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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE SCOPE AND METHOD OF STATE NATURAL HISTORY SURVEYS[1]

IT is a matter of common knowledge that before the middle of the last century many of the states of the union had established state surveys, and the national government was exploring the great west, fixing boundaries, locating routes and trails, and mapping the physical features in those vast areas. In both state and national surveys, geology received a large share of attention, but physiography, zoology and botany were not neglected. Many of the states, after making a recognizance of the geological features, identified and listed their plants and animals, as did the states of Maine, New Hampshire, Massachusetts, New Jersey, Ohio and Indiana. A condition to be noted in the establishment of a number of these early state surveys is that they were organized for the purpose of exploring and studying all of the natural resources of the commonwealth, scientific as well as economic. The survey of Michigan was established at the admission of the state to the union in 1837 as geological, zoological, botanical and topographic. The prevailing idea in these early surveys in the various states seems to have been what we may designate by the word *recognizance,* including geology, physiography, botany and zoology.

As the century continued through its third and entered its fourth quarter, the main attention of the state surveys became

[1] Address of the vice-president and chairman of Section G, American Association for the Advancement of Science, Cleveland, December 31, 1912.

more and more centered in things concerned with mineral wealth; surveys that formerly had included natural history became restricted to geology, and the geology was often confined to economic studies, so that more than one geologist found himself subject to censure because he wasted his time on such supposedly worthless things as fossils. However, there was a great diversity among the states in the scope of the work they tried to do; and some of them published occasionally a volume on plants and animals. One of the best of such publications is the botany of California, appearing in 1880, the work on which was done by Brewer, Watson and Gray. This is a description of species with notes on habitat and range; but the most of the botany and zoology of this period is mere lists of species, as far as state surveys are concerned.

Special note should here be made of the survey of New York, which is the only example known to the writer that from the first has continued its natural history studies.

It is evident from what has been said that 30 years ago natural history had been largely eliminated from state surveys. In recent years, however, there seems to be a slight tendency to replace this work in the state survey. It is true that the number of states adding natural history to their work within the past quarter of a century has been small, only the states of Connecticut, Wisconsin, Michigan and North Dakota; but the surveys of New York, Illinois and Minnesota have shown renewed activity in natural history within this period, and the activity of agencies outside of official state surveys may be taken as an indication that other states will soon be persuaded to resume this work. These agencies include universities, colleges or museums that are doing some work without order from the state, like the state museums of New Jersey and Louisiana; academies of science, like those in Indiana, Illinois and other states which have started surveys, some of these academies having their work published at state expense; volunteer associations, like the Botanical Seminar of Nebraska and the recent association of universities and colleges of Ohio; and, finally, individuals, like Pammel in Iowa, Hitchcock in Kansas, Nelson in Montana, Bray in Texas and Ramaley in Colorado, who contribute papers on the biogeography of their respective states, sometimes as bulletins of the institutions with which they are connected, sometimes as reports of academies, sometimes as a gratuitous paper in a geological survey.

Though we may feel encouragement over the awakening of interest in natural history, the present condition of the survey work in this subject in most of the states must be regarded as very unsatisfactory. Only 7 states are conducting continuous and systematic natural history surveys, and the most of the work done by outside agencies is more or less haphazard and sporadic. State academies seldom have funds enough to plan any large undertaking, and their future income is not sure enough to allow the laying of plans for a series of years. Men in colleges who may have started surveys give up their positions, and the work stops. Moreover, the scattering of the reports of surveys through several serials, official surveys, college bulletins, and academy reports, is not to be commended. Suppose one should wish to learn what had been published on the botanical survey of Ohio; in how many different publications would he have to search?

What is here said must not be interpreted as condemning state survey work outside of the official surveys. I am not

ignorant of the immense amount of valuable work that has been done by these volunteer agencies, work that would be still undone if it had waited for the call of the state. What a happy conjunction of ability, disposition and means was that in Nebraska which resulted in the "Phytogeography" of that state! A brilliant effect not repeated elsewhere. Also one recalls the valuable papers dealing with state vegetation in Vermont, New Jersey, Iowa, Kansas, Colorado and Texas, all done in recent years outside the official surveys. Success of this kind usually depends on the ability and activity of one or a few spirits whose mantles do not descend on their followers in office.

Besides their value to science, these efforts of individuals, academies, and other non-governmental organizations to contribute to state surveys have the valuable effect of stimulating and promoting interest in such matters till such time as the state will establish and conduct surveys at state expense. The establishment of the Biological Survey in Michigan in 1905 was the direct result of the efforts of the Michigan Academy of Science put forth for the preceding ten years.

There are probably few states in the union whose governing bodies have not been appealed to within the last quarter of a century for funds to undertake natural history surveys; and yet, in spite of all this effort, only four states within this period, to the best of the writer's knowledge, have responded with any considerable financial support—the states of Wisconsin, Connecticut, North Dakota and Michigan. The states of New York, Illinois and Minnesota began their natural history surveys before this quarter-century, and have continued them with fairly generous support.

Seeing that so many of the state governments have been appealed to for aid, and only seven are lending any considerable support, the conclusion is inevitable that the appeal has not strongly interested the governing body; or, to reduce the matter to terms of practical politics, the appeal has not aroused sufficient backing to move state executives and legislatures. What have been the terms of this ineffective appeal? Here let the writer call upon his own experience, while believing that his own experience has been that of many others.

The appeals for state aid have generally recited three classes of benefits to be enjoyed by the state from state natural history surveys. These three are classed as economic, scientific and educational. Taking a leaf from the uniformly successful experience of geological surveys, the natural history promoters have first of all argued for the economic good to the state to come from a natural history survey, in the way of better knowledge of agricultural lands, the promotion of forestry, the increase of fish and game, the discovery and combating of plant and animal diseases, etc. Although this argument has been strengthened by reference to the profitableness of the fish and game industry of Maine, by depicting the sad state of the cut-over forest lands which the survey might remedy, and by numerous other citations, the legislators seem never to be sure that the argument applies to their own state; or, they are not sure that the benefits will not come without the cost of a survey.

The trouble with the argument for economic good seems to be that it is too vague to be convincing. The state geologist in asking for his appropriation proposes to explore a district for iron or copper, or to make a report on water-power or artesian waters. Local or corporate interests force

the matter through the legislature. The committee from the academy of science in presenting to the legislature its claims for a natural history survey, unlike the geologist, seldom has a definite promise of a definite task to be performed whose conclusion will be of economic interest to the state. It may be that some advocates have the ability to convince a legislative committee of the economic value to the state of a natural history survey; but it is certain that the most of the advocates of the past have not been so highly gifted.

The second argument usually employed in furtherance of a natural history survey pertains to the benefit to be enjoyed by science. The legislators have been reminded that the pride and patriotism of the state require that she should do her part toward building the great structure on which New York and Illinois are so faithfully laboring. On this argument the scientific advocate would like to dwell; but he realizes, at least he does after a little experience, that it is one of the least effective. The legislator counts on his fingers the scientists he knows in the state, and decides to risk their displeasure.

If it be conceded that, as a means of moving legislatures, the argument for economic benefit is weak because vague; and the argument for promoting science is ineffective because the class specially interested is small; what may be expected from the third argument most often used—the benefit to education, the benefit to the schools of the state?

In attempting to answer this question, it may be said that there are several conditions favorable to the use of this argument. The number of people in the state directly or indirectly interested in the work of the schools is very large. This large body is constituted by the better educated and more intelligent citizens, and therefore one of the most effective classes of citizens. Again, the active members of this body are organized, extending from the state department of education to institutes, associations, clubs and circles, all of which could easily be reached if their influence was desired.

Some one now offers the suggestion that this proposal contains nothing not already tried, and that its use in the past has brought few results, seeing that but a paltry half-dozen states are at present conducting natural history surveys. I will readily admit that the argument has been unsuccessfully tried in several or many states within the past two decades. But I wish also to say that in my own state, Michigan, I believe it was the argument of educational benefit, more than any other, which resulted in the establishment of the biological survey in 1905. We appealed for aid in passing the bill to scores of teachers, and to several teachers' organizations. I wish also to say that the argument for educational benefit usually contains the same weakness that pertains to the argument for economic benefit: it is vague because it does not have definite tasks to propose, definite things that the survey will surely do for education. It is true that several of the reports or bulletins on biological matters, issued within the past twenty years by the state surveys of Minnesota, Wisconsin, Connecticut, Michigan and New York, are as much or more for educational as for scientific purposes. But, to my mind, the most of these are not convincing examples of the benefits which a survey can give to the schools. The most of them can not be used by the schools, either because they are not written so as to be used or they cover so large a territory that they arouse no local interest. These reports are not written wholly for science; for their descriptions and illustra-

tions are for many species little more than repetitions of what the scientist is familiar with elsewhere. Such publications therefore, are not very satisfactory illustrations of what a survey can do for the schools, either to the advocates of a bill before a legislature or to the school instructors whose aid may be sought for the bill. And if such productions seem unsuited to the purpose to those who are working for the bill, how shall these advocates employ these reports to show what the proposed survey may do? But can the argument for a state natural history survey be strengthened by holding up for its aim a definite, worthy and vote-compelling task, just as definite as the proposal of the geologist to explore an iron range?

The plan for a natural history survey which seems to me most likely to bring legislative consideration in the largest number of states, a survey which, if once started, will carry with it all that is desired for education, economics and science, is that of a *regional survey,* biogeographic in its nature, the reports of which should be so written as to be intelligible and useful to scientists, citizens and school children alike.

The method of regional surveys within a state is not new. New York uses it for the geological survey, making the unit-regions the quadrangles of the U. S. Topographic survey; and Maryland uses it, making the county the unit-region. The biogeographic method is now made to include not only flora and fauna with their distribution but also climate, topography, soil and general relation to environment. This biogeographic method of survey was used among the first by Professor Flahault, of Montpellier University, in France, and was later applied by R. Smith to survey the region about Edinburgh, and still later by Messrs. G. Smith, Moss and Rankin for Yorkshire, England. In our own country similar attempts have been made by the Botanical Seminar in Nebraska, by Hitchcock in Kansas, by Livingston in two counties in Michigan, and by the Geological and Biological Survey of Michigan in the bulletin of 1911, entitled "A Biological Survey of the Sand Dune Region of the South Shore of Saginaw Bay, Michigan." This list names but a few of the attempts at biogeographic survey work, some of which have been noted successes, while others have had inadequate publication facilities. The method has been tried and found feasible. It was used by Schimper in his "Pflanzengeographie," in Spalding's "Distribution and Movements of Desert Plants," and is now in use in the making of that excellent series under the editorship of Engler and Drude, "Die Vegetation der Erde."

A regional, biogeographic survey requires maps on which to spread data of distribution and habitat. Fortunately for the purpose, good base maps are already provided in the topographic survey of the government. Every state in the union has had a considerable portion of its area thus mapped in quadrangles of 20 to 50 or more miles square, and these maps are covered with contour lines giving just what is needed for the spreading of biogeographic data.

Conceive that a survey party goes into one of these quadrangles provided with a topographic map, that the work of the survey eventuates in a report on the phytogeography and the zoogeography of the region, that distribution data are spread on the topographic maps, that climate, soil and other physical features are given, and finally that all parts are so presented that the reading of the report and the study of the region will put the intelligent reader into possession of what that quadrangle

contains in the way of natural features and the influence of these features upon one another, and we have, it seems to me, the best kind of a natural history survey to which the state could devote its efforts.

One good report of this kind, made for a judiciously chosen quadrangle, or fractional quadrangle, would put a powerful weapon into the hands of those who are fighting for the establishment or the continuance of natural history surveys. If the report was successfully written so that it could be used by the school teachers and the schools, the advocates of a survey bill before the legislature would have a proposition just as definite in its promise as any geologist could offer for his work. If state academies of science, or other bodies who are working for the establishment of surveys, could, by their own efforts, produce one such report as a sample, it seems to me they would be able to present the strongest possible argument for the state to continue the good work, and they would find plenty of support on the part of the schoolmen and schoolwomen. Let me cite an illustration from my own state: Michigan is among the most backward in appropriating money for cooperation with the federal government in the making of the topographic survey. While some states have nearly all of their area mapped, and many states have more than a half mapped, Michigan has only fifteen to twenty quadrangles mapped. New maps have been added slowly and those interested in the survey have had to fight for every appropriation. But the people of the unmapped areas have at last discovered what these maps mean, and from various parts of the state calls for maps will be sent to the legislature just convening. So certain are the members and friends of the Geological Survey that the request for funds for topographic work will for the future take care of itself, that for the first time they will make no effort in its behalf.

So, it would seem, may it be with the natural history survey. We have tried to use the argument of financial benefit, and it has not worked. We have tried the argument of the benefit to science, and it has not worked. The trouble with the first argument seems to be that we have not and we can not clearly define the work we would do so as to be reasonably sure of pecuniary returns. The weakness of the second argument is that relatively so few citizens would be benefited. The argument for educational benefit has met with little better success than the others, but this is probably owing to lack of definite plan. There is herewith proposed a definite plan which is believed would find supporters numerous enough to be influential. This method of doing the work, even in state surveys, has been practised by Adams, Ruthven and others in this country. I am urging the adaptation of the plan for the benefit of the schools of the state, believing that it can be made the strongest possible argument for the state survey.

Suppose such a biogeographic regional survey to be in operation, and suppose the reports to be so written up and the maps to be so made that the schools could use the reports for guides in the study of the geology, geography and natural history of the region, such a treatment of the survey would also furnish guides for all that increasing number of citizens who like to study nature. The benefits to these classes of our population, the young people in the schools, and the citizens who like the outdoors, would justify the survey. But there are other benefits that would follow: The survey could be planned so as to furnish data for instruction in agriculture and forestry and other applied sciences.

This biogeographic regional survey

would have all the scientific value attaching to the taxonomy, geography and ecology of such work. But besides this, such a survey would be the very best means of discovering the special problems that should always form a part of a state survey. There has been no intention in what has been said here to limit the work of the natural history survey to the surveyed quadrangles of the Topographic Survey. Rather, it seems to me, should this be adopted as the general policy of the survey; and, if successfully done, it could be made to carry the other scientific work of the survey. Important problems in morphology and physiology would arise, and sometimes the survey would wish to explore a region sparsely inhabited, the report of the work in which would not be of immediate use to the district, but might be of great value to science.

There are still two benefits to be mentioned which I believe would follow the adoption of the biogeographic regional survey. The first is the stimulation to investigation within the state in natural science, including natural history. This stimulation would produce better work as the result of opening up multitudes of problems on distribution, habits, etc. An increase of activity in the study of scientific problems of the state would tend to produce more valuable contents both for the survey reports and for the reports of the academies of science. We might even hope to see the lists of algæ from Bermuda and the crayfish from Yucatan crowded out of these reports by the press of work done in the state.

The second benefit to follow, incident to the awakening of scientific interest in the state by the phytogeographic and the zoogeographic survey, and the problems discovered by these surveys, would be the strengthening of the state academies of science, and the better understanding and sympathy among scientific workers, and between scientific workers and teachers of science. Many of us know how hard it is to make the state academy of science a worthy and profitable institution; we know how hard it is to obtain interesting matter for the annual programs. On the other hand, we know how many teachers out in the state would gladly participate in work on some problem. Cooperation between the state survey and the academy of science offers a means for many people of some scientific ability, but not specialists, to engage in profitable work. Some of this work can be used by the survey and some by the academy of science. The survey and the academy of science should be closely allied, and generously critical of one another.

As to the organization for a state natural history survey, I have nothing to give except a word of advice to those who have to start the work with but a small appropriation. Undoubtedly it would be best to have a specialist at the head of each scientific department represented; but if the annual fund is but a thousand or two, this is out of the question. But if the fund is only a thousand dollars annually, it is better to spend half of it in the employment of a director for part time, than to attempt to direct the work by a committee. The survey needs continuity of thought and purpose and a good deal of drudgery such as a committee is not likely to perform. If the reports or bulletins are designed for educational purposes as well as scientific, see that the written matter is presented so as to be capable of the use for which it is intended; much good matter has been buried by a bad presentation. It is not of the first importance that at the very start of the new survey the time-honored desig-

nation of "Geological Survey" should be changed to "Geological and Natural History Survey." Some legislators are fearful of the change. The important thing is to get an appropriation and start work. If a good start is made and the survey shows its desert, the change in title can come later.

In summarizing, I will but mention the few points I have tried to emphasize in this paper:

1. With but seven states in the union supporting natural history surveys, the present condition of such work the country over is unsatisfactory.

2. Though efforts have been made to induce numerous states to establish natural history surveys, such efforts have been attended with but little success.

3. The probable cause of failure lies in the difficulty experienced by the promoters of such surveys in stating definite and important results that the survey will accomplish.

4. The suggestion is made that if the plea for a natural history survey propose a biogeographic regional survey whose reports can be used as guides for study by the schools, the proposal will be definite and the object such as to interest a large body of supporters.

5. To make these reports serve the purpose of scientific treatises as well as guides to the study of natural history and biogeography, special care must be used in the organization and presentation of the material in written form.

6. The successful preparation of local guides for the study of natural history, phytogeography and zoogeography will enable the survey to carry on other scientific work.

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RECENT LEGISLATION AFFECTING EDUCATIONAL INSTITUTIONS IN KANSAS

The state of Kansas, through its legislature which has just closed its biennial session, has finally decided to enter upon what may appeal to many as a doubtful experiment in educational administration, although it is hoped that a step forward has been taken. Essentially, the new arrangement consists in the application of the commission form of government, somewhat modified, to all of the state supported educational institutions.

Two years ago a bill to place the state university, agricultural college and normal school under one board of administration was passed. It will be recalled that Governor Stubbs at that time obtained the opinion of many prominent educators and administrators as to the probable success of the plan. Finding that there was almost a unanimous sentiment against this method of university administration, the governor finally vetoed the measure.

The present state officials were elected on a platform which pledged them to a reform measure which would place all higher educational institutions of the state under a single board. The motive for this change is a desire to secure a more efficient, and at the same time less expensive, administration, in that costly duplication of work in three separate institutions might be avoided without decreasing the efficiency or impairing the present high standards of all the institutions. In addition, it is believed that such a plan should lead, if properly carried out, to a better cooperation of all the parts of a complex educational system.

The act to bring about the centralization of authority in the management of the large state institutions was passed by the legislature, and signed by the governor on February 11. This measure includes the following institutions which are all placed under a single board of three members: The State University of Kansas, with the school of mines at Weir City; The Agricultural College at Manhattan, with its experiment stations located at Hays City, Dodge City, Garden City and Colby; the Normal School at Emporia, with the Manual Training Normal at Pittsburgh and the Nor-