State of Connecticut.

SECOND BIENNIAL REPORT OF THE COMMISSIONERS

OF THE

State Geological and Natural History Survey

1905-1906

State of Connecticut

PUBLIC DOCUMENT No. 47

State Geological and Natural History Survey

BULLETIN NO. 9

HARTFORD PRESS
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1906

SECOND BIENNIAL REPORT OF THE COMMISSIONERS

OF THE

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HARTFORD, CONN., December 26, 1906.

HIS EXCELLENCY, HENRY ROBERTS, Governor of Connecticut,
Hartford, Connecticut.

Sir: — I have the honor to transmit to you herewith, in behalf of the Connecticut Geological and Natural History Survey Commission, the report of the Superintendent of the work, covering the period of two years ending December 31, 1906.

Very respectfully,
FLAVEL S. LUTHER,
Secretary of the Commission.

STATE GEOLOGICAL AND NATURAL HISTORY SURVEY.

SECOND BIENNIAL REPORT.

SCOPE AND PLAN OF THE SURVEY.

In this second report it may be convenient briefly to recapitulate what was more fully stated in the first report in regard to the aims of the Survey and the plan of organization which has been adopted. The act establishing the Survey was approved June 3, 1903. The title given to the Survey in that act, and the more explicit language of section 2 of the act, present to the Survey two subjects for investigation; viz., the geology of the state, and the natural history, or botany and zoology, of the state. While no specific directions are given in the law as to the proportionate amounts of time and money to be expended upon the various objects of study, it has been assumed as a fair interpretation of the spirit and intent of the law that geology and biology should receive not far from equal shares of the appropriation. The law establishing the Survey further sets before us three aims to be regarded in the studies undertaken and in the mode of publication of their results:—first, the advancement of our knowledge of the botany, zoology, and geology of the state, as a matter of pure science; second, the advancement of the economic interests of the state by the acquisition and publication of the knowledge of its resources; third, the promotion of the educational work of the schools of the state by the publication of the results of investigation in such form as will be adapted for the use of teachers. We have planned the work of the Survey with the purpose of accomplishing these three objects as far as our limited means would allow.

The plan of organization, of which an account was given in the first report, has been retained. Only one salaried officer has been appointed by the Commissioners; viz., the Superintendent. Other scientific men have been engaged to investigate particular subjects and to prepare reports or bulletins thereon. In the great majority of cases the terms of contract with these scientific men have been that the investigator should receive a certain sum as compensation when the bulletin presented was accepted by the Superintendent, and that a certain allowance should also be made from the appropriation for the Survey for the expenses of the work, the allotment for expenses to be drawn upon from time to time as the expenses were actually incurred. In a few cases scientific men have been engaged to commence investigations which they were not expected to finish within the current biennial term; in which cases the compensation offered has been regulated by the amount of time which was to be spent in these preliminary investigations.

Each report prepared is published as a separate bulletin, the bulletins being numbered consecutively, generally in the order of time in which they are received. Each bulletin bears the name of the author or the names of the authors, and each author is responsible for his own work. The bulletins are issued in paper covers, but a part of the edition is reserved for binding. From time to time the bulletins which have been published will be collected for binding in volumes generally of not less than 500 pages nor more than 1000. The publications of the Survey are distributed by the State Librarian. They are given liberally to colleges, public libraries, geological surveys, and other scientific institutions, and to scientific men of repute in the branches of science with which the respective bulletins are concerned. In many cases publications of great value are received in exchange for the publications of the Survey. All books and papers thus received in exchange are deposited in the State Library. The publications of the Survey are also distributed liberally

to citizens of our own state. In the case of persons in other states who are not known as scientific men, and who appear to have no special claim for the donation of the publications of the Survey, the bulletins are sold at prices sufficient to cover the cost of printing and binding.

BULLETINS ALREADY PUBLISHED.

The First Biennial Report of the Commissioners is numbered in the consecutive series as Bulletin No. 1. Since the presentation of that report four other bulletins have been published as follows:—

No. 2. A Preliminary Report on the Protozoa of the Fresh Waters of Connecticut; by Herbert William Conn.

No. 3. A Preliminary Report on the Hymeniales of Connecticut; by Edward Albert White.

No. 4. The Clays and Clay Industries of Connecticut; by Gerald Francis Loughlin.

No. 5. The Ustilagineæ, or Smuts, of Connecticut; by George Perkins Clinton.

These reports have received high commendation from scientific journals and from the newspaper press of our own and other states, and it is believed that they record important accessions to the useful knowledge of the natural history and resources of our state.

Professor Conn's Report on the Protozoa of our Fresh Waters is illustrated by thirty-four plates made from drawings by his own hand. This bulletin is of great utility in an educational point of view, since most of the literature dealing with the protozoa is not readily accessible to the teachers in our high schools and to students who may wish to study the minute life of Connecticut fresh waters.

Professor White's Report on the Hymeniales deals with a group of relatively large and conspicuous fungi, which are of economic importance because some of them are edible and others are extremely poisonous. The report is illustrated with forty plates mostly from exquisite photographs taken by Professor White himself. Within the last few years a great interest has been awakened in the

subject of fungi, particularly with reference to their edible qualities, and Professor White's work has therefore responded to a popular demand.

Dr. Loughlin's paper on the Clays and Clay Industries of the state is a valuable contribution both from the standpoint of pure science and from that of the economic application of science. It discusses the distribution of our Connecticut clays and the geological conditions under which they were formed, and their physical and chemical properties, and treats very fully of their uses in the manufacture of brick and pottery.

Dr. Clinton's Report on the Smuts deals with a group of microscopic parasitic fungi whose economic importance is very great on account of the destruction of agricultural products which they cause. It has been estimated that in Illinois an average loss of oats alone to the value of $1,000,000 is caused by two species of these parasitic fungi. Dr. Clinton's investigation has been thorough and elaborate, and his brief paper is of high scientific and economic value.

BULLETINS ACCEPTED FOR PUBLICATION.

Three bulletins have been accepted for publication, two of which are already in type. These are the following:—

No. 6. Manual of the Geology of Connecticut; by William North Rice, Professor of Geology in Wesleyan University, and Herbert Ernest Gregory, Professor of Geology in Yale University.

No. 7. Preliminary Geological Map of Connecticut; by Herbert Ernest Gregory, and Henry Hollister Robinson, Instructor in Geology in Yale University.

No. 8. Bibliography of Connecticut Geology; by Herbert Ernest Gregory.

The Manual of Geology will be the first publication which has aimed to give a somewhat detailed account of the geology of the entire state of Connecticut since the publication of Percival's report in 1842. It is needless to say that our knowledge of the subject has greatly advanced within that period of almost two-thirds of a century. Much

has been done in the study of Connecticut geology in the field by officers of the U. S. Geological Survey and by private individuals, and the general advance of dynamical geology has put a new interpretation upon facts previously known. But the results of the new work on Connecticut geology, so far as they have been published, are scattered through numerous volumes of official reports, scientific journals, and proceedings of learned societies, so as to be inaccessible to those who are not within reach of large libraries or who have not acquired the difficult art of searching through numerous reports and serials for the scattered treasures buried therein. Especially for the teachers in our state it is believed that the Manual of Geology will meet a long felt want.

The Geological Map of Connecticut is on a scale of four miles to the inch. It is to be produced by chromolithography in the establishment of Julius Bien & Co. The map will be accompanied by a brief pamphlet giving a historical sketch of the geological investigations which have furnished the data, with all necessary explanations of the map itself. The map is to be issued in three different forms:— the first, printed on thin paper, folded and inserted in the pamphlet; the second, printed on thick paper, rolled, and forwarded in a pasteboard tube; the third, mounted on cloth and provided with rollers for use as a wall map. Those persons and institutions who choose to receive the map in one of the two latter forms, which are, of course, more expensive than the first, will pay the difference in cost. It is hoped that a copy of this map will soon be displayed in every high school in the state.

The Bibliography of Connecticut Geology has been compiled with much labor and care by Professor Gregory. It gives not only the titles, but also a brief analysis of the contents, of all important publications relating to Connecticut geology, whether appearing as independent works or as articles in government reports or in scientific serials. An account is also given of maps in which the geology of the entire state or of parts of the state is shown. It is

believed that all students of the geology of the state will find this bulletin very useful.

WORK STILL IN PROGRESS.

The investigations still in progress may be described under the three heads, geology, botany, and zoology.

I. Geology.

Professor Joseph Barrell, of Yale University, has been engaged, with the assistance of Dr. G. F. Loughlin, on a paper on the rocks of Connecticut. This paper will describe all the important lithological types represented in Connecticut, giving their chemical and mineralogical constitution, their appearance to the naked eye, and somewhat in regard to their aspect when studied in thin sections under the microscope. Special attention will be given to those rocks which are useful as building stones or as ornamental stones. This bulletin will be illustrated by suites of specimens of the rocks of Connecticut which have been collected under the direction of Professor Barrell. One of these suites of specimens will be given to each of the colleges, normal schools, and important high schools and academies of the state, on the simple condition of payment of the expense of transportation. Such a suite of typical Connecticut rocks, with the bulletin describing the same in language no more technical than is absolutely necessary, will be, it is believed, of very great educational value.

F. P. Gulliver, Ph.D., of Norwich, is engaged in a detailed and elaborate study of the terraces of the Thames estuary. This paper, it is expected, will be a valuable contribution to geological science. Recent studies have shown that in all probability some of the river terraces, particularly in the lower or estuarine parts of the rivers, were not formed, as has been commonly assumed, after the retreat of the ice sheet of the Glacial period from the valley or portion of valley in which they are situated, but are rather in the nature of delta deposits formed by the water flowing out from tongues of the glacier which projected

into the valleys after the ice had receded from the higher ground adjacent. The work of Dr. Gulliver on the terraces of the Thames is an example of a kind of work which should be done on other rivers.

Professor H. E. Gregory, of Yale University, has commenced a general study of the Quaternary geology of the state. In the geological map which is soon to be published the Quaternary is entirely omitted. It is hoped that it may be practicable at no very distant date to construct a map of the Quaternary deposits of the state, perhaps on the same scale as the map of the older formations now being published. It is not expected that Professor Gregory's work will be sufficiently advanced to be embodied in a bulletin within the present biennial term; but, if an appropriation shall be made for the next biennial term, his work will doubtless be continued, and will result in the preparation of an important bulletin.

II. Botany.

The Connecticut Botanical Society has nearly finished an annotated list of the flowering plants and the highest group of the flowerless plants (phanerogams and pteridophytes) of the state. This list represents a large amount of labor contributed by a large number of earnest workers. It will be a valuable contribution to science, and especially useful to the teachers of the state.

Professor Alexander W. Evans and Mr. George E. Nichols, of Yale University, have been engaged for some time on a paper on the mosses and liverworts (bryophytes) of the state. Their work is nearly ready for publication, and will be issued as a bulletin. It will be a valuable contribution to our knowledge of that group of plants.

Professor E. A. White, of the Connecticut Agricultural College, has continued his study of the fleshy fungi, on which he presented a preliminary report, published as Bulletin No. 3. A second bulletin, which he is expected to have ready for publication at an early date, will present the result of a more detailed study of the family Agaricaceæ.

Special attention will be given in this paper to the full description of the edible species of the group.

George P. Clinton, Sc.D., of the Agricultural Experiment Station, New Haven, whose paper on the smuts was published as Bulletin No. 5, is at work on another important group of parasitic fungi; viz., the downy mildews. This group includes a number of parasites destructive to important agricultural products, and will be therefore an important contribution to the economic botany of the state.

Professor H. W. Conn, of Wesleyan University, is continuing his study of the microscopic life of our fresh waters and particularly of our reservoirs. He has already published as Bulletin No. 2 of this Survey a report on the protozoa of these waters. A paper on the fresh-water algæ, by Professor Conn and Mrs. L. W. Webster, is well advanced towards completion, and will doubtless be presented for publication at an early date. Investigations of the bacteria of our fresh waters are also in progress in Professor Conn's laboratory, but it is not expected that the work on that group will be so far advanced as to be published within the present biennial term.

III. Zoology.

Mr. John H. Sage, of Portland, and Dr. Louis B. Bishop, of New Haven, are at work upon a very elaborate and valuable paper on the birds of Connecticut. Their bulletin will not contain descriptions of the birds, since good manuals of the ornithology of this part of the country are readily accessible. The work of Messrs. Sage and Bishop will contain an immense amount of information in regard to the date of arrival and departure of our migratory birds, the localities of rare birds, and the food and habits of the birds. This bulletin will be of very great importance, both economically and educationally. A large edition will be printed, and its wide distribution will be of great utility.

W. E. Britton, Ph.D., of the Agricultural Experiment Station, New Haven, with the assistance of Messrs. H. L. Viereck and B. H. Walden and other collaborators, is pre-

paring reports on two important groups of insects, viz., the hymenoptera and the orthoptera. These bulletins will contain analytical keys for the identification of the genera and species, and will also treat of the economic relations of the insects of these groups. Many of the insects of these groups are notably useful or injurious; and these reports of Dr. Britton will be important contributions in all three of the lines to which the work of the Survey is directed: the scientific, the economic, and the educational.

Professor Wesley R. Coe, of Yale University, is preparing a paper on the small but exceedingly interesting group of echinoderms. The star-fishes, which are among the best-known representatives of this group, occasion a very serious loss to the resources of the state by the ravages which they make in oyster beds; and, apart from the purely scientific aspect of the group, Professor Coe has given much attention to their economic relations. This paper on echinoderms, it is hoped, will be the beginning of a series of papers by various authors on the various groups of marine animals on our coast.

DISTRIBUTION OF THE APPROPRIATIONS.

The payments for the work already completed have been as follows:—

Name	Work	Compensation	Expenses
W. N. Rice,	Superintendence, 1903-5,	$400	$189.41
H. W. Conn,	Bulletin No. 2,	400	198.73
E. A. White,	" " 3,	150	88.68
G. F. Loughlin,	" " 4,	30	9.03
G. P. Clinton,	" " 5,	50	8.20
H. E. Gregory,	" " 6,	150	
H. E. Gregory and H. H. Robinson,	" " 7,	450	250.00

In several of these cases the payments on account of expenses have been much less than the amounts allotted.

The allotments for work now in progress are as follows:—

Name	Work	Compensation	Expenses
W. N. Rice, . . .	Superintendence, 1905-7,	$400	$300
J. Barrell, ...	Rocks, ...	150	550
F. P. Gulliver, . . .	Terraces of Thames River, ...	100	150
H. E. Gregory, . . .	Quaternary Geology, .	200	150
Conn. Botanical Society, .	Phanerogams and Pteridophytes, . . .	0	100
A. W. Evans and G. E. Nichols, ...	Bryophytes, . . .	100	50
E. A. White, . . .	Agaricaceæ, . . .	100	75
G. P. Clinton, . . .	Downy Mildews, . .	50	25
H. W. Conn, . . .	Algæ and Bacteria of fresh water, . .	150	250
J. H. Sage and L. B. Bishop, . . .	Birds, ...	200	200
W. E. Britton, . . .	Hymenoptera and Orthoptera, . . .	125	75
W. R. Coe, . . .	Echinoderms, . .	75	25

The fact will be noted that the compensation is in all cases very small in relation to the amount of work done and the grade of ability and attainment of the scientific men employed. The work has been indeed on the part of all who have been engaged in it a labor of love.

LEGISLATION DESIRED IN REGARD TO PUBLICATION OF THE REPORTS OF THE SURVEY.

In our first Biennial Report attention was called to the fact that the general law of the state allows only 1375 copies of any official report to be printed, and that such an edition is altogether inadequate for the bulletins of the Survey. It is desired that the bulletins of our Survey should be, as is customary in other states, widely distributed to colleges, scientific institutions, public libraries, scientific men, teachers, and others. The editions of similar reports published by other states are never less than 1500, and generally range from 3000 to 8000. In our former report we recommended that 3000 copies of the Biennial Report, 4500 of the Manual of Connecticut Geology and the report of Messrs. Sage and Bishop on Birds, and 3500 of the other

bulletins then in preparation, should be printed. At the last session of the General Assembly a resolution was adopted authorizing the printing of the desired number of copies of so many of the bulletins as should be ready for printing before January 1, 1907. As the authorization granted by this resolution lapses before the beginning of the ensuing session of the General Assembly, it is necessary for us now to request the General Assembly to authorize the printing of editions of the bulletins to be published in the near future larger than is permitted by the general law. As is apparent from what has already been said, the bulletins which will soon be issued present much variety of contents, some of them being of a more popular character and appealing to a larger constituency than others. The respective numbers of copies of the bulletins to be published in the near future, necessary to meet the demand which may be reasonably anticipated, are as follows:—

Author	Subject	No. of Copies
H. E. Gregory,	Bibliography of Connecticut Geology,	3000
J. Barrell,	Rocks of Connecticut,	3500
F. P. Gulliver,	Terraces of Thames River,	3000
Conn. Botanical Society,	Flora of Connecticut,	4000
A. W. Evans,	Mosses and Liverworts,	3000
E. A. White,	Fleshy Fungi,	3500
G. P. Clinton,	Downy Mildews,	3000
H. W. Conn,	Fresh-water Algæ,	3500
J. H. Sage and L. B. Bishop,	Birds of Connecticut,	4500
W. E. Britton,	Orthoptera and Hymenoptera,	3500
W. R. Coe,	Echinoderms,	3500

We accordingly respectfully recommend that a number of copies of each of the above named bulletins may be authorized to be printed, in addition to the 1375 copies prescribed by the general law, sufficient to amount to the numbers above specified.

PLANS FOR FUTURE WORK.

I. Geology.

It may be said in general that much more of detailed work will be required than has yet been given to many parts of the state. The Manual of Geology and the Geological Map which are now in press must be considered as reports of progress and not as final reports upon the geology of the state. It has been deemed wise to publish these two bulletins as representing the present state of our knowledge, rather than to wait an indefinite period for the correction of all errors and the supplementing of all deficiences. But the geological work which has been done in some parts of the state is little more than reconnoissance. This is especially true of the crystalline rocks of eastern Connecticut. It is possible that the prosecution of detailed work in the field may bring to light facts which will lead to important changes in our general conception of the geological history which those rocks represent.

In the important department of glacial geology, only a beginning has been made. Much of the work which has been done in the study of terraces and other Quaternary formations has been largely vitiated by theoretical notions now believed to be erroneous. Evidently a large amount of work must be done before the Glacial and post-Glacial history of our state can be understood. The detailed investigation by Dr. Gulliver in regard to the terraces of the Thames estuary is an example of the kind of work which needs to be done in other localities. Professor Gregory has made a beginning of a general study of the Quaternary formations of the state; but a large amount of work must be done before any satisfactory map of our Quaternary formations can be prepared.

A report on the mineralogy of our state would be very useful. A simple list of minerals found in the different towns of the state has, indeed, been published in Dana's standard works on Mineralogy; but a report on the mineralogy of the state should give a somewhat detailed description of the important mineral localities, illustrated,

when necessary, by sketch maps; and should also treat of the geological relations of the various minerals.

Another subject on which a bulletin would be desirable is the fossil fishes of the Triassic formation. Our knowledge of fossil fishes in general has advanced considerably since the publication of Newberry's Fossil Fishes of the Triassic (Monograph No. 14 of the United States Geological Survey). Extensive collections of the fossil fishes of Connecticut are to be found in the museums of Yale and Wesleyan, and also in possession of the United States Geological Survey; and a monograph written in the light of most recent knowledge would be very desirable.

The work of the United States Geological Survey in testing the fuel value of various mineral hydrocarbons has awakened great public interest in the deposits of peat. It has long been known in a vague and general way that Connecticut, like all other regions in which the preëxistent drainage was disturbed by the ice sheet of the Glacial period, possesses extensive deposits of peat; but nothing is definitely known in regard to the area, or depth, or quality of the peat deposits of Connecticut. An investigation which should be undertaken at an early date, is a detailed survey of the peat deposits of Connecticut. Such an investigation may result in the revelation of an important item of our resources.

II. Botany.

It is unnecessary for the State Survey to publish a manual giving descriptions of flowering plants or of ferns and their allies, since there are books readily accessible to the public that treat in a full and satisfactory way the systematic botany of the higher groups of plants. An investigation which the State Survey might appropriately undertake would be the study of the distribution of plants with reference to altitude, geological formation, distance from the sea, temperature, and rain-fall, and the grouping of plants into plant societies in different areas — in short, the study of what is now called the ecology of plants.

While there is no lack of works accessible to the public on the phanerogams and the higher cryptogams, the case is very different with the lower cryptogams, to which, in general, much less attention has been given. The work of Professor White on some of the groups of large and conspicuous fungi, of Dr. Clinton on some of the microscopic parasitic fungi, and of Professor Conn on the fresh-water algæ and bacteria, is a good beginning; but much work remains to be done in that field.

III. Zoology.

One of the plans which were discussed among those who were interested in the establishment of a State Natural History Survey, even before the organization of the Survey was effected, was that of making a complete study of the life, and particularly of the minute life, of our fresh waters, both in the interest of pure science, and in the thought of possible economic results from the knowledge of distribution of organisms in reservoirs and other sources of the water supply of the community. In accordance with this general plan, Professor Conn is engaged in the study of the protozoa, algæ, and bacteria of our fresh waters. This study should be extended to include all the other groups of organisms living in our fresh waters. A thorough study, for instance, of the minute crustacea that abound in our fresh waters, would be interesting and valuable.

Dr. Britton and his collaborators will soon have ready for publication elaborate and important papers on two groups of insects, the hymenoptera and the orthoptera. There are, however, other groups of insects, more numerous than these, including larger numbers of species economically important for the good or the evil which they do to agricultural interests. It is obviously desirable that, in the near future, similar studies should be made of other groups of insects.

Connecticut has a long coast line and a varied marine fauna, including a number of useful species and some very decidedly injurious ones. Practically nothing has been

published on the marine invertebrate fauna of our coast, with the exception of descriptions of particular species and other papers on technical details, since the paper by Verrill and Smith on the Invertebrate Animals of Vineyard Sound, published in the report of the United States Commissioner of Fish and Fisheries for 1871-2. A series of papers on the various groups of marine animals, with analytical keys to families and genera, and with due notice of those species whose utility or injuriousness makes them of economic importance, would be invaluable to teachers, and might also be of considerable utility to the fisheries of the state.

THE NEED OF FURTHER APPROPRIATIONS.

While it is believed that the investigations which have been undertaken under the auspices of the State Survey, and the publications in which the results of these investigations have been or will be embodied, are important scientifically, educationally, and economically, it is at once obvious that the work completed or in progress is only a very small part of the work which may appropriately be done by such a Survey. If it was wise to establish a State Survey in 1903, it is wise now to continue it and provide the necessary appropriation for its maintenance.

Many of the other states are carrying on at the present time geological surveys on a much larger scale than that of our own state. For instance, North Carolina, Wisconsin, and New Jersey have been appropriating in recent years $10,000 annually for the work of their geological surveys, exclusive of the cost of publication. Maryland appropriates $10,000 a year for its geological survey, inclusive of the cost of publication, but exclusive of much larger appropriations for topographical work and improvement of highways. Alabama appropriates $7,500 per year; Ohio, $2,900; Michigan, $8,000; Indiana, $7,620; Vermont, $1,550; West Virginia, $7,000; Georgia, $8,000. Kansas appropriates $3,000 for its geological survey, exclusive of the salary of the director. All of these appropriations (except that of Maryland) are exclusive of the cost of publication of the results

of the survey. Most of these appropriations, moreover, are for geology alone. Ohio is agitating for the establishment of a natural history survey, in addition to its geological survey. The comparison with other states makes it obvious that, in the appropriation of $3,000 for the biennial term, Connecticut is not erring in the direction of too lavish expenditure.*

The history of the state surveys in other states shows a differentiation, more or less definite, of surveys that have been established, into two classes. In some instances, appropriations have been made, generally somewhat liberal in amount, for a very short term of years, in the expectation that final reports on all the subjects treated should be published, and the survey should be discontinued. In other cases, the plan of annual appropriations has been followed, often comparatively small in amount, continuing somewhat permanently. The state of New York, for instance, though it has at present no institution bearing the title of State Geological Survey, has been maintaining geological and biological investigations and publishing reports of the same almost continuously for more than sixty years. There is certainly much to be said in favor of the plan of moderate appropriations continued permanently, as contrasted with the plan of large appropriations for a few years. In the nature of the case, it is impossible that the study of the geology or the biology of a state should ever be exhausted. The advance of science, while it solves some problems, suggests new ones. The changes which are being made continually in the processes of arts and manufactures bring into use from time to time new forms of raw material and create a demand therefor. The study of the products and resources of any area, whether from the scientific or from the economic standpoint, takes on from time to time new meanings with the progress of science and art.

If, then, final reports are issued and a survey discontinued, a new survey is imperatively demanded after a

* The numerical statements in this paragraph were obtained in 1905. There may have been changes in the amount of the appropriations by more recent legislation in some of the states.

lapse of not many years. A survey continued as a permanent institution with a moderate appropriation each year is able to do its work economically, in that it can largely employ the services of teachers in colleges and other institutions and to some extent of amateur scientists, who are willing to work in vacations or at odd times for merely nominal compensation. If, on the other hand, a survey is to be hurried up and final reports produced within a period of a very few years, a considerable corps of scientific workers must be engaged, and salaries paid which will command substantially their whole time. A permanent survey can adjust its work from time to time to special conditions, both of supply and demand. It can avail itself of important investigations which have been commenced by various scientists within or without the state, and thus afford a medium for the publication of researches of importance which might otherwise remain long unpublished. It can turn its attention from time to time to particular natural products in which popular interest may be excited, as, for instance, in the case of peat deposits at the present time. Its work may thus have an added value, dependent upon its timeliness. It can revise and correct its own work when the progress of science demands it, by the publication of supplementary reports.

It is not probable that the state of Connecticut will make at present any large appropriation for the State Survey. It should certainly provide for the continuance of a moderate appropriation, and it would seem entirely reasonable that there should be some increase of the very small appropriation which has been made for the present and the previous biennial term.

ADVERTISEMENT.

List of Bulletins of the State Geological and Natural History Survey of Connecticut.

1. First Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1903-1904.
2. A Preliminary Report on the Protozoa of the Fresh Waters of Connecticut; by Herbert William Conn.
3. A Preliminary Report on the Hymeniales of Connecticut; by Edward Albert White.
4. The Clays and Clay Industries of Connecticut; by Gerald Francis Loughlin.
5. The Ustilagineæ, or Smuts, of Connecticut; by George Perkins Clinton.
6. Manual of the Geology of Connecticut; by William North Rice and Herbert Ernest Gregory. (In press.)
7. Preliminary Geological Map of Connecticut; by Herbert Ernest Gregory and Henry Hollister Robinson. (In press.)
8. Bibliography of Connecticut Geology; by Herbert Ernest Gregory. (In press.)
9. Second Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1905-1906.

Bulletins 1 and 9 are merely administrative reports, containing no scientific matter. The other bulletins may be classified as follows: —

Geology; Bulletins 4, 6, 7, 8.
Botany; Bulletins 3, 5.
Zoölogy; Bulletin 2.

These bulletins are sold and otherwise distributed by the State Librarian. The prices are as follows: No. 1, $0.05; No. 2, .35; No. 3, .40; No. 4, .30; No. 5, .15; No. 6, .50; No. 7, .60*; No. 9, .05.

It is intended to follow a liberal policy in gratuitously distributing these publications to public libraries, colleges, scientific institutions, and to scientific men, teachers, and others who require particular bulletins for their work, especially to those who are citizens of Connecticut.

Applications or inquiries should be addressed to

GEORGE S. GODARD,
State Librarian,
Hartford, Conn.

*If map is printed on thick paper, and sent in a mailing-tube, $0.75; if map is mouuted as a wall map, and sent by express, $1.60.

CATALOGUE SLIP.

Connecticut. *State geological and natural history survey.*

... Bulletin no. 9. Second biennial report of the commissioners of the state geological and natural history survey, 1905–1906. Hartford, 1906.

23 pp., 23^{cm}.

[Administrative report, containing no scientific matter.]