

Chapter 1.

Prologue: U.S. Geological Survey Mandates, 1879–1939

**[W]hat's past is prologue, what to come
In yours and my discharge.¹**

—William Shakespeare

On March 4, 1879, as President Franklin D. Roosevelt (FDR) asked the 76th Congress for additional funds for national defense, the U.S. Geological Survey (USGS) quietly entered the 61st year of its existence with its name, one of its two original mandates, and most of its subsequent missions intact. In 1878, the 45th Congress and President Rutherford B. Hayes asked the National Academy of Sciences (NAS) to plan for reforming the Federal science and mapping surveys. The NAS ad hoc committee, advised by Clarence King at its chairman's request, prepared the plan. Carl Schurz, the Secretary of the Interior, asked King and Representative Abram S. Hewitt (Democrat of New York, hereinafter D–NY) to turn the plan into draft legislation. As enacted on March 3, 1879, the USGS Organic Act required “the Director of the Geological Survey” to manage the new agency's

classification of the public lands and examination of the Geological Structure, mineral resources and products of the national domain.²

The new law provided for a bureau of practical geology, within the Department of the Interior (DoI), principally to aid America's growing mineral industry as the Federal Government had assisted the Nation's agricultural industry since 1862.

Beginning in 1879 and during the remainder of the 19th century, the USGS sought and gained statutory and continuing responsibilities for making topographic maps, collecting mining statistics, conducting water-resources investigations, and surveying forest reserves and Indian lands.³ The 45th Congress and President Hayes specifically expected USGS investigations and mapping, planned and managed by new Director King, to help locate and develop the new sources of iron needed for construction and precious metals required for currency. In 1879, Congress and Hayes did not agree to establish the separate Federal mapping agency for surveys of measurement and position sought by the founders of the USGS to advance the national geologic compilation and the agency's other work. The Attorney General's interpretation that year of “national domain” as the lands whose title still resided with the Federal Government limited official operations by the USGS to the States and Territories with public lands, areas mostly west of the Mississippi River.

In 1882, the planned official expansion of USGS operations nationwide arrived with the authority, sought by King and his successor John W. Powell from the 46th and 47th Congresses and Presidents James A. Garfield and Chester A. Arthur,

to continue the preparation of a geological map of the United States.⁴

Director Powell's interpretation of the new law enabled the agency to begin the needed national program of topographic mapping, including cooperation with the States beginning in 1884, but at the cost of deemphasizing the mandated efforts in economic geology for which Congress and Hayes established the USGS. To continue work led by Raphael Pumpelly and conducted during 1879–81 in cooperation with the Tenth Census (as arranged and cofunded by King), Congress and Arthur also directed the USGS in 1882 to begin officially “the procuring of statistics in relation to mines and mining other than gold and silver and in making chemical analyses of iron, coal, and oil.”⁵

In 1888, responding to pleas for aid from farmers and ranchers devastated by arid summers and harsh winters on the Great Plains, the 50th Congress and President Grover Cleveland gave the USGS authority and \$100,000 for

investigating the extent to which the arid region of the United States can be redeemed by irrigation, and the segregation of the irrigable lands in such arid region, and for the selection of sites for reservoirs and other hydraulic works necessary for the storage and utilization of water for irrigation and the prevention of floods and overflows, and to make the necessary maps⁶

of the lands west of the 100th meridian. Another clause in the new law reserved from sale, entry, settlement, or occupation “all the lands which may hereafter be designated or selected by such United States surveys for sites for reservoirs, ditches, or canals for irrigation purposes and all the lands made susceptible of irrigation”⁷ by those engineering works. Powell established an Irrigation Survey within the USGS to select and map the sites required for the dams, reservoirs, and waterways. Until the USGS did so, however, the Attorney General ruled the statute closed the public lands to all homestead or other entry. The law also denied the gifts of Federal dowry lands promised for education and other public uses in each of the six new States—Idaho, Montana, North Dakota, South Dakota, Washington, and Wyoming—that entered the Union during 1889–90. When the USGS, despite receiving an additional \$140,000 for the work, did not promptly designate all the sites, the 51st Congress and President Benjamin Harrison repealed the entry and dowry restrictions and discontinued the Irrigation Survey in 1890. Congress and Harrison then turned to the Agriculture Department for what proved to be a temporary solution. The USGS gained statutory responsibility for continuing national investigations of water resources in 1894, as sought by Charles D. Walcott, whom President Cleveland nominated as Director after Powell resigned. The 53d Congress and Cleveland provided the USGS with an initial \$12,500 during fiscal year 1894–95 for

gauging the streams and determining the water supply of the United States, including the investigation of underground currents and artesian wells in arid and semiarid sections.⁸

The USGS received authority and appropriations for surveys of Indian lands and forest reserves during the 1890s. In 1895, the Interior Department's Office of Indian Affairs (OIA) transferred funds to the USGS for

the survey of the lands in the Indian Territory * * * under the supervision of the Director of the Geological Survey, by such persons as may be employed by or under him for that purpose⁹

and continued to provide sums for those surveys of boundaries and topography. In the Forest Management Act of 1897, the 55th Congress and President William McKinley approved draft legislation prepared by Walcott that required Secretary of the Interior Cornelius N. Bliss to arrange to survey the future forest reserves and

any of those designated by Harrison and Cleveland since 1891 that were not yet mapped. The USGS received funds in 1898 to support the General Land Office (GLO) by continuing

the survey of the public lands that have been or may hereafter be designated as forest reserves.¹⁰

The Forest Act of 1905 transferred the administration of the forest reserves from Interior to the Agriculture Department's Bureau of Forestry, an agency founded in 1901, which originated in Agriculture as a Division in 1881. In 1905, USGS responsibilities for classifying forested public lands shifted to the Bureau of Forestry (renamed the Forest Service in 1907), but the USGS retained the topographic (and special) surveys of forest reserves. Those surveys remained funded as a separate line item in the agency's appropriations until 1918, when it was merged with the line item for general topographic surveys nationwide.

After 1900, the USGS gained new missions in reclamation, the testing of fuels and structural materials, and the regulation of mineral resources, but it did not keep all of them. Units established within the USGS or transferred to the agency to carry out those functions that did not develop or retain scientific programs became separate bureaus within the DoI or were transferred outside it. In 1902, the Newlands Act established a reclamation fund, from the proceeds of sales and disposals of public lands in western States and Territories, intended to aid

the construction of irrigation works for the reclamation of arid lands.¹¹

The new statute enabled Interior Secretary Ethan A. Hitchcock, at President Theodore Roosevelt's request, to establish promptly a Reclamation Service within the USGS. The Reclamation Service became an independent bureau within Interior in 1907, as Walcott left the USGS to become the Smithsonian Institution's fourth Secretary. The Reclamation Service was renamed the Bureau of Reclamation (USBR) in 1923.

In 1906, the 59th Congress and President Theodore Roosevelt changed the USGS role from scientific classification of the public lands to resource evaluations made by the agency before the GLO sold or otherwise disposed of these lands. Roosevelt ordered the withdrawal of Federal coal lands, nearly 67 million acres, from public entry until the two agencies completed their determinations. The GLO and the USGS agreed to have the USGS finish its examination and classification of the coal lands and to report its findings to the GLO for action. Two years later, the USGS established a Land Classification Board to manage this practical assistance to the GLO that soon would include oil and phosphate lands and waterpower sites. George Otis Smith, Walcott's successor as USGS Director, raised the Board to branch status in 1912, but the Land Classification Branch continued to be funded by assessment on the three program branches until the 65th Congress and President Woodrow Wilson approved in 1917 the agency's budgetary line item for "the examination and classification of lands."¹²

Some of the functions of the U.S. Bureau of Mines (USBM) also originated within the USGS but did not remain there. In 1904, the 58th Congress and President Theodore Roosevelt funded completion by the USGS of a roster of U.S. mines. In the following year, they also approved appropriations for the agency's "analyzing and testing of the coals, lignites, and other fuel substances of the United States, in order to determine their fuel values" by a facility the USGS established at the Louisiana Purchase Exposition in St. Louis, Missouri. The plant began operating on September 1, 1904. They added responsibilities for investigating "the structural materials of the United States (stone, clays, cements, and so forth)."¹³ Walcott established a Technologic Branch in 1907 to administer those responsibilities and

operations, which continued after the Exposition closed and included from 1909 the inspection of mines and the investigation of the causes of mine explosions. In 1910, the 61st Congress and President William H. Taft agreed to transfer the Technologic Branch's Fuels Division and its Structural Materials Division from the USGS to Interior's newly established USBM. The Structural Materials Division then passed to the National Bureau of Standards (NBS, now the National Institute of Standards and Technology) in the Department of Commerce and Labor.

In 1925, President Calvin Coolidge shifted other functions between the USGS and the USBM. Coolidge's Executive order¹⁴ transferred the USGS Division of Mineral Resources to the USBM, where it later became a unit for Minerals Information that continued the earlier statistical work by the USGS. The same order, as another Federal response to the Teapot Dome scandal,¹⁵ moved the USBM to the Department of Commerce and transferred the USBM's Mineral- and Oil-Leasing Divisions to the USGS. The USGS then combined its two new units with the agency's Land Classification Branch and the Water Resources Branch's Division of Land Classification to form the Conservation Branch. The USBM returned to the Interior Department in 1934. Two years later, the functions, funds, and staff of the USBM's geophysical investigations passed by statute to the USGS; there, the unit formed the Geophysical Prospecting Section in the Geologic Branch.

Earlier in 1925, the 68th Congress and Coolidge also modified USGS cooperative work with the States, efforts that began with topographic mapping in 1884 and expanded to geology in 1899 and to hydrography in 1900. Congress passed and President Coolidge signed in 1925 the Temple Act that provided

for the completion of the topographical survey of the United States¹⁶

and authorized \$950,000 for that purpose during fiscal year 1925–26. The USGS expected that this amount and subsequent equivalent sums would enable its Topographic Branch to complete the work within the statutory requirement of 20 years, but no such money ever was appropriated. The statute also was enacted to raise to a maximum amount the funds provided by the States for this mapping and to allow Federal monies to be used for the remainder of the work rather than just ensure dollar-for-dollar cooperation. In 1926, the 69th Congress and Coolidge agreed to add to the USGS line item for topographic surveys a requirement that no part of the nearly \$452,000 provided for that purpose should be expended in cooperation with any State, county, or municipality unless they bore the expenses required beyond those provided by Federal appropriations to the USGS to complete the work,

such share of the Geological Survey in no case exceeding 50 per cent.¹⁷

They also made \$372,000 of the appropriation “only for such cooperation with States and municipalities.”¹⁸ The appropriations authorized for water-resources investigations by the USGS during fiscal year 1928–29 applied the same 50-percent restriction to the Water Resources Branch's cooperative work with the States, counties, and municipalities and made available only for that purpose \$125,000 of the \$247,000 provided to the Branch.¹⁹

In 1929, USGS Chief Geologist Walter C. Mendenhall emphasized the agency's and the Nation's pressing needs for fundamental work in geology to gain a better understanding of “unknown general relations and natural laws” and thereby contribute to solving “the growing volume of practical problems, which are constantly increasing in complexity.” In asking for greater human, institutional, and monetary support, Mendenhall warned that if the country wished to

apply science to human needs, there must be science to apply. Research can not be neglected in any field of science, geologic or other, without jeopardizing its usefulness.²⁰

Later that year, President Herbert Hoover, in his State of the Union Message to Congress, requested a reorganization and centralization of Federal efforts in conservation to secure “proper development and adherence to broad national policies.”²¹ To expand basic studies within the Federal Government, Hoover’s initial budget contained increased funding for its scientific agencies. The 71st Congress and Hoover agreed to authorize a new line-item appropriation for the USGS of \$100,000 for

fundamental research in geologic science²²

during fiscal year 1931–32. Mendenhall, who succeeded Smith as Acting Director in 1930 and as Director in 1931, requested the same amount for USGS fundamental research in geologic science in fiscal 1932–33. The 72d Congress and Hoover provided only \$40,000 for fiscal 1932–33,²³ and the growing effects of the Great Depression thereafter ended authorizations for this basic work supported by its own line-item funds.

In 1933, Franklin Roosevelt’s administration renewed and reorganized Federal activities in resource management and conservation. Interior Secretary Harold L. Ickes transferred to the USGS Conservation Branch the responsibility for receiving and keeping accounts on rents, royalties, and license fees from mineral-resources lands on the public domain before sending the monies to the GLO.²⁴ In 1934, the 73d Congress and Roosevelt agreed to enact a statute intended “to stop injury to the public grazing lands by preventing overgrazing and soil deterioration, to provide for their orderly use, improvement, and development, and to stabilize the livestock industry”²⁵ without impinging on mining and water rights but also allowing land exchanges within individual States. The new Taylor Act authorized Secretary Ickes to establish grazing districts, or add to them or modify their boundaries, whose area would not exceed 80 million acres of “vacant, unappropriated, and unreserved lands from any part of the public domain,”²⁶ except Alaska; national forests, monuments, and parks; and Indian reservations. The new statute also required Ickes to supervise the issuing of grazing permits for these districts and to determine the fees and number of livestock allowed on them. That law, while withdrawing most of the remaining public lands in the conterminous United States, authorized homestead entries in the grazing districts on tracts of less than 320 acres that Ickes determined were “more valuable and suitable for the production of agricultural crops than native grasses and forage plants.”²⁷ The statute also enabled Roosevelt to place under Forest Service administration those unappropriated lands principally valuable for grazing but lying within the watersheds of national forests. In 1935, Ickes ordered the transfer of the USGS Conservation Branch’s Agricultural Division (which had been responsible for classifying grazing lands since 1908) to the Department’s new Division of Grazing. In 1939, Ickes reorganized the Division of Grazing and renamed it the Grazing Service.

As the world’s political situation continued to deteriorate in the late 1930s, Mendenhall warned Congress that it was “futile to wait for an emergency and then expect sound and complete information on essential war materials to be provided immediately.”²⁸ He began diverting some of the agency’s activities to preparations for a greater role in the defense effort. In April 1938, the 75th Congress and President Franklin Roosevelt agreed to direct \$500,000 of the Navy Department appropriations for fiscal year 1938–39 to the specific procurement and transportation

of materials determined to be strategic and critical by the Secretary of the Navy. The 76th Congress and Roosevelt added in May 1939 another \$500,000 to Navy funds for this purpose. In June, they provided separately for the common defense by authorizing the Secretaries of War, Navy, and Interior, acting through the Army and Navy Munitions Board (ANMB), to acquire

stocks of strategic and critical materials essential to the needs of industry for the manufacture of supplies for the armed forces and the civilian population in time of national emergency, and to encourage * * * the further development of strategic and critical materials within the United States for the common defense.²⁹

This act supplied \$500,000 more in each of fiscal years 1939–40 through 1942–43, of which \$350,000 in the individual years would go to the USBM and \$150,000 to the USGS for “scientific, technologic, and economic investigations”³⁰ of domestic strategic and critical minerals.

Major changes in American science occurred in the 19th century before the founding of the USGS in 1879. By the beginning of the Civil War in 1861, earth scientists and other specialists (both civilian and military) had organized collective research and secured financial and other support for their endeavors from the States or the Federal Government. They planned and conducted mapping and science surveys of boundaries, coasts, land districts, and transportation routes within and across the United States. Federal mapping and science surveys of large areas of the public domain west of the 96th meridian began in 1867. Science in the United States continued to develop from the avocation of individuals to a professional occupation and from a lack of interest in abstract science and a preoccupation with practical or applied science to a greater emphasis on basic or fundamental research. The interval between 1846 and 1876, as Robert V. Bruce suggested in “The Launching of Modern American Science,” saw the establishment of national patterns and institutions in science and technology that gradually transformed 19th-century science into its 20th-century avatar. During those years, science increasingly came to resemble a group and businesslike activity.³¹ The increasingly professionalized approach, Bruce emphasized, required capital, labor, and management, and the careful evaluation of markets to gain significant support for research. Those key elements for transforming science were in place when the USGS began operations in 1879.

The establishment of the USGS marked the last stage in the progression, from State and Territory, to region, and then to Nation, of the collective researchers’ efforts to gain financial support for their work. Science in general could not make a similar transition to the modern era without one additional important change. It required abandoning the widely held view that science was finite, representing a body of knowledge that could in time be determined completely, in favor of the concept of its limitlessness. When that substitution occurred in the 1890s, the scope of scientific problems increased, special fields of investigation, including those on the borders between them, began to proliferate, the importance of basic, or fundamental, research was recognized more generally, and the necessity of organized effort became clearer.

USGS managers, like their predecessors in the Federal Government, knew the path to continuity, growth, and prosperity for the agency in serving the American people and their elected representatives lay in gaining new functions that provided increased funds, staff, and operations. In the 60 years after 1879, the USGS actively sought or derived some of its new missions based on internal decisions. Other and safer mandates arrived via statutory changes or orders by higher management in the executive branch in response to the demands of emergencies in times of peace and war. On June 30, 1939, at the end of the fiscal year, the USGS retained unchanged one of its original twin mandates—geological surveys—although the

other—classification of the public lands—was changed in 1906 from a scientific classification to an assessment made before the sale or disposition of these lands. Of the newer and mostly statutory missions assigned between 1882 and 1925, the USGS kept topographic surveys; cooperation with States, counties, and municipalities; the continuous study of water resources; and mineral-resources regulation. Restrictions imposed on USGS funds available for matching-fund cooperative work with the States and smaller government entities in 1926 and 1928, respectively, in topography and water resources also remained in place. After the turn of the century, the USGS spun off to other Interior Department organizations its functions, funds, and staffs in reclamation in 1907, fuels and structural materials testing and mine inspection and safety in 1910, and agricultural- and grazing-land classification in 1935. Funds for USGS investigations of critical and strategic minerals (1939) renewed studies last significantly increased during the Great War of 1914–18, later known as World War I.

During the years between 1879 and 1939, the Nation's attitude toward and its need for science and its products also affected USGS plans and operations. The responses by the five Directors—King, Powell, Walcott, Smith, and Mendenhall—to the pressing national problems of their times also governed the agency's efforts to varying degrees and produced both successes and failures. The USGS, from its outset, actively supported the modernization of science in America, even after the growth of graduate programs in research at Johns Hopkins and other universities before 1900 and the advent of private-grant organizations like the Carnegie Institution of Washington in 1902. In the subsequent years, USGS funds, staff, and operations grew slowly but intermittently, until they reached the largest levels and widest scope yet attained during fiscal year 1938–39. In that year, the USGS remained one of the smaller Federal bureaus when assessed by its total funds of less than \$8 million and staff of about 1,300 employees. Mendenhall and the USGS, however, were about to face a new challenge to the Nation and the agency, one far beyond those posed by World War I and the Great Depression of the 1930s.