yi)$ is determinate up to multiples of 2π; and this is the only way to avoid error arising from the definition.

The second point is this. Suppose we have two infinite series—

$$s=a_1+a_2+a_3+\ \ldots$$
$$s'=b_1+b_2+b_3+\ \ldots$$

of such a nature that $a_i=b_j$, where i is uniquely determined by j and conversely, we can define s' as a *permutation* of s, on the ground that every term of s' occurs in s and conversely. But it does not follow that the sum of s' is equal to the sum of s, even though both are convergent. We are, however, able to say that if s is absolutely convergent, and s' is such a permutation of s that the relation $b_j=a_i$ makes j finite whenever i is finite, and conversely, then s' is absolutely con-

© 1915 Nature Publishing Group

vergent, and its sum is equal to that of s. The essential thing is to note that an infinite series is defined not only by its terms, but by the order in which they are written. The author fails to emphasise the fact that in dealing with permutations of series we must keep any term in a finite place in a finite place. G. B. M.

FARM MANAGEMENT AND RURAL IMPROVEMENT.

(1) *Soil Management.* By the late Dr. F. H. King. Pp. ix+311. (New York: Orange Judd Co.; London: Kegan Paul, Trench, Trübner and Co., 1914.) Price 1.50 dollars.

(2) *Hunt and Burkett's Agriculture: Farm Animals, covering the General Field of Animal Industry.* By Prof. T. F. Hunt and Prof. C. W. Burkett. Pp. ix+534. (New York: Orange Judd Co.; London: Kegan Paul, Trench, Trübner and Co., 1914.) Price 1.50 dollars.

(3) *A Handbook for Farmers and Dairymen.* Sixth edition. By Prof. F. W. Woll. Pp. xvi+490. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1914.) Price 6*s.* 6*d.* net.

(4) *Rural Improvement: the Principles of Civic Art Applied to Rural Conditions, including Village Improvement and the Betterment of the Open Country.* By F. A. Waugh. Pp. xi+265. (New York: Orange Judd Co.; London: Kegan Paul, Trench, Trübner and Co., 1914.) Price 1.25 dollars net.

(1) THE book on soil management, which has been prepared from various notes and lectures of the late Dr. King, bears eloquent testimony, not only to his wealth of knowledge of the subject he had made so thoroughly his own, but also to much painstaking inquiry into the systems of agriculture and soil treatment in China, Korea, and Japan. Much of the book is naturally devoted to the consideration of productive capacity as determined by water supply, soil structure, and the physical features of the soil generally, and also contains many original observations on the effect of cultivation, mulching, and drainage. Teachers of agricultural science in this country will not fail to find much useful matter and many apt illustrations in this portion of the book. Not the least valuable portion of the work, however, will be found in those pages descriptive of the practices adopted in the Far East, by means of which soil fertility has been conserved to such a remarkable degree that a greater number of people are fed per unit area than in any other country in the world. Strict economy of all fertilising material is the main consideration, but the practical experience of centuries of Asiatic agriculture has evolved modes of conservation, fermentation, and crop production in respect to which we stand, at the present day, merely on the fringe of investigation.

(2) The perusal of Messrs. Hunt and Burkett's book on farm animals leaves one with a number of dissimilar impressions. The work is primarily intended for use by high-school pupils of fourteen to eighteen years of age, and aims at providing a survey of the whole range of animal industry. The scope of the book is certainly wide enough for all ordinary requirements, and there seems to be no reason to doubt that by a process of judicious mental winnowing sufficient concrete impressions may be obtained to impart an intelligent recognition of the issues upon which successful husbandry depends. A number of admirable practical exercises constitute the most valuable portion of the book, but one is inclined to deplore the inclusion of matter such as the first lesson on the "sorting of animals" and the apparent lack of discrimination in respect to many illustrations of the kindergarten type.

(3) Prof. Woll's handbook comprises in tabular form many of the data of value in agriculture generally, and dairying in particular, and the fact that it is now in its sixth edition may be taken as evidence of the useful function it is performing. The various sections, *e.g.*, those on farm animals, poultry, veterinary science, seeds, weeds, farm pests, forestry, etc., are prefaced by short articles by American authorities, and give an excellent digest of the subject. A certain proportion of the data bears, of course, reference to American conditions only, but the majority of the subject-matter will be found useful by English and colonial readers. Most of the tables are taken from trustworthy sources, and only one or two of doubtful authenticity have crept in. It is perhaps a matter for regret, from an agricultural point of view, that soils have not received any attention.

(4) Although much of the attention of the dweller in American rural districts has, in times past, been occupied by the necessity of making both ends meet, signs are not lacking at the present time that the main problem now is "not how to make more money, but how to live more comfortably." Whilst the value of co-operation in the purchase and sale of commodities, however, has been extensively realised, that of common effort in the development of civic life and institutions has not received the attention which it must ultimately do, and Mr. Waugh in his interesting book on rural improvement makes a strong plea for the appreciation of civic art—the art that builds a sound physical frame for the

© 1915 Nature Publishing Group