

had a separate existence in the colleges, but with the growth of various interests, certain branches have developed until now they are treated independently, pomology and vegetable gardening being notable examples. With the better recognition of the importance of the forests to the nation, the instruction of forestry has advanced from exclusive concern with questions of afforestation to consideration of the vital problems of the proper protection, management, and perpetuation of existing stands of timber. The land grant colleges recognise their opportunity and responsibility to train the leaders with the necessary technique and with the broad outlook which will enable them to develop sound public policies of dealing with the forests and to establish right standards of practice. The general scheme of education keeps in view both the scientific and practical aspects of agriculture, and endeavours to emphasise the entire interdependence of the two. In addition to the branches already mentioned, special sections are devoted to soils and fertilisers, plant pathology, entomology, animal, dairy, and poultry husbandry, veterinary education, and agricultural engineering.

It is recognised that the four-year college course is not sufficient to supply the demand for trained workers on the land, partly because so large a percentage of graduates draft off into other occupations, as teachers, county agents, scientific workers, etc., and partly because a large proportion of those intending to farm cannot afford the time or money for a full college training. To meet the needs of the latter class, various types of short courses have been developed covering the various sections of the community concerned. The older boys and girls are catered for by special agricultural schools, farmers are provided

with short courses extending over a few weeks only, at the slackest times of the year, and short schools are held for training specialists in such subjects as dairying, cotton culture, and ice-cream manufacture. In addition, courses in agriculture and horticulture are run for one, two, or three years, primarily for young men and women who intend to make farming their life work. Many problems have arisen in the development of these short courses, and special endeavours are made to solve them in such a way as to render the courses an integral and valuable part of the whole educational scheme.

During recent years a very marked development has taken place with regard to the professional training of teachers in agriculture. Special legislation has provided grants from Federal funds for the purpose, on the condition that equal sums are found by the States participating. The expenditure in this respect increased from 121,244 dollars in 1918 to 651,792 dollars in 1921, the growth of the work being so rapid that it was difficult for the land grant colleges to secure adequately prepared instructors for the purpose. Still more recently a demand has developed for courses in education designed to meet the needs of college instructors, and there seems little doubt that this part of the work will increase in relative importance. The same may be said of the agricultural extension work, which has steadily increased until in 1921 more than 18 million dollars were expended thereon, directly aiding the improvement of the farm and home practice of more than two million workers directly connected with the land, the whole of the extension work in 1920 costing 75 cents for each 1000 dollars of gross returns from agricultural production in the United States.

The Rainfall of Dry Periods in Relation to Water-power Schemes.

IN all questions relating to water-power schemes, some estimate of the water available is of first importance. Most schemes involve the storage of water in reservoirs, the size of which depends on the proposed draw-off compared with the run-off from the gathering ground in a dry period. Undoubtedly measurements of stream flow afford the best hydrological data upon which to base calculations. Such data are, however, often too short to give the average over a long period or the flow in the all-important dry period. Thus to a large extent calculations have to be based upon measurements of rainfall, compared where possible with gaugings of stream flow. It is, therefore, important to consider the relation of the average rainfall (1) to that of the period for which stream gaugings are available, and (2) to falls in dry periods in that area.

An investigation has been carried out on this subject by Capt. W. N. McClean,¹ who has analysed the monthly and annual rainfall figures for the fifty years 1871 to 1920 for thirty-five stations in Scotland. This mass of data is marshalled into a convenient graphical form, the unit of measurement of rainfall being expressed throughout in inches per annum, and the rainfall being plotted as the aggregate excess or deficiency from the average of the whole fifty years. The curves reproduced in the paper make it possible to read off:

- (1) The actual rainfall of each calendar month and year;
- (2) The lowest rainfall of each month and year; and
- (3) The predicted lowest falls of periods of various lengths based on (2) above.

The fifty years, 1871 to 1920, were remarkable for

¹ "An Analysis of Scottish Rainfall Records." By W. N. McClean. Pp. 19 + 16 plates. (The Institution of Water Engineers, December 1925.)

the run of wet years in the 'seventies, the years 1872 and 1877 being the wettest in the series. The rainfall of the years 1886 to 1889, especially that of 1887, provided in many cases the lowest values in the period under discussion and would have severely taxed the storage capacity of the reservoirs. Outside the series, the year 1870 was as dry as 1887 over Scotland as a whole, while 1921 was noteworthy for the lowest annual totals on record in parts of the east of Scotland. Had these years, 1870 and 1921, been included in the analysis, lower values would certainly have been obtained in some instances and the smoothed enveloping curve of predicted values might have been modified.

One of the important facts brought out by the paper is that the rainfall at some stations is more variable year by year than at others, and this characteristic persists throughout the fifty years. The mean deviation of annual rainfall from the average is known to exceed 12 per cent. in central and south-eastern Scotland. This value diminishes towards the coast on all sides, but especially to the north-west, where, in islands to the west of Scotland, the value is only 8 per cent. This small variability factor in the rainfall of parts of Scotland is of considerable importance in connexion with the supply of storage reservoirs. In arriving at the predicted lowest values for each record, a factor is used based on the mean lowest value for the thirty-five gauges. Since there is this marked geographical variation, it would clearly be advantageous to use a factor varying with the geographical position of each individual station.

The curve of lowest predicted values is obtained from the one extreme value of the low rainfall for each of the periods of varying length. It is, however,

essential to know the frequency of occurrence of low readings and whether any of them are fortuitous. Such information can be readily obtained from the mean deviation, which takes account of all the deficiencies in the series. This is another reason for including some such measure of the variability of the rainfall in the curve of the predicted lowest values.

This exhaustive analysis of Scottish rainfall is of particular importance in that the Western Highlands of Scotland provide a promising field for the further development of water-power schemes, having a large area with an average annual fall of more than 80 inches (reaching locally 150 inches) and a smaller factor of variability than most other areas in Great Britain.

The Spider Crabs of America.¹

MISS RATHBUN has completed a very beautiful systematic monograph on the American spider crabs. It is a work of enormous labour, for no less than seventy-nine genera and nearly three hundred species are described, with minute details of their distribution and lists of the specimens examined from all localities. The figures are good photographs or clear diagrams and occupy nearly half the book, which is a most important contribution to the study of carcinology, and will be extremely useful to all systematists.

The companion volume is "The Grapsoid Crabs of America," forming Bulletin 97 of the United States National Museum, 1918, and here is to be found an introduction serving for both volumes, which are to be followed by others. The collections in the United States National Museum, embracing many hundreds of specimens, form the basis of both bulletins.

We have in the present volume a handbook for the study of American spider crabs which will be indispensable to workers in all countries. Some of these crabs have an extremely wide range of distribution; such are *Hyas araneus* and *Hyas coarcticus*, aptly termed "toad crabs," both of which are common on British coasts. *Hyas coarcticus*, which was originally described by Leach from British seas, is shown to have also a wide vertical range, extending from low water to (exceptionally) 906 fathoms.

The love of spider crabs for decoration is remarkable, and although in a work of this kind there is no room for details as to habits, still much may be learnt from it as to habitat and adaptation. Whether the animals actually decorate themselves with foreign substances or, without using them, are so like their environment that decoration is unnecessary, they are all so perfectly adapted to their surroundings that even in dead specimens one can usually recognise the kind of ground on which they live. The members of the Majidae are the most important of the "masking crabs," but even among these there are some which do not cover their bodies with extraneous matter. Thus we have the bright red *Thoe puella* in the fringing shallows living on broken pieces of coral which have portions of sponge scattered over them of a similar colour to the crab; and the hairy *Mithrax verrucosus*—the hiding-place of which is in rocky holes covered with madrepores—which only comes out to feed at night. In the smaller family, Parthenopidae, there are *Heterocrypta granulata*, the "pentagon crab," living on shingly bottom, bearing a striking resemblance to a freshly broken chip or flake of stone, and *Parthenope serrata*, which lives in the sand in shallow water with

only the rostrum, eyes, and afferent apertures exposed, these apertures being situated between the base of the finger and the margin of the orbit.

There are very good diagrams showing the nomenclature of the parts as used in the monograph, and the descriptions of the crabs and the keys are all clear and easy to understand.

University and Educational Intelligence.

ABERDEEN.—Ordinances for the establishment of chairs in forestry and bacteriology have been approved of by Order in Council.

The Right Rev. E. W. Barnes, Bishop of Birmingham, has been appointed Gifford Lecturer for the period 1926-8.

CAMBRIDGE.—Mr. G. E. Briggs, fellow of St. John's College, has been reappointed as demonstrator in plant physiology. Mr. Briggs has in the past done effective research on carbon assimilation and growth.

The Royal Commission has issued amended regulations governing the initial appointments to be made under the new statutes.

Certain amendments to the regulations of the mechanical sciences tripos have been brought forward. The proposed changes are chiefly concerned with the regrouping and amendment of the "B" (advanced) papers, the special function of which is to grade the candidates.

The local nominees to the first committee of management of the new Polar Institute consist of the present Vice-Chancellor, and three antarctic explorers—Messrs. Debenham, Priestley, and Wordie. The Council of the Royal Geographical Society has nominated Dr. H. R. Mill as its representative.

A Gordon Wigan prize of 30*l.* has been awarded to Mr. F. H. Constable, fellow of St. John's College, for chemical research on "The Nature of Catalytic Action."

ST. ANDREWS.—The degree of D.Sc. has been conferred on Mr. James Forrest, lecturer in natural philosophy, University College, Dundee, for a thesis entitled "Magnetic Quality in Crystals; Part I., Magnetic Discrimination of Molecular Lattices; Part II., Stability of Molecular Lattices."

STERLING Fellowships for Research in the Humanistic Studies and the Natural Sciences at Yale University Graduate School have been established by a gift of 1,000,000 dollars from the trustees of the estate of the late John W. Sterling to stimulate scholarship and advanced research in all fields of knowledge. They are divided into two general classes: Research or Senior Fellowships, candidates for which must be of the standing of the Ph.D. degree; and Junior Fellowships, candidates for which must be well advanced in their work towards the Ph.D. degree. The annual stipends of the former range from 200*l.* to 500*l.* or more, dependent upon the character of the proposed investigation, and of the latter from 200*l.* to 300*l.* The fellowships are open equally to graduates of Yale University and other approved colleges and universities. Applications for the fellowships should be addressed to the Dean of the Graduate School of Yale University, New Haven, Connecticut, for Junior Fellowships, by March 1, and for the Senior Fellowships by April 1.

THE December number of the *University Bulletin* of the Association of University Teachers contains an article by Dr. Alex Hill, of the Universities

¹ Smithsonian Institution; United States National Museum. Bulletin 129: "The Spider Crabs of America." By Mary J. Rathbun. Pp. xx+613 +283 plates. (Washington: Government Printing Office, 1925.) 2 dollars.