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A NATIONAL DEPARTMENT OF SCIENCE

NECESSARY FOR THE

COORDINATION OF THE SCIENTIFIC WORK

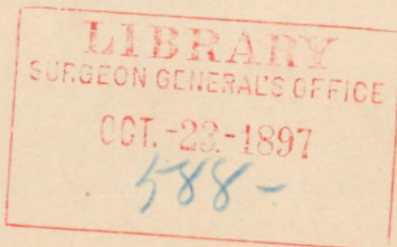
OF THE

UNITED STATES GOVERNMENT

BY

CHARLES W. DABNEY, JR.

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A NATIONAL DEPARTMENT OF SCIENCE.

The Present Organization of the Scientific Work of the Government, Especially that Designed to Discover and Develop the Resources of the Country, Considered with Reference to the Upbuilding of Such a Department of Science.

The United States Government is doing more to discover the resources of its territory and to teach its people to develop them than any other government in the world. Our many noble establishments for the promotion of science, both pure and applied, are the admiration of all. Foreigners regard these institutions as the most unique feature of our government. They represent the true American idea. It is the more to be regretted, therefore, that this grand idea, so well established in our laws, is not adequately represented in the organization of the Government.

THE PRESENT ORGANIZATION OF THE SCIENTIFIC WORK.

The scientific work of the Government is carried on by many agencies scattered through the various Departments, the more important ones, however, being connected with the Treasury Department, the Navy Department, the Department of the Interior, and the Department of Agriculture. Some of them are not connected with any Department.

The majority of these bureaus have no logical connection with the Departments to which they belong, and an investigation of their origin is necessary in order to find out how they became attached to the several Departments. It usually came about in this way. Some Government official became deeply interested in a certain line of scientific work bearing upon the development of the country. After agitating the matter for several years he finally secured an appropriation from Congress authorizing the investigation to be made in the Department with which he was connected. Either the originator or some other friend of the scheme was put in charge of the work, and if it proved beneficial it received increased appropriations from year to year, and finally grew to be

a great bureau. This method has led to some strange connections. It was in this way that the Coast Survey, the Bureau of Navigation, the Marine Hospital Service, and the Life Saving Service came to be placed under the Treasury Department, while the Navy Department controls the National Observatory, the Hydrographic Office, and the Nautical Almanac. These accidental connections, once established, have usually been kept up, and so far, although they are often as disadvantageous as they are illogical, a majority of the bureaus have remained in the Departments where they originated.

The list appended to this paper includes the chief Government scientific agencies having these, or similar objects, as distinguished from the purely executive agencies of the Government. It shows that the United States Government now employs 5,225 persons in this scientific and economic work, not including the Census, and expends upon it nearly eight million dollars annually.

A glance at this magnificent array of forces is all that is necessary to impress one, not merely with the grand initiative of the American people which has called them forth, but with the sadly divided and scattered condition of this army of workers. The list shows that our Government is now supporting twenty-eight separate scientific bureaus, surveys, divisions, or investigations, distributed among six different departments, not including fifty-four agricultural experiment stations and many other outlying bureaus.

Science is conducting in America a grand campaign for the advancement of civilization, but its forces are divided into so many camps that it does not win half the victories it should. What we want is an organized army, with a general staff and a commander-in-chief.

DUPLICATION OF WORK—UNAVOIDABLE AT PRESENT.

Scattered as our scientific agencies are through all the Departments, organized under broad and often very indefinite laws, supervised and directed, when they receive any attention at all, by different Secretaries, usually not scientific men, and always overrun with other work, there is ample opportunity for confusion and duplication of work, and consequent waste of time and money. A few illustrations will show how this works.

The Government has three distinct and separate agencies for measuring the land of the country, namely, the General Land Office and the Geological Survey, both in the Interior Department, and the Coast and Geodetic Survey, in the Treasury Department. In addition to these the Engineer Corps of the Army makes military, boundary, and geographic explorations and surveys.

There are four hydrographic offices in as many departments, viz, the Hydrographic Office of the Navy, a similar office in the Coast Survey of the Treasury Department, the Division of Hydrography in the Geological Survey (Interior Department), which measures the rivers of the arid regions, and the Weather Bureau, which measures rivers and studies lake currents. These agencies are supposed to have different fields of labor, but all are liable to meet in the navigable rivers of the country. In addition, the Fish Commission measures the waters of fishing grounds and rivers, and the Engineer Corps of the Army measures the Mississippi River, the lakes and harbors. Four or five of these agencies have actually been engaged in making measurements and studies in the navigable rivers and the Great Lakes within the last few years.

The Coast Survey, the Naval Observatory, and the Weather Bureau have all been engaged in recent years in studying the magnetism of the earth.

The Government has at least five separate and distinct chemical laboratories in the city of Washington alone.

There are many other scientific agencies similar to these in Washington scattered throughout the country in mints, Government schools, hospitals, etc., which receive appropriations for general work.

The Secretary of the Interior and the Secretary of Agriculture some time ago appointed a board to compile the laws on irrigation, and find out what each bureau of each Department should do. It took this board a year to inform these two Secretaries what the law required of each of them. Its report shows that eight bureaus in the two Departments must cooperate in order to accomplish any thorough work on the great problems of irrigation. Three distinct branches of the Interior Department alone are engaged in irrigation work, viz, the General Land Office, the Office of Indian Affairs, and the Geological Survey. The last Census also prepared a report on this subject. The Weather Bureau and the Divisions of Soils and Vegetable Physiology of the Department of Agriculture should assist in these irrigation investigations.

It is needless to say that, with so many agencies to promote irrigation, very little has been done by any of them. The Hydrographic Division of the Geological Survey deserves the credit of having done most that has been accomplished.

Although the agricultural experiment stations receive an annual appropriation of \$750,000 through the Department of Agriculture, which has an Office of Experiment Stations for compiling the results of their work, advising and assisting them, the management of their affairs is vested entirely in independent State boards, the supervision of the Department of Agriculture being

limited at present to the reports of expenditures submitted by the station officers. Their plans of work are usually formulated by local boards or executive committees, and cover nearly all conceivable subjects connected with agriculture, horticulture, and the animal industry. Only a few feeble efforts have so far been made to correlate and coordinate the investigations of these stations for the purpose of preventing duplication.

The statistics of the natural resources and the products of the country, of exports and imports, of population, schools, etc., are, in like unfortunate manner, collected and compiled by 8 or 10 different agencies in 5 or 6 different Departments. Besides the Census, which has collected and discussed nearly all conceivable classes of statistics, we have these agencies regularly at work: Meteorological statistics are collected by the Weather Bureau; statistics of "mineral resources and natural products of the national domain" by the Geological Survey; agricultural statistics are collected by the Department of Agriculture; statistics of exports, imports, etc., by the Treasury Department; statistics of wages, cost of living, and industrial statistics of all kinds are collected by the Department of Labor; statistics of transportation are collected by the Interstate Commerce Commission; statistics of Fisheries are collected by the Fish Commission; and statistics of schools, colleges and universities are collected by the Bureau of Education in the Interior Department.

The same confusion exists in the practice pertaining to other lines of work. Illustrations might be almost indefinitely multiplied. But the reader must, however, be referred to the appended list and the Government reports.

This duplication is the necessary result of the lack of efficient organization. Bureaus for doing the same, or closely related things, have been attached to many of the Departments and have remained there. Congress has been liberal to them and they have extended their work until many of them now overlap each other. This overlapping of work is not so bad, however, as the almost total absence of cooperation. The different bureaus being under different Secretaries, there is no way to enforce cooperation.

REORGANIZATION NEEDED—PLAN PROPOSED.

The time has arrived when the successful prosecution of the scientific work of the Government requires that these various bureaus should be organized in accordance with a logical plan. It is proposed in this paper to suggest a plan which, it is believed, will, without injuring the work of any of them, lead to a reorganization of these bureaus and effect the necessary coordination of their researches.

The scientific agencies connected with the execution of the laws, with the construction of naval and military equipment, and with the Government schools, are, of course, not included in this plan. A chemical laboratory will, for example, probably always be needed in connection with the revenue office of the Treasury Department, for the purpose of analyzing sugars, alcoholic liquors, etc. The War and Navy Departments will always need their own testing laboratories, and both the naval and military academies their extensive teaching equipments. The present discussion applies only to those agencies of the Government which are designed to promote pure science or its applications to the discovery, conservation, and development of the resources of the country in the broadest sense of these terms.

A rational classification of these Government scientific agencies would begin with the National Observatory and the Nautical Almanac, which locate our planet in space and our country upon the globe, and supply our mariners with the data by which to sail. Next would come the Coast and Geodetic Survey, which determines the coast and boundary lines of the country, and its chief heights and geographical positions. Following this would come the Geological Survey, which is charged with "the classification of the public lands and the examination of the geological structure and resources of the national domain." The Weather Bureau, whose duty it is to investigate our climate, and especially its relations to agriculture and other industries, would naturally come next. This would be followed by various agencies for studying the fauna and flora and determining the life zones, such as the Biological Survey, the Divisions of Entomology and Botany, and the National Museum, including the National Herbarium.

The chief applications of the principles elucidated by these surveys would be carried out by another group of bureaus, like the Forestry Bureau, the Agricultural and Horticultural Bureaus, and the Fish Commission. These in turn would be followed by other agencies organized for the purpose of investigating great economic problems, such as the forage interests of the country, the irrigation question, the industries of the arid region, and so on.

Finally, the new department should include a great statistical agency, such as the proposed permanent Census Bureau. Statistics, showing the products of natural forces and the results of the people's work along all lines of endeavor, form the basis of all economic science, and would be needed, therefore, in connection with the work of the bureaus above mentioned. Many of them would have to assist in collecting these data. There must, therefore, be the most intimate cooperation between the agencies of the Government for the exploitation of

resources and the promotion of industries and the Census Bureau which measures the one and counts the results of the other.

The permanent Census, now proposed, will consolidate much of this scattered work and prevent duplication almost entirely. It should take charge of several other statistical agencies, and do on a systematic plan through ten years the work hitherto done in a haphazard way at intervals. It is a move in the same direction as that here advocated for the other scientific services.

The average expense of the Census alone, not including the existing bureaus mentioned herein under their own Departments, is estimated at \$1,000,000 per annum.

THE METHOD OF PROCEDURE.

A general coordination of the scientific work of the Government is demanded. The question is how to accomplish this. It is probable that a commission of Congress or of scientific men, while perhaps not able to reconcile all of the conflicting interests involved in a general plan of reorganization, would still be productive of much good. But the first thing is for Congress to decide upon a programme.

An important step was taken when the officers and employees of the scientific bureaus were put in the classified service. This renders it almost impossible to use patronage in getting appropriations, or promoting legislation, and puts every man on his mettle to maintain his place by good work instead of political influence, which signifies a great deal. It is not believed, however, that much further progress can be made toward the reorganization of these bureaus and the coordination of their work until they have first been brought together under one executive head. However good their intentions and earnest their desires to do so, it is not likely that the several heads of Departments can ever agree as to the plans of scientific work which shall eliminate all duplication. Each would consult his chiefs of bureaus and be influenced by their advice, and naturally each chief will want to retain his hold upon all his former work. It is evident, therefore, that the only way to avoid duplication and waste of time and money, and to secure the proper coordination and cooperation is to first bring all these bureaus together in one of the existing Departments, or in a new Department.

When these bureaus have been thus brought together under the direction of one Secretary or executive head, the reorganization will be comparatively easy. It should take place gradually and naturally in the course of ordinary business. The details of this reorganization can not be considered until the new Depart-

ment has been formed. When this has been done the plans for reorganization might well be left to a board composed of our leading scientific men, or of the chiefs of the bureaus involved, presided over by the Secretary, or some eminent scientist appointed by him, who would act as arbitrator.

No revolutionary proceedings are advocated. The policy should be to transfer the different scientific bureaus or surveys to one Department, as opportunity offers, or as the Secretaries now having charge of them find it expedient to recommend it. Let Congress once adopt a fixed policy with regard to this matter and establish it in the good opinion of the people of the country, and the reorganization will follow. A great new department of science would thus be the result of natural development, rather than of revolution, and the reorganization and coordination of the work would in the end be accomplished without injury to any scientific investigations now in progress.

It is really a wonder that our Government has accomplished so much excellent scientific work through the agency of so unscientific an organization. With enormous expenditure of energy and money, it has done a great deal for the advancement of science, but it is deplorable that so much has been wasted in doing this. We garner the golden grain of truth, to be sure, but we cut our wheat with the old-fashioned sickle, bind it with straw, thrash it with a flail, and then wait for a favorable wind to blow away the chaff. Harvested by these antiquated methods our product costs us a great deal more than it should, and, what is worse, we lose a large part of the grain. Shall our Government not use the most improved machinery for its work? Is it not time that we had a complete scientific department for harvesting scientific truth? Such a perfect machine would garner—and garner at much less cost—a far larger harvest than the varied cumbrous appliances now in use.

APPENDIX.

LIST OF SCIENTIFIC AGENCIES OF THE GOVERNMENT.

Following is a list of the scientific agencies of the United States Government, engaged either in the promotion of pure science or in the discovery and development of the resources of the country, arranged by the Departments with which they are at present connected. Only their chief duties, compiled from the statutes and reports, are enumerated. The amounts of money appropriated for their expenses for the fiscal year ending June 30, 1897, and the total number of employees connected with each, are added.

IN THE NAVY DEPARTMENT.

Naval Observatory: The National Observatory makes astronomical observations, corrects chronometers, etc. Appropriation, \$51,660; total number of employees, 48.

Nautical Almanac: Prepares the American Ephemeris and Nautical Almanac, and collects and disseminates information on navigation. Appropriation, \$22,480; total number of employees, 20.

Hydrographic Office: Collects information and publishes charts with regard to direction and force of winds; set and strength of currents; feeding grounds of whales and seals; regions of storms, fogs, and ice; the position of derelicts and floating obstructions; the best routes to be followed by steam and sail vessels; also general hydrographical and marine meteorological information, weather warnings, etc. Appropriation, \$103,940; total number of employees, 79.

IN THE TREASURY DEPARTMENT.

The Coast and Geodetic Survey: General location of the national domain; latitude and longitudes; surveys of coasts, rivers, lakes, inland waters, and deep seas adjacent to our coasts; magnetic and gravity research; general survey of the country; heights, geographical positions, etc. Appropriation, \$401,370; total number of employees, 163.

[The War Department also surveys military reservations, and runs boundary lines, such as the boundary line between the United States and Mexico, when called upon to do so.]

IN THE INTERIOR DEPARTMENT.

The General Land Office: Is charged with the survey, sale, and general management of the public lands and the issuing of titles therefor; it classifies mineral and swamp lands; protects the public domain from depredation, etc. Appropriation, \$1,651,940; total number of employees, 1,169—in Washington, 380; outside Washington, 789.

The Geological Survey: By the original act this Survey is charged with "the classification of the public lands and the examination of the geological structure, mineral resources and products of the national domain." This was first considered as limiting its work to the Territories, but in 1882 authority was granted to continue the work upon the geological map of the United States. Under this law the words "national domain" are construed as including the entire country, and the provision for studying the "products of the national domain" is understood to give the Geological Survey broad authority for many kinds of scientific work. At the present time the Survey is engaged on no work not specifically provided for by statute.

As at present organized, the Geological Survey has, besides two administrative branches, two scientific branches—a geologic branch and a topographic branch.

The operations of the geologic branch include the preparation of a geologic atlas of the entire United States, and special geologic researches. The palæontologic work is subsidiary to the geologic work, and is conducted by a division under this branch. The other divisions of this branch are: a chemical laboratory, which analyses minerals and ores; a lithologic laboratory, in which thin sections of rock are prepared for study; a division of mineral resources, which collects and compiles mineral statistics; and a division of hydrography, which studies the underground and surface water supplies of the country, with special reference to applications thereof in irrigation.

The topographic branch has a division of triangulation and a division of topography, the latter divided into five sections.

Total appropriation for the Geological Survey, \$774,862.38; total number of employees, 600—permanent 335, temporary field men 265.

[The Geological Survey, in addition to the above, is now engaged in making, under special enactment, a land subdivision survey in the Indian Territory.]

Bureau of Education: Collects facts and statistics showing the condition and progress of education in the States and Territories, and supplies information respecting the organization and management of schools, school systems, and methods of teaching; promotes education. Appropriation, \$57,520; total number of employees, 44.

The Decennial Census: Collects statistics covering population, mortality, manufacturing, railroad, fishing, mining, and other industries; statistics of the telegraph, express and insurance companies, and of churches, and of other subjects according as Congress directs in the special law for each census. These laws are usually drawn to include every reasonable suggestion that is made to the Committee on the Census, and vary more or less for each census.

The result is that the Census is made to duplicate, to a large extent, the work of the permanent bureaus of the Government. It is supplied with large sums of money, and reports are often made by it which ought, in the nature of things, to be made by other Government bureaus. This leads to further duplication and great waste of time and money. Much work is expended upon ill-advised or poorly organized schemes.

IN THE DEPARTMENT OF AGRICULTURE.

This Department is wholly devoted to the development of the natural resources of the country. It is not restricted to agriculture, but aims to promote all of our industries, for which reason it might be better named "The Department of Public Works." Its organization is as follows:

ADMINISTRATIVE AND BUSINESS OFFICES.

Office of the Secretary.

Division of Accounts and Disbursements.

Division of Publications, with a document section.

Gardens and Grounds.

Seed Division.

SCIENTIFIC AND TECHNICAL AGENCIES.

Weather Bureau: Has charge of the forecasting of weather; the issue of storm and other weather signals; the gauging of rivers; the reporting of temperature and rainfall conditions for the cotton, rice, sugar, and other interests; the distribution of meteorological information, and the taking of meteorological observations to establish and record the climatic conditions of the United States. It includes five investigators, meteorological data division, forecast division, climate and crop service, instrument laboratory, monthly weather review, and has one hundred and fifty-four weather observing stations, etc.

- Bureau of Animal Industry*: Inspects meat for interstate and export trade; is charged with the control and eradication of contagious diseases and the inspection of imported and exported animals; investigates diseases of animals; prepares tuberculin and mallein for distribution to the States; studies animal parasites of domesticated animals, etc.; collects and distributes information in regard to the dairy industry, etc. It includes Division of Animal Pathology; Zoological Laboratory; Biochemic Laboratory; Inspection Division; Field Investigations; Dairy Division; Experiment Station; and has, in addition, one hundred meat inspection stations in the country; twenty-one quarantine stations on coast, Canadian and Mexican borders; nine stations for inspecting exported stock; nineteen Texas fever inspection places, etc.
- Division of Statistics*: Collects information as to the principal crop and farm animals; collects and coordinates statistics of agricultural production, distribution, and consumption; publishes a monthly crop report for the information of producers and consumers, and for their protection against combinations. It supervises twenty outside statistical agents, and has a section of foreign markets.
- Biological Survey*: Studies the geographic distribution of animals and plants; maps the natural life zones of the country; investigates the economic relations of birds and mammals, and promotes the preservation of beneficial and the destruction of injurious species.
- Division of Botany*: Maintains the National Herbarium; publishes information on the treatment of weeds; experiments with poisonous and medicinal plants, and tests seeds with a view to their increased purity and commercial value.
- Division of Forestry*: Experiments, investigates, and reports upon the subject of forestry, and disseminates information upon forestry matters.
- Division of Agrostology*: Investigates the natural history, geographical distribution, and uses of grasses and forage plants, their adaptation to special soils and climates, and the introduction of promising native and foreign kinds.
- Division of Vegetable Physiology and Pathology*: Seeks, by investigation in the field and experiments in the laboratory, to determine the causes of disease and the best means of preventing them; studies plant physiology in its bearings on pathology.
- Division of Entomology*: Obtains and disseminates information regarding insects in their relation to vegetation; investigates insects sent to the division, in order to give appropriate remedies; studies insect life in relation to agriculture in different parts of the country; conducts an insectary for studying the habits of insects, etc.
- Division of Pomology*: Collects and distributes information in regard to the fruit interests of the United States; investigates the habits and peculiar qualities of fruits; their adaptability to various soils and climates and conditions of culture, and introduces new and untried varieties.
- Division of Chemistry*: Investigates the methods proposed for the analyses of soils and fertilizers and agricultural products; investigates and reports on adulteration of foods, and on special subjects as ordered by Congress or the Secretary, and conducts chemical investigations for other bureaus of the Department of Agriculture.
- Division of Agricultural Soils*: Investigates the texture and other physical properties of soils and their relations to crop production.
- Office of Experiment Stations*: Represents the Department in its relations to the experiment stations in all the States and Territories, for which the Government appropriates \$720,000 annually; collects and disseminates general information regarding the colleges and stations; publishes accounts of agricultural investigations at home and abroad; indicates lines of inquiry; aids in arranging for cooperative experiments; reports upon the expenditures and work of the stations.

Office of Fiber Investigations: Collects and disseminates information regarding the cultivation of textile plants, including new and hitherto unused kinds; investigates the merits of new machines and processes for preparing them for manufacture.

Office of Road Inquiry: Collects and distributes information concerning the systems of road management in the United States and the best methods of roadmaking.

Museum: Contains soils, minerals, and agricultural products of the different States and Territories.

The total appropriation for the Department is \$2,448,532; total number of employees, 2,043.

Agricultural Experiment Stations: In addition to the above the Government appropriates annually, for 54 agricultural experiment stations in the States and Territories, \$720,000; total number of employees in stations, 575.

The work of the Agricultural Department is very closely related to that of the others. That of the Division of Soils, for example, depends upon the work of the Geological Survey. The work of the Weather Bureau is also very closely associated with that of the Hydrographic Office of the Navy and of the Coast Survey. These various Departments, bureaus, and divisions overlap and cross each other everywhere, causing many duplications and difficulties.

IN THE SMITHSONIAN INSTITUTION.

Bureau of Ethnology: Collects, compiles, and publishes information with regard to the native races of America. Appropriation, \$45,000; total number of employees, 21.

U. S. National Museum: "The authorized place of deposit for all objects of art, archaeology, ethnology, natural history, mineralogy, geology, etc., belonging to the United States or collected by any agency whatsoever for the Government of the United States, when no longer needed for investigations in progress. The collections in the Museum are intended to exhibit the natural and industrial resources, primarily of the United States, and secondarily of other parts of the world, for purposes of comparison." Appropriation, \$187,725; total number of employees, 197.

THE COMMISSION OF FISH AND FISHERIES.

Formerly connected with the Smithsonian Institution, the Commission is not now connected with any Department. It studies the rivers, lakes, bays, and fishing grounds along the coast for the purpose of determining their food resources, and of promoting the development of the commercial fisheries; collects and compiles statistics of fisheries; propagates and distributes fish and conducts laboratories for studying marine life, etc. Appropriation, \$347,360; total number of employees, 172.

THE DEPARTMENT OF LABOR.

The Department of Labor is not connected with any of the Executive Departments. It collects and publishes useful information on subjects connected with labor; its relations to capital, hours of labor, earnings of laboring men and women, and means of promoting all their interests; investigates strikes and controversies between labor and capital; the cost of production in competing countries, including wages, etc. Appropriation, \$172,170; total number of employees, 94.

There are many other minor agencies scattered through the Departments which contribute much to the development of the country's resources.

SUMMARY.

The total appropriations for 1897 to the Departments and bureaus above described as engaged in promoting science and the development of the country amount to \$7,984,559.38.

The total number of employees in the above Departments and bureaus is, not including the Census, 5,225.

