ing and hauling done over these earth roads by the people of Maryland costs them annually not less than $3,000,000 more than it would cost were the more important of these roads transformed into well built modern highways.

That there exists to-day in so important and intelligent a commonwealth, a condition of affairs so costly, and so unnecessarily bad, a condition which greatly retards the material, social and intellectual development of its rural population especially, is deplorable enough; but a still more unfortunate fact is that, looking over the whole of this great country of ours, there are scarce half a dozen states that claim a better record.

J. A. Holmes.

WORK AND EXPENDITURES OF THE AGRICULTURAL EXPERIMENT STATIONS FOR THE YEAR ENDING JUNE 30, 1899.

The report on the work and expenditures of the agricultural experiment stations in the United States for 1899, prepared by Dr. A. C. True, Director of the Office of Experiment Stations, Department of Agriculture, has recently been transmitted to Congress. The general conclusions regarding the present status of the stations are stated in the report in substance as follows:

The work of the stations during the past year has for the most part been along the same lines as heretofore, and in the aggregate a large amount of useful work has been accomplished. By their own efforts and with the aid of the colleges of agriculture and the State boards or commissioners of agriculture, the stations are bringing their work home more closely to the farmers through publications, farmers' institutes, agricultural associations, home reading courses and the press. It is becoming evident that farm practice in this country is being materially affected by the work of the stations, and they are more and more relied upon by our progressive farmers for advice and assistance.

THE FINANCIAL BUSINESS OF THE STATIONS.

The financial business of the stations is now generally conducted systematically and carefully, and with due regard to the limitations of the Hatch Act and the State laws governing their operations. The wisdom of Congress in making the Hatch fund a research fund is every year becoming more apparent. This Department is therefore disposed to more strongly insist on a strict interpretation of this act in this direction, and to hold that it is not only in accordance with the obligation, but also to the interest of the States, to devote the Hatch fund to investigations in agriculture and to supplement this fund as far as may be necessary to promote the interests of agriculture in other lines.

RELATIONS OF COLLEGES AND STATIONS.

The movement for the improvement of courses of agriculture in the colleges with which the stations are connected is steadily growing. The past year has witnessed many changes for the better as regards specialization of the work of instruction and the development of courses suited to the varied needs of students. More then ever before the colleges are reaching out beyond their class rooms and are carrying useful instruction to the farmers through farmers' institutes, correspondence courses, and other forms of so-called university extension. As this outside work becomes better organized, it is more apparent that it belongs to the college rather than the station. At the same time when properly managed it affords efficient means for bringing the results of station work home to the farmer, and thus usefully supplements the publications of the stations. With the return of financial prosperity the States are more liberally endowing the colleges and providing them with better buildings and equipment. As the

stations usually make considerable use of the improved facilities given to the colleges, the means for making their work more efficient have been materially improved during the past year.

As the work of both college and station grows in extent and complexity, it becomes more apparent that in order to perform the most efficient service the station should be organized strictly as a separate department of the institution with which it is connected, and that it should have an organization so compact that its work may proceed in accordance with a schedule carefully planned and energetically administered. To secure this end experience shows that it is quite desirable that the station should have a competent executive officer, who can devote his time very largely to planning and directing its operations, managing its general business, and representing its interests before the public. It is encouraging to observe that in several States during the past year these considerations have led to the more complete separation of the business of the station from the general business of the college, and to the appointment of a director of the station as a separate officer.

THE WORK OF STATION OFFICERS AT FARMERS' INSTITUTES.

One of the most striking evidences of the great awakening of our farmers to the importance of technical education relating to their art is the rapid extension of farmers' institutes in all parts of the country during the past few years. Institutes are now held with more or less regularity in 43 States and Territories. It is estimated that during the past year no less than 2000 institutes were held in the United States, which were attended by 500,000 farmers. As this movement progresses there is an increasing demand for the services of experts at these institutes. The farmers best like to hear those men who have made a thorough study of the subjects of which they treat, and who can impart up-to-date information.

In States where the farmers' institutes have been held for a number of years the farmers who attend them are becoming quite familiar with the general principles of agricultural science and the results of the work of the stations as set forth in their publications. It therefore becomes necessary for the speakers at these institutes to devote more time to the preparation of their lectures in order to successfully meet the needs of progressive farmers and give them new information. This fact, as well as the increasing number of institutes, makes it impracticable for station officers to engage very largely in institute work without detracting from their efficiency as investigators. Moreover, to make the thorough investigations which intelligent farmers now insist upon station officers, must devote themselves very closely to this work. It is, therefore, quite clear that we need in this country to devote a corps of institute workers, who can glean from the work of the stations and other sources the fresh information which our farmers demand and can take the time to attend a considerable number of institutes each year. These men must be well trained in the science and practice of agriculture and at the same time must have peculiar gifts as lecturers before popular assemblies. This would not necessarily mean that the station officers should withdraw wholly from the institutes. Without doubt, it is desirable that they should from time to time meet the farmers in this way, but this work should be kept within such limits that it will be merely incidental to their legitimate business as investigators.

THE STATION PUBLICATIONS.

There is still great variety in the character of the publications issued by the sta-

tions and much difference of opinion as to what these publications should contain. A large amount of compiled information is still issued. Without doubt, much of this is useful, but it needs still to be remembered that time taken by station officers in preparing such material must be deducted from that which would otherwise be devoted to the work of investigation. Certainly the publications of the stations intended for wide distribution among farmers should be carefully prepared, and the results of investigations should be interpreted in a clear and readable manner. It seems, therefore, unwise to make the station bulletins the vehicle for the publication of the detailed records of experiments or for the scientific presentation of investigations. It would seem better to reserve these details for the annual report. If it is desirable to keep the publication of detailed records of work more nearly up to date this report might be issued in parts, as has been done by a few stations. It would not be necessary to distribute this report to the entire mailing list. If this plan were followed it is believed that the station bulletins might be made more acceptable to the farmers and at the same time the detailed records of work could be put in better shape for the use of students and investigators. Properly managed, this plan would result in greater economy as regards expenditures for printing.

THE INSPECTION SERVICE OF THE STATIONS.

From the very first the stations in this country have been largely engaged in the inspection of commercial fertilizers, and this work has been so efficiently and usefully conducted that from time to time additional inspection duties have been laid upon the stations. The movement for the establishment of different kinds of inspection service under authority of the National and State Governments is growing apace, and and it is very important that the relations of this work to the other functions of the stations should be clearly understood. Soon after the establishment of the stations under the Hatch Act, this Department ruled that the funds appropriated under this Act could not be legitimately applied to pay the expenses of the inspection and control of fertilizers. The same principle holds good with reference to other forms of inspection service demanded of the stations. While the methods and usefulness of inspection in any particular line are still problematical, it may be justifiable for a station to take up this work to a limited extent, but as soon as it becomes a matter of routine business the State should provide funds for its maintenance. If it seems expedient that any part of the inspection service should be performed by the station under State laws and at State expense, the matter should be so arranged as not in any way to interfere with the investigations of the station. It is a great mistake to divert the time and energy of a competent investigator to the toilsome routine work of inspection service.

CO-OPERATIVE EXPERIMENTS WITH FARMERS.

The number and importance of the experiments which the stations are conducting in co-operation with practical farmers and horticulturists have greatly increased of late. Thousands of such experiments are now annually conducted in the United States. These range all the way from simple tests of varieties of plants to special experiments in the management of farm or horticultural crops, live stock, or particular operations, such as tobacco curing. It is coming to be more clearly recognized that the field operations in agriculture or horticulture conducted on the station farm need to be supplemented by similar work in a considerable number of localities in order to be of general usefulness to the State. In experiments with orchard fruits it is often

better for the station to make arrangements to work in orchards already established. Special investigations of different kinds must be carried on away from the station in order to be of any use. By going into different localities, as the needs of its work demand, the station can make itself more useful to the State as a whole. Without doubt co-operative experiments need to be very carefully planned and thoroughly supervised to be successfully conducted, and their success depends on their quality rather than their number. It is encouraging to observe that more careful attention is being given to this important matter by station officers, and it is believed that this work may be made much more economical and useful than the permanent substations as ordinarily managed.

CO OPERATION OF THE STATIONS WITH THE DEPARTMENT OF AGRICULTURE.

As the stations and the various branches of this Department are working along similar lines, it has been found increasingly desirable for the Department and the stations to unite in co-operative enterprises, and this has been done to an increasing extent. This policy has been approved by the action of Congress, which in recent years has in an increasing number of instances authorized or directed co-operation with the stations in the appropriation acts making provision for the maintenance of this Department. These co-operative enterprises have so far increased in extent and variety as to make it desirable to have a more formal plan for arranging for such co-operation than has hitherto been necessary. In recognition of this need the Secretary of Agriculture made an order under date of February 28, 1899, requiring the officers of this Department to submit their plans for co-operation with the stations for his approval before negotiating with the stations, and designating the Office of Experiment Stations as the representative of the Department in arranging for such co-operation and keeping a record of the co-operative enterprises agreed upon. Under this order the Department and the station each designate the officers who are to have immediate charge of the co-operative work in any given case, and these officers carry out the details of the plan agreed upon. Recognizing the importance of this matter, the Association of American Agricultural Colleges and Experiment Stations, at its recent meeting in California, appointed a committee to confer with the Secretary of Agriculture on this subject and make a report to the Association at its next session.

The governing boards and executive officers of the stations feel the necessity of having the terms of co-operative operations definitely stated and the whole transaction made a matter of record as a component part of the station business. It is also desirable that ample opportunity should be given for the station to consider how far and in what ways co-operation with the department is desirable, and to what extent its funds will be involved in such co-operation. The stations are to an increasing extent becoming centers of information and authority on lines of work in which they have been engaged with special reference to the local requirements of agriculture, and it is by supplementing the funds already at the disposal of the stations for work in special lines, and by securing the services of their expert officers and the use of the special facilities at their command, that the Department can oftentimes accomplish results more economically and efficiently than by instituting parallel and independent investigations. As the operations of the stations become better organized in their respective localities, they have a just expectation that their knowledge of the local requirements of agriculture and their position as authorities on the subjects in which they work will be more fully

recognized. By the union of these State institutions with this Department in the conduct of the larger enterprises for the promotion of agriculture in the United States, much more can be accomplished than by either agency working separately. The relations between the stations and this Department were never more cordial and intimate than they are now, and a relatively large number of co-operative enterprises have been undertaken during the past year on terms mutually satisfactory to the Department and the stations.

AGRICULTURAL EXPERIMENT STATIONS IN ALASKA.

The work in Alaska during the past year has included a continuation of the agricultural survey of this region and the inauguration of permanent experiment stations in accordance with the changed terms of the appropriation act of the current fiscal year. The results of our investigations and the accumulated evidence from other sources have, it is believed, sufficiently shown the desirability and feasibility of regular experimental inquiries for the promotion of agriculture in Alaska. With the completion and equipment of the offices, laboratories, and farm buildings at Sitka and Kenai, it will be possible to prosecute these inquiries much more efficiently. The establishment of headquarters for similar work in the interior, which, it is hoped, may be done the coming season, will make it possible to obtain more definite information regarding the agricultural capabilities of this region, which differs so materially from the coast region.

AGRICULTURAL EXPERIMENT STATIONS IN HAWAII, PUERTO RICO, AND THE PHILIPPINES.

The experiment station at Honolulu, in the Hawaiian Islands, maintained by the Hawaiian Sugar Planters' Association, has continued to be successfully conducted during the past year. It is hoped that advantage will be taken of the basis for experimental inquiries in agriculture in these islands thus laid by local enterprise, and that the United States Government will speedily supplement the efforts of the people of these islands in this direction as it has done in the States and Territories. Agricultural experiment stations should also be established without delay in Puerto Rico, and a plan should be made for their organization in the Philippines as soon as peace and order are established in those islands. In some respects legislation for the establishment and maintenance of agricultural experiment stations in the islands, under the control of the United States Government, should be wider in its provisions than the Hatch Act. Especially should provision be made for meeting the need of the people of those islands for immediate information regarding improved methods of agriculture which it is possible to give them, on the basis of the results of agricultural investigations already made elsewhere.

Any plan for experiment stations in Hawaii, Puerto Rico, and the Philippines should involve the following features: (1) A local station with land, buildings, and equipment for field and laboratory investigations; (2) an agricultural survey to study the agricultural capabilities and requirements of these islands; (3) co-operative experiments with resident farmers; (4) dissemination, under frank, of bulletins of original and compiled information in the language of the people for whom they are intended; and (5) the holding of farmers' meetings in different localities for the diffusion of practical information.

EXPERIMENT STATION EXHIBIT AT THE PARIS EXPOSITION OF 1900.

An exhibit designed to show the development and present status of the experiment station enterprise in this country has been

prepared for the Paris Exposition of 1900 by a committee of the association of colleges and stations, of which Professor H. P. Armsby, director of the Pennsylvania Experimental Station, is chairman. The exhibit consists of a collection of special devices for station work and illustrations of notable results by means of models and otherwise, photographs and charts showing the buildings and equipment of the stations and special features of their work and their results, and the publications of the stations and of this office. In connection with this exhibit a comprehensive illustrated report on the history and present status of the stations has been prepared in the office of Experimental Stations with a view to showing what has been accomplished by the stations since their establishment, and the scope of this great enterprise on behalf of our agriculture as it exists at the close of the nineteenth century.

THE OFFICE OF EXPERIMENT STATIONS.

The work of the Office of Experiment Stations during the past year, as heretofore, has included the supervision of the expenditures of the stations; conferences and correspondence with station officers regarding the management, equipment, and work of the stations, and the collection and dissemination of information regarding the progress of agricultural investigations throughout the world by means of technical and popular bulletins. The special investigations on the nutrition of man and on irrigation assigned to this office have been prosecuted very largely in co-operation with experiment stations, educational institutions, and other agencies in the different States and Territories.

During the year the office issued 46 documents, aggregating 2924 pages. These include 13 numbers of the Experiment Station Record, with detailed index; 13 bulletins, 8 Farmers' Bulletins (including 5 numbers of the subseries entitled 'Experiment Station Work'), 3 circulars, 1 schedule, 3 articles for the Yearbook of the Department, the Annual Report of the Director, a report to Congress on the work and expenditures of the experiment stations, and 3 special articles published as separates.

The tenth volume of the Experiment Station Record comprises 1220 pages, and contains abstracts of 361 bulletins and 35 annual reports of 53 experiment stations in the United States, 172 publications of the Department of Agriculture, and 1224 rereports of foreign investigations. The total number of pages in these publications is 57,230. The total number of articles abstracted is 2023, classified as follows: Chemistry, 150; botany, 127; fermentation and bacteriology, 27; zoology, 23; meteorology, 46; air, water, and soils, 86; fertilizers, 109; field crops, 236; horticulture, 173; forestry, 34; seeds and weeds, 37; diseases of plants, 180; entomology, 202; food and animal production, 223; dairy, farming and dairying, 168; veterinary science, 86; technology, 6; agricultural engineering, 28; statistics, 82. Classified lists of articles, in some cases with brief abstracts are also given in each number. The aggregate number of titles thus reported is 1820.

STATISTICS OF THE STATIONS.

Agricultural experiment stations are now in operation, under the act of Congress of March 2, 1887, in all the States and Territories. As stated above, agricultural experiments have been begun in Alaska with the aid of national funds, and an experiment station is in operation in Hawaii under private auspices. In each of the States of Alabama, Connecticut, New Jersey, and New York a separate station is maintained wholly or in part by State funds, and in Louisiana three stations are maintained with national and State funds. Excluding

the branch stations established in several States, the total number of stations in the United States is 56. Of these, 52 received the appropriation provided for in the act of Congress above mentioned.

The total income of the stations during 1899 was $1,143,334.93, of which $720,000 was received from the National Government, the remainder, $423,334.93, coming from the following sources: State governments, $240,300.20; individuals and communities, $12,100; fees for analyses of fertilizers, $75,294.42; sales of farm products, $69,312.60; miscellaneous, $26,327.71. In addition to this the Office of Experiment Stations had an appropriation of $40,000 for the past fiscal year, including $10,000 for the Alaskan investigation. The value of additions to equipment of the stations in 1899 is estimated as follows: Buildings, $27,218.64; libraries, $10,796.15; apparatus, $16,917.07; farm implements, $10,784.88; live stock, $16,265.95; miscellaneous, $22,521.93; total, $104,504.62.

The stations employ 678 persons in the work of administration and inquiry. The number of officers engaged in the different lines of work is as follows: Directors, 71; chemists, 148; agriculturists, 68; experts animal husbandry, 9; horticulturists, 77; farm foremen, 21: dairymen, 23; botanists, 52; entomologists, 48; veterinarians, 36; meteorologists, 17; biologists, 7; physicists, 7; geologists, 5; mycologists and bacteriologists, 20; irrigation engineers, 5; in charge of substations, 16; secretaries and treasurers, 24; librarians, 9; and clerks, 43. There are also 48 persons classified under the head of 'miscellaneous,' including superintendents of gardens, grounds, and buildings, apiarists, herdsmen, etc. Three hundred and eight station officers do more or less teaching in the colleges with which the stations are connected.

During 1899 the stations published 445 annual reports and bulletins. Besides regular reports and bulletins, a number of stations issued press bulletins, which were widely reproduced in the agricultural and county papers. The mailing lists of the stations now aggregate 500,000 names. Correspondence with farmers steadily increases and calls upon station officers for public addresses at institutes and other meetings of farmers are more numerous each year. The station officers continue to contribute many articles on special topics to agricultural and scientific journals. A number of books on agricultural subjects, written by station officers, have been published during the past year.

SCIENTIFIC BOOKS.

The Diuturnal Theory of the Earth. Published by Myra Andrews and Ernest G. Stevens. New York. 1899.

This work belongs to a class usually not worth reviewing, but concerning which it is perhaps unwise to be absolutely silent. In this instance the earnest, well-meaning seriousness of the author, the abounding faith of the publishers, growing probably out of close family relationship, together with the absence of absolute impossibility or absurdity in the general doctrine advocated, fully justify a brief notice of the book. It is a well-printed octave volume of about 550 pages, and includes a portrait and a biographical sketch of the author.

Mr. William Andrews, the discoverer of the 'diuturnal motion of the earth,' was born in Philadelphia in 1798, and died at Cumberland, Md., where he had lived for half a century, on August 6, 1887. The preface to his book is dated 1876—and it was issued late in the year 1899. His business was that of a stationer and book binder, but his chief delight was in making geological and natural history collections, accumulating a 'museum' containing many thousand specimens. In this work he appears to have been successful and a portion of his 'museum' was purchased by the State of New York. The preparation of this work occupied much of his time during the later years of his life, but he also left manuscript essays on psychology and