



The Way Cartography Was: A Snapshot of Mapping and Map Use in 1900

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Most of the countries of Europe have been surveyed under a uniform plan or system and mother maps produced therefrom. In these cases the mother map is everywhere of uniform quality and character. In the United States, on the other hand, many partial surveys have been made under independent authorities and of widely differing degrees of accuracy, and the maps resulting therefrom differ in scale and value.

—Henry Gannett, 1892¹

This essay is a broad-brush reconstruction of the state of American cartography in the year 1900. Our goal is a benchmark for assessing change in mapping, mapmaking, and map use during the twentieth century: a largely irreversible change readily labeled “progress” in less methodologically contentious times. By focusing on differences between cartography then and cartography now, we seek to avoid naïve assumptions about rate of change and beneficial impact. Identification of salient differences can, we think, usefully inform efforts to research and synthesize the history of cartography in the twentieth century.

Our strategy seems embarrassingly unsystematic—more a reconnaissance than a triangulation. One of us has interacted with David Woodward in devising an appropriate table of contents for a history of cartography in the twentieth century and explored in modest depth the development of several relevant genres: journalistic cartography, hazard-zone mapping, and meteorological cartography. The other spent much of summer 1997 in map collections and research libraries, immersed in various bibliographies and research catalogs, as well as in the Catalogue of Title Entries of Books and Other Articles Entered in the Office of the Register of Copyrights, a Library of Congress publication in which a separate section differentiates maps from books, music, and other forms of

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modes are topography, systematic cartography, charting, mathematical cosmography, thematic mapping, and chorography. Two of these modes were already well established by 1500: topography (the detailed large-scale representation of "limited portions of land") and chorography (the "small-scale mapping both of regions and the world"). By the mid-nineteenth century, topography was manifest principally in the maps of land surveyors, engineers, and architects, whereas chorography was most apparent in atlases, geography textbooks, and similar products that constructed knowledge through cartographic generalization. A third mode, charting, was a "subset of maritime geography and oceanography" that had evolved from the portolan charts and lists of sailing directions in use early in the sixteenth century. Each of these three "classical" modes reflected cartography's scientific reformation in its distinctive reliance on mathematical projections and geodetic surveys.

Edney's remaining three modes reflect a "fragmentation" of the "mathematical cosmography" that arose during the Enlightenment as a fusion of refined astronomical and terrestrial measurements. Although mathematical cosmography continued to serve the "centralized, militaristic state" with a focus on precise triangulation and higher-order surveys, two distinctly different modes emerged in the seventeenth and eighteenth centuries: a systematic cartography that "allowed the state to understand and control [the nation's] physical territory" and a thematic cartography that afforded similar dominion over the territory's "social contents."⁷ These modes were fully emerged by the late nineteenth century. As evidenced by national surveys like the U.S. Geological Survey (USGS), systematic mapping "created standardized map images and surrounded them with a rhetoric [of precision]."⁸ By contrast, public-sector thematic mapping had become a collateral activity of the Bureau of the Census, the Department of Agriculture, and other government agencies, state as well as federal, responsible for an inventory of citizens or industries.

For the most part, Edney's six rubrics are readily apparent in 1900. Topography, systematic mapping, thematic mapping, and chorography are easily recognizable despite an enriched variety that warrants refinement. Although primitive antecedents of the aeronautical chart might well exist—we found none—charting is equally distinct as a version of systematic mapping focused on marine navigation. Less clear for 1900 is the scope and distinctiveness of mathematical cosmography. According to Edney, the latter mode absorbed geodesy in the eighteenth century but lost exclusive rights to the label "mathematical" when systematic and thematic mapping emerged as separate modes. Although the importance of map projections and survey calculations to other cartographic modes warrants recognition for 1900, mathematical cosmography is recognizable today chiefly in global positioning system (GPS) technology.⁹

intellectual property.²

We readily concede a serious limitation: a concentration on the cartography of the United States of America. Clearly an instance of the "nationalist paradigm" identified and mildly denounced by Blakemore and Harley, our focus was also a practical necessity dictated by our country of residence and the time available.³ Another self-confessed flaw is an overt emphasis on description, reflected in a deficit of synthesis and whatever oversights arise from the subtle biases of our backgrounds and vision (or lack thereof). Readers should regard this effort as merely a first approximation.

A third limitation, a focus on artifacts, is more readily mollified. To offset the bias of trolling in map collections, cartobibliographies, and other sources that privilege commercial cartographic firms and government mapping agencies, we infer additional modes of map use by civil and sanitary engineers, public utilities, and various municipal departments in which maps might be presumed indispensable. These charts and drawings are seldom described in the cartographic literature, much less preserved in map collections, and histories of technology and textbooks published circa 1900 were only marginally helpful in suggesting or confirming categories of map use not otherwise evident.⁴ Secondary sources were also invaluable in demonstrating, at least tentatively, the apparent scarcity in 1900 of cartographic genres known to have evolved early in the century.

A Working Taxonomy

Rather than organize our findings according to the Library of Congress classification or another schema favoring map collections or cartobibliographies, we adopted the taxonomy of "cartographic modes" introduced in Matthew Edney's provocative essay on the historical development of European mapmaking.⁵ According to Edney, a cartographic mode is "a set of specific relations which determine a particular cartographic practice."⁶ These relations reflect map use as well as map production and may be technological, social, or cultural. Despite their inherent ambiguity, cartographic modes afford an insightfully concise synthesis of cartographic change, as Edney demonstrated with a schematic diagram describing the convergence of modes after about 1500 and the subsequent divergence of modes after about 1800. Although we deliberately avoid explanations for further divergence, our application of Edney's categories might usefully inform subsequent syntheses of cartographic development during the nineteenth century.

According to Edney, by the middle of the nineteenth century "formal" European cartography had developed six modes, which suggested a crude spectrum of scales. Ordered from large-scale to small-scale, these

Although “blue-printing or any similar cheap and expeditious process for reproducing drawings” limited the use of color, they offered four pages of advice using a sable- or camel-hair brush to apply more or less standardized tints.¹³ “In representing topography by colors,” for instance,

... woods are commonly colored yellow; grass land, green; cultivated land, brown; brushwood, marbled green and yellow; vineyards purple; lakes and rivers, light blue with a darker tint at the shore line; seas, dark blue with a little yellow added; marshes, the water blue, with patches of green applied horizontally; and roads dark brown.¹⁴

Wary of accidents, the ICS pedagogues suggested removing streaks “by a careful application of a sponge rubber after the paper is thoroughly dry.”¹⁵ Focused on practical advice and common practice, Mapping lacked the design-oriented conceptual frameworks of later cartographic textbooks published by Erwin Raisz in 1938 and Arthur Robinson in 1952.¹⁶

Although large-scale, turn-of-the-century, public-sector maps might remain interred in the basements of courthouses and city halls, their most prominent private-sector counterpart—the fire insurance map—is readily accessible in the Library of Congress as well as at many local historical societies, planning offices, university libraries, and municipal libraries with rare books collections.¹⁷ The genre originated in London late in the eighteenth century and emerged in the U.S. around 1850. Valued by historical geographers and industrial archaeologists for their building-by-building depictions of large cities and small towns, fire insurance maps helped local officials compile land-use, planning, and zoning maps. But in 1900, when city planning was meek and largely utopian, these massive cartographic inventories primarily served insurance underwriters concerned with the vulnerability of individual buildings, which varied markedly in their proximity to flammable structures, fire hydrants, and fire houses.¹⁸ Accounting for 68 percent of the 1,558 copyrighted maps published in 1900, fire insurance maps dominated all other commercial cartographic products deposited with the U.S. Copyright Office.

The largest producer of fire insurance maps was the Sanborn-Perris Company of New York, which produced 95 percent of the 1,068 fire insurance maps published in 1900.¹⁹ Founded in 1876 by surveyor D.A. Sanborn, the company developed a distinctive style of portraying cities at fifty or a hundred feet to the inch and differentiating type of construction with color tints: blue for stone, brown for adobe, green for iron, pink for brick, and yellow for wood. In 1902, the newly renamed Sanborn Map Company published a catalog listing maps and atlases for nearly 5,000 cities and towns. Although nationwide in scope, coverage was far from complete; by 1924, the firm added 6,000 additional titles through acquisitions as well as new surveys. Aggressive in buying out competitors, the company enjoyed a virtual monopoly by 1910.

Less detailed, but equally important as an element of American topography, is the county land ownership atlas.²⁰ Michael Conzen, who

Topography

Perhaps the greatest irony of Edney's typology is that most geographers hold a very narrow view of "topographic map," a term reserved largely for the more widely circulated products of a systematic statist cartography intent on representing the physical landscape—together with specific human modifications—on a single map, albeit a map of many sheets and diverse standardized symbols. Edney, who assigns published series of topographic quadrangle maps their own distinct mode (systematic mapping), applied the rubric "topography" to all other large-scale mapping activities focused on, but not necessarily limited to, transportation and land ownership. And he is quite right in doing so. Based on a Greek expression meaning "to describe a place," the mode topography tolerates comparatively little generalization. In describing boundaries or delineating facilities, its large-scale maps typically favor words and numbers over abstract or pictorial symbols.

With its scope so broadly construed, topography's artifacts have largely eluded cartobibliographers and collectors. Designed for use by small, often secretive groups of landowners, public officials, and engineers, these representations are often unreproduced, unpublished "one off" drawings that point out monuments, record key measurements, identify owners—personal, corporate, or municipal—or describe railways, water mains, power lines, and similar facilities, exposed or buried. Seldom accessioned to library map collections, they are mentioned occasionally in treatises on governmental administration and civil engineering. For example, the staff of the International Correspondence Schools (ICS), as the anonymous authors of *Mapping and City Surveying*, published in 1906 and 1907 by the International Textbook Company of Scranton, Pennsylvania, offered advice for drawing, coloring, filing, and reproducing plat maps, subdivision maps, railroad maps, general street plans, and topographical drawings (with either contours or hachures). According to *City Surveying*, maps intended for reproduction were drafted "on tracing cloth, from which blue or positive prints on tough paper may be made for office and field use."¹⁰

Treating cartography as an amalgam of surveying and mechanical drawing, the ICS staff praised hand-eye coordination but discouraged creativity. As they sermonized in *Mapping*, "ornamental letters are entirely out of place on a map, except for ... the titles of very elaborate maps."¹¹ The goals were legibility and uniformity, with neatness an overriding virtue:

There is no work where practice is more essential, if skill is to be acquired, and nothing adds more to the finish of a drawing, than good lettering, while poor and slovenly lettering will rob of all merit an otherwise perfect drawing.¹²

Yesler Avenue, Seattle, Washington," registered by Seattle resident A. B. Wilse, and "Mendenhall's Road Map of Michigan," published by Charles S. Mendenhall of Covington, Kentucky.²⁵ Education/reference maps copyrighted separately, rather than as elements of a book or atlas, account for 13 percent of all registrations. Representative titles include "Tunison's New Railway, Post-Office, and Distance Map of Alabama and Georgia," published by Henry C. Tunison of Jackson, Illinois, and the "General Map of Countries Mentioned in the Bible," published by Powers, Higley, and Company of Chicago.²⁶ Mineral maps, largely reflecting interest in gold in Alaska, oil in California, and various metals in Colorado, account for 4 percent of all registrations.²⁷

Cartographic inventories of routes were crucial to the U.S. Post Office Department, in which the Office of the Topographer compiled, revised, and distributed post-route maps to postal employees and the public. Its largest client was the Railway Mail Service, which received 70 percent of the 23,719 copies distributed between July 1, 1899, and June 30, 1900.²⁸

The Office of the Topographer's report for 1899-1900 lists thirty-nine separate map sheets at scales ranging from 1:250,000 (1 inch \approx 4 miles) for New Jersey to 1:750,000 (1 inch \approx 12 miles) for Texas and 1:2,500,000 (1 inch \approx 40 miles) for the Alaska Territory. New compilations in progress for ten states and the Hawaiian Islands reflected changes resulting from the creation of rural free delivery in 1896 as well as increased use of railroads.²⁹

Victory in the war with Spain placed additional demands on the Post Office, which had recently compiled and published post-route maps of Cuba, "Porto Rico" (Congress changed the official spelling to "Puerto Rico" in 1932), and the Philippine Islands.

Largely unrecorded were the countless maps of various public utilities and municipalities that required detailed plans of underground and surface facilities conveying drinking water, sewage, electricity, gas (for lighting and heating), and various electronic communications, notably telephone, telegraph, and public and private alarm systems.³⁰ Although it is impossible to imagine utilities and municipalities without them, these large-scale engineering plans were rarely, if ever, registered for copyright or deposited in a map collection. Indeed, none appear among the maps published in 1900 and registered for copyright. Although largely fugitive, maps of public utilities occasionally illustrate engineering or public works reports. The excerpt in Figure 1, for example, is from a March 1900 assessment of New York City's water supply and distribution system.

Several other types of urban maps warrant mention. As planning historian John Reps points out in several lavishly illustrated books, private publishers had produced a variety of bird's-eye views, panoramic maps, and other decorative illustrations of American cities throughout much of the nineteenth century.³¹ Preceding these dramatic oblique views were more mundane planimetric maps showing the layout of streets as well as the allocation of land for urban parks and other public uses. Although

described five distinct stages in the genre's evolution, identified 1900 as the pivotal year in the transition from the "Neo-professional" era, in which metropolitan firms like the George A. Ogle Company of Chicago and the Northwest Publishing Company of Minneapolis, produced "standard atlases" for local officials and real estate businesses, and the "Utilitarian" era, in which both national and local companies served the same market with comparatively Spartan plat books.²¹ The Neo-professional era, which began around 1886, represents a sharp break from the county-format subscription atlas, which door-to-door pitchmen persuaded small-town homeowners to purchase as heirlooms. Consumers deserted the mass-market novelty atlas for the full county history, and the atlas publishers quickly followed. Less elegant than its predecessor, the standard atlas evolved in the 1890s into a variety of aesthetically austere products: minimalist plat maps, hardbound county plat books, inexpensive paperback atlases of plat maps, and assembly-line "township composite" wall maps. Fostered by blue-printing and other inexpensive reproduction technologies, the transition to utilitarian plat books was, according to Conzen, "the least clear-cut of all."²² Technology played a key role, though, as blue-printing and other inexpensive reproduction methods not only fostered cost-cutting competition among national firms but encouraged local surveyors to publish cadastral maps "on demand."

Although Sanborn-Perris dominates the list of copyright registrations for 1900, a few other firms merit comment. George H. Walker and Company of Boston registered twenty-eight copyrights for maps, mostly large- to medium-scale, of communities within roughly a hundred miles of Boston. Most of these entries appear to be street maps, but a few are comparatively focused, for example, "Free Public Libraries" and "the Portland District, Maine, Cyclist's Route Map."²³ By contrast, the 117 map copyrights registered by the Matthews-Northrup Company of Buffalo, New York, indicate that the firm focused on smaller-scale maps, chorographic rather than topographic in Edney's schema, and often registered individual state reference maps prepared for the National Newspaper Directory and Gazetteer. Also noteworthy is Colton, Ohman and Company of New York City, which registered seven copyrights for large-scale utility and transportation maps, such as "Boroughs of Manhattan and the Bronx, Showing the Electric Service" and "Ohman's Road Map of Westchester County, N.Y."²⁴ Of the 490 copyrights registered for maps other than fire insurance maps, 48 percent appear to be for maps in the topographic mode, while 45 percent are probably chorographic and 7 percent are not easily classified.

Three functional categories are readily apparent among the 490 maps not intended for insurance underwriters: wayfinding/navigation, education/reference, and mineral exploration/extraction. Wayfinding maps, which account for slightly more than 1 percent of the total copyright registrations for maps published in 1900, include "Bicycle Paths North of



uncatalogued, in daily and weekly newspapers. Because few newspapers had either the staff or the facilities for preparing timely maps for breaking news or local stories, small-scale maps, largely from syndicates that supplied text as well as illustrations, dominated turn-of-the-century journalistic cartography.³⁸ Maps were sporadic and uncommon in larger newspapers until the late 1930s, when the Associated Press Wirephoto service provided a small selection of timely news maps with its daily offering of news photos. Among smaller daily newspapers, which used syndicate maps during World War II and the Korean War, news maps were comparatively rare until the 1980s.

the City Beautiful Movement of the 1890s laid a philosophical foundation for urban planning and growth management, local governments had little authority to regulate land use with zoning maps and planning maps until the 1920s.

Chorography

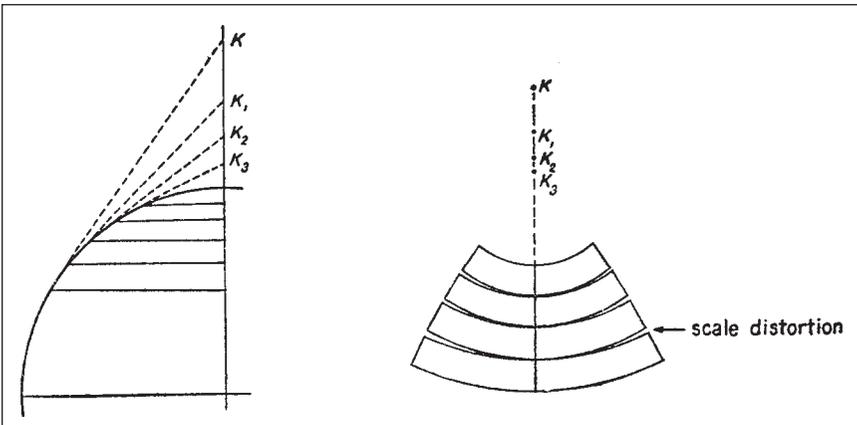
Defined by Edney as mapping at scales of 1:1,000,000 or less, turn-of-the-century chorography was most apparent in atlases, geography textbooks, and similar works by authors who constructed knowledge through cartographic generalization.³² Encouraged by nineteenth-century advances in wax engraving, small-scale, general-purpose maps were produced and reproduced far less expensively in 1900 than fifty or even twenty years earlier.³³ Jeffrey Patton attributes the development of the school atlas during the nineteenth century to advances in both printing technology and public education.³⁴ He also notes that the globular projection, which reinforced the notion of a round earth, was markedly more common for world reference maps than the Mercator projection, which atlas authors preferred for world thematic maps. Possible explanations for the nonetheless widespread misuse of the Mercator projection include its convenient rectangular shape and its prominent use by naval explorers in charge of worldwide scientific expeditions.

New territorial acquisitions in Puerto Rico and the Philippines, booty in the 1898 war with Spain, stimulated Americans' interest in geography and expanded the market for world and regional maps and atlases. Historian Susan Schulten attributes the rise of "popular cartography" in the late nineteenth and early twentieth century to the synergy of overseas possessions, increased world trade, expanded public education, and technical advances in graphic reproduction.³⁵ A by-product of the Spanish-American War was the war atlas, for which two commercial atlas publishers, Rand McNally and George F. Cram, repackaged and adapted existing material to quickly and inexpensively meet sudden demand.³⁶ In an examination of the atlases' content and design, Schulten notes an unabashed endorsement of expansionism and a reorganization of the world according to wealth and commerce, in contrast to earlier schemas based largely on race. The recent victory over Spain also inspired the editors of *National Geographic Magazine* to include a fold-out map titled "The Philippine Islands as the Geographic Center of the Far East," to accompany an article by a former ambassador to Siam.³⁷ The National Geographic Society was still largely a scholarly, scientific organization interested in commerce and exploration, and at the turn of the century most issues of its monthly magazine contained at least one article with small-scale maps as illustrations.

Additional examples of chorographic cartography survive, largely

Systematic Mapping

Turn-of-the-century America was far behind Europe in systematic mapping. Its official mapping agency, the USGS, was founded in 1879 as an amalgamation of the famed surveys of the American West, but did not carve out a distinct systematic national mapping role until 1882, when Congress broadened the agency's responsibilities for geological mapping to include the entire nation.⁴⁶ Although Congress had not specifically authorized a systematic, general-purpose survey, the Geological Survey's geologic and economic maps required detailed base maps—Chief Geographer Henry Gannett called them “mother maps”—uniform in scale and content. Individual states, mining companies, and assorted entrepreneurs had mapped much of the country, but according to Gannett, coverage varied widely.⁴⁷ Private firms had surveyed almost all northern states and much of the South, but their maps were “essentially diagrams of roads,” on which streams were “feebly represented” and relief was “rarely shown.” In a disparaging reference to subscription atlases, Gannett noted that “houses along the roads are generally represented, together with the



In 1900, marine charting was the responsibility of the U.S. Coast and Geodetic Survey, which Congress, at the urging of Thomas Jefferson, had established in 1807 as the Survey of the Coast. Ruppert Southard, a former chief of the USGS National Mapping Division, called the president's action "the first major political decision regarding national mapping."³⁹ According to Southard, Jefferson recognized the federal government's role in fostering economic development. A responsibility of the Treasury Department, which also oversaw the U.S. Coast Guard, the charting agency became the U.S. Coast Survey in 1836, and was renamed the U.S. Coast and Geodetic Survey in 1878. As a quasi-military organization, the Survey had depended heavily on the assignment of naval and army engineer officers, especially during the Civil War and the Spanish-American War.⁴⁰ In 1900, Congress made the Survey a purely civilian agency, which the newly formed Department of Commerce and Labor absorbed in 1903.⁴¹

Focused on mapping the coastline, adjacent waters, and nearby inland topography, the Coast and Geodetic Survey published maps at a variety of scales.⁴² Harbor charts were its most detailed products, with scales between 1:5,000 and 1:40,000, followed by coast charts at scales between 1:80,000 and 1:100,000, and general charts of the coast at scales ranging from 1:200,000 and 1:400,000. Least detailed, but broadest in geographic scope, were the Survey's sailing charts, with scales between 1:600,000 and 1:3,600,000.

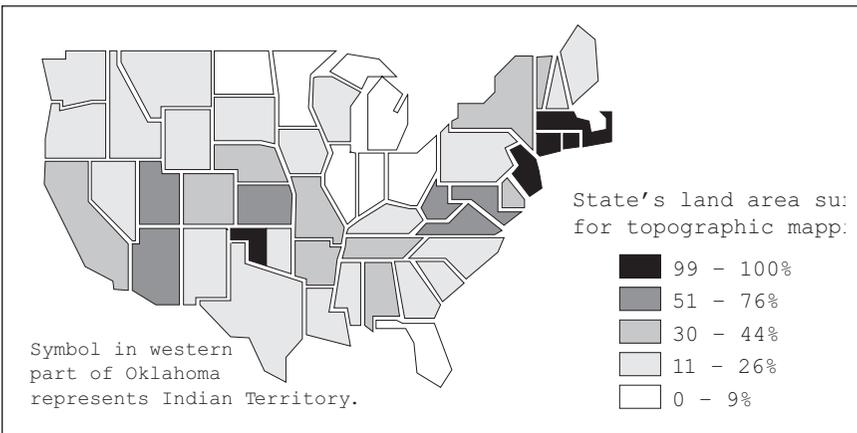
Much of the agency's hydrographic work involved monitoring and remapping change in the bottom of oceans, lakes, and navigable rivers, and updating its charts for navigation and defense. In 1895, in a law addressing the publication of public documents, Congress affirmed the policy of selling the Survey's charts at the cost of paper and printing.⁴³ Marine safety demanded a pricing policy favoring wide dissemination and ready replacement of obsolete charts.

Ferdinand Rudolph Hassler—the first superintendent of the Survey of the Coast—left three legacies: the marine charting agency itself, an appreciation of geodesy and rigidly accurate control surveys, and the polyconic projection, so called because every parallel of latitude is a line of true scale. Parallels are circular arcs, which diverge from the central meridian, also a line of true scale (Figure 2). Neither conformal nor equal-area, the polyconic projection is especially suitable for quadrangle maps and regions of considerable north-south extent like the American coasts. Hassler devised the projection around 1820 to afford a balanced distribution of the map's minimal distortion and to avoid having to specify a secant conic projection's two standard parallels.⁴⁴ The projection is also "universal" insofar as a single set of published tables enable a cartographer to convert easily from spherical to rectangular coordinates for a locally centered polyconic projection.⁴⁵ Tables published by the Coast and Geodetic Survey account in part for the projection's adoption by the USGS, which used the polyconic on all quadrangle maps through the late 1950s.

nied cadastral mapping in the late 1890s, and coverage was 99 percent complete at the turn of the century.⁵⁰

Projects like the Indian Territory Surveys tended to concentrate topographic surveying in comparatively few areas. According to the Geological Survey's annual report for 1900, over half of the 29,428 square miles newly surveyed during the previous year was in six states: Arkansas, California, New York, Washington, Wisconsin, and Wyoming.⁵¹ Among the seven states with systematic surveys for less than 10 percent of their territory, the report mentioned recent progress in only three: Indiana, Minnesota, and Ohio.

Publication typically lagged two years behind completion of the field survey because of an intricate manufacturing process that included editing, engraving, and printing. During the 1899-1900 budget year, the USGS added eighty-six new sheets to the 111 maps awaiting engraving as of July 1, 1899.⁵² Of these, seventy-two sheets were published or in press at the end of the budget year, forty were being engraved, thirty-five had been edited and approved for engraving, and sixty had not yet been approved. Of the seventy-two sheets listed as "engraved and printed (or in press)," forty-one were 15-minute quadrangles mapped at 1:62,500, typically with a contour interval of twenty feet, and twenty-eight were 30-minute quadrangles mapped at 1:125,000, with a contour interval of twenty or fifty feet. The other three sheets are the 1:1,584,000 (1 inch = 25



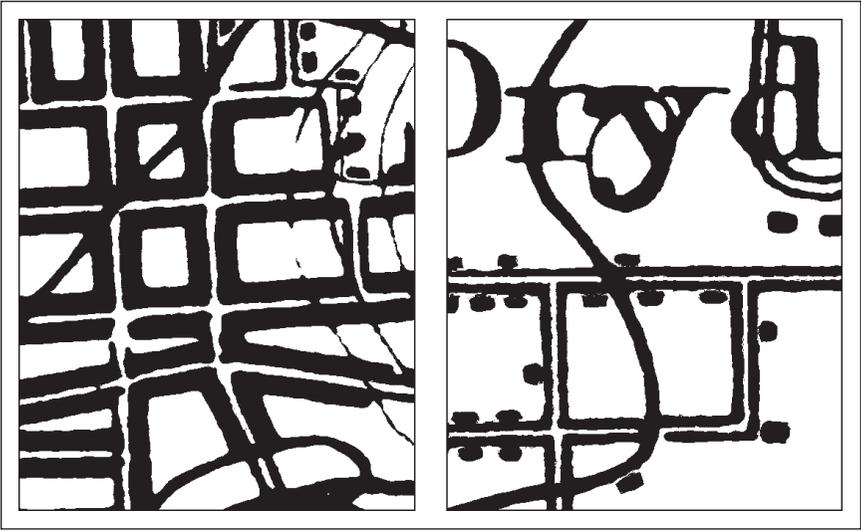
names of owners, as it is found that this aids in the sale of the maps."⁴⁸

Faced with the daunting task of mapping nearly 3,000,000 square miles, Gannett and USGS Director John Wesley Powell adopted a divide-and-conquer strategy of nested quadrangles partitioned by meridians and parallels. The basic unit was the square degree mapped at 1:250,000, a combination of geographic scope and map scale that allowed an efficient, broad-brush treatment of structural geology on a 16.5- by 20-inch sheet of paper. Within an identical format, 30-minute by 30-minute quadrangle maps at 1:125,000 afforded added detail for more topographically or geologically complex areas, and 15-minute by 15-minute quadrangle maps at 1:62,500 or 1:63,360 could accommodate urban street networks and intricate shorelines. Although the scheme in principle assigned every part of the county to a 15-minute, a 30-minute, and a 1-degree quadrangle, few areas were mapped at all three scales. Because efficiency depended upon extent of settlement, USGS officials generally reserved 1:62,500 and 1:125,000 mapping for urban and more settled agricultural areas, respectively, and mapped relatively empty areas, largely in the west, at 1:250,000.

In 1892, in a presentation to the National Geographic Society, Gannett reported that in ten years the Geological Survey's Topographic Division had surveyed 550,000 square miles—over a sixth of the nation. Although cooperation with state agencies had allowed the USGS to complete topographic surveys of Connecticut, Massachusetts, New Jersey, and Rhode Island, large areas of the country lacked even the most rudimentary base maps. Gannett listed seven regions with surveys "too scanty to warrant" representation at 1:1,000,000:

- northern Maine
- New York's Adirondack "plateau"
- southern Florida
- most of Idaho and much of Montana
- the Cascade and Coast ranges of Oregon and Washington
- western North Dakota and South Dakota
- western Texas and southeastern New Mexico.⁴⁹

By 1900, the USGS had expanded the area surveyed to 835,316 square miles: not quite 28 percent of the nation's estimated 3,024,880 square miles. As Figure 3 illustrates, coverage varied widely among the states. In contrast to considerable progress in non-mountainous coastal states from Virginia through Massachusetts, over 90 percent of Florida and several midwestern states lacked systematic surveys. Surveys over 50 percent complete in Arizona, Nebraska, and Utah reflect federal interest in fostering Euro-American settlement and relocating native peoples. In Indian Territory, represented on the map by the western half of what in 1907 became the state of Oklahoma, topographic mapping accompa-



Equally telling is the label “Polyconic projection, North American datum.” Until the late-1950s, when numerical tables and mechanical coordinate plotters fostered increased use of the State Plane Coordinate (SPC) System, the USGS based all its topographic maps on the polyconic projection, developed around 1820 by Ferdinand Hassler, the first superintendent of the Survey of the Coasts.⁵⁶ Ironically, around 1920, the Coast and Geodetic Survey began to convert its nautical charts to the Mercator projection, and in the early 1930s, two decades before the USGS abandoned the polyconic projection, the Coast and Geodetic Survey adopted the transverse Mercator projection for SPC zones with a north-south elongation.⁵⁷

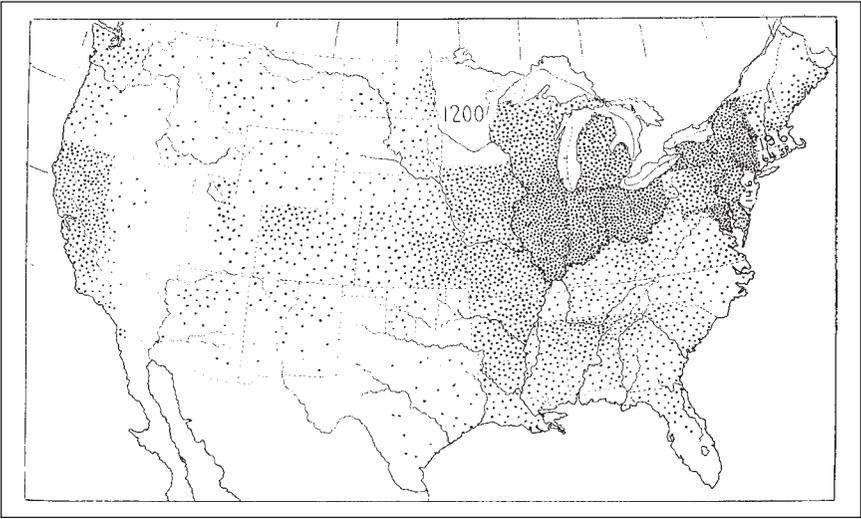
Thematic Mapping

Although few copyright registrations identify individual thematic maps, this cartographic mode is readily apparent in 1900 in various atlases, journal articles, and government reports. In *Early Thematic Mapping in the History of Cartography*, Arthur Robinson described key developments in thematic mapping in the eighteenth and nineteenth centuries, and observed that “the first five or six decades of the nineteenth century were a kind of ‘golden age’ of thematic cartography ... the steepest part of

miles) Topographic Map of Texas; a 1:14,400 map with ten-foot contours of Franklin Furnace, New Jersey, a geologically unique area rich in minerals; and a 1:23,600 map of the Rico District, a mining area in Colorado. Although mapmaking focused on quadrangle maps, USGS cartographers also served the agency's need for "special" projects.

Turn-of-the-century USGS quadrangle maps look different from their more recent counterparts. Smaller in size and less detailed, the earlier maps often had a contour interval twice that of their modern equivalents. (In the 1950s, the USGS adopted the 7.5-minute quadrangle mapped at 1:24,000 on a twenty-two- by twenty-seven-inch sheet as its standard treatment.) Engraved on copper plates but transferred to lithographic stones for printing in three colors—brown for terrain; blue for hydrography; and black for labels, roads, and other "culture"—the older maps lacked the familiar red and green tints that identify built-up and wooded areas as well as the distinctive purple symbols with which photorevised maps highlight features added since the last revision. Instead of pointing out landmark buildings, early USGS quadrangle maps portrayed cities as networks of closely spaced double-line streets bordered by thick black rectangles—cartographic amalgamations offering no distinction between row homes and fully detached single-family houses on fifty-foot-wide lots (Figure 4). Equally characteristic is the copperplate engraver's technique of highlighting oceans, lakes, and wide streams with a series of closely spaced blue lines parallel to the shoreline.

Text in the "collar"—Geological Survey jargon for the largely white area surrounding the map—reveals still deeper differences: instead of merely stating year dates for aerial photography and previous editions, these earlier maps identify their authors by name. For example, the lower-left corner of the 1898 Syracuse, New York, quadrangle map identifies Henry Gannett as chief topographer and H. M. Wilson as the "Geographer in charge," and attributes the topography to J. H. Jennings and J. W. Thom. Directly to the right, a thumbnail diagram credits Jennings with most of the effort and notes that Thom worked only in the northeast part of the quadrangle, north of the Oneida River. Although another credit line acknowledges "Triangulation by N.Y. State Survey," the state's surveyors remain anonymous. The explanatory note at the lower right, "Surveyed by reconnaissance methods," indicates that Jennings and Thom used a plane table for traversing, sketching, and secondary triangulation and estimated differences in elevation using spirit level, telescopic alidade, and an aneroid barometer.⁵³ Although the Topographic Branch experimented with aerial surveying during World War I, the agency made little use of photogrammetry until the late 1930s.⁵⁴ Ironically perhaps, although USGS quadrangle maps are no doubt more geometrically precise and reliable now than in 1900, contemporary topographic maps at 1:24,000 are often not much more detailed than either their European counterparts at 1:50,000 or their American forebears at 1:62,500.⁵⁵



country received readings from some but not all observers. Fax technology and long-distance telephone service were primitive at best, and more or less timely, centrally produced weather maps did not appear until 1935, when the Associated Press Wirephoto service provided morning and evening weather maps for afternoon and morning newspapers. In 1900, individual forecasters plotted their own weather maps, which clerks or printers at over 100 forecast offices reproduced in small quantities and distributed locally as "Station Weather Maps." Until 1912, when the Weather Bureau actively sought the cooperation of the news media, no more than a handful of newspapers carried a daily weather map.

Prepared largely at the initiative or whim of individual scholars, scientists, mining companies, or state geological surveys, large-scale geologic maps were geographically sporadic in 1900—and still are in 2000 because of the detailed field work required. But complete coverage was not essential for a small-scale national overview, as demonstrated by W. J. McGee, who, in 1883, produced what geological historian Andrew Ireland considered the most accurate small-scale national geologic map at the beginning of the twentieth century.⁶⁷ Based on existing maps and unpublished field notes, the multi-hued 1:7,115,000 (1 inch \approx 112 miles) USGS map shows eleven geologic "divisions."⁶⁸ In 1893, the USGS printed a revised version of McGee's map, in color with generalized contours and at a slightly smaller scale (1 inch \approx 100 miles). By contrast, soils mapping was far less developed than geologic mapping. The Department of Agriculture initiated a soil survey in 1899 and its Bureau of Soils surveyed over 9,000 square miles by mid 1901. But the work was tainted by a

the thematic revolution."⁵⁸ In *Cartographical Innovations: An International Handbook of Mapping Terms to 1900*, Robinson and co-author Helen Wallis provided dates for various types of maps and symbols.⁵⁹ Earliest dates for important thematic treatments include 1826 for choropleth maps, 1833 for dasymetric maps, 1830 for dot maps, 1837 for flow maps, 1584 for isarithmic maps, 1857 for isopleth maps, 1838 for proportional-circle maps, and 1801 for divided-circle (pie chart) maps.⁶⁰

That famous firsts need not always herald widespread use is readily apparent in U.S. Bureau of the Census's statistical atlas for the twelfth census, published in 1903. Choropleth and dasymetric maps are predominant, while dot and proportional-circle maps are conspicuously absent.⁶¹ Instead, two-category choropleth maps portray "principal regions" for field crops and other agricultural phenomena, while a quintet of centrogographic maps charted the westward advance of settlement and manufacturing activity and compared various agricultural indicators.⁶² As Wallis and Robinson note, "the dot map ... did not become popular until the early twentieth century."⁶³

The relative rarity of dot maps in government and scholarly publications might explain the appallingly naïve example in Figure 5, which graced the inaugural, January 1900 issue of the *Bulletin of the American Bureau of Geography*, a short-lived magazine for elementary- and secondary-level geography teachers.⁶⁴ Used to illustrate an article titled "Educational Value in Geography," the map was meant to show the "number and approximate distribution of persons (in the U.S.) recently invited to take part in the exchange of geographic material, and to co-operate for the purpose of bettering the teaching of geography."⁶⁵ For states without an overwhelming density of potential contributors, the map author either assumed a uniform density or substituted exact counts for dots, as in Massachusetts, Minnesota, and three other states. Exceptions include sparsely inhabited areas like northern Maine and eastern Oregon but not the Adirondack Mountains in northern New York. And in reporting a markedly greater concentration in northern California, the map ignores massive and widespread growth in southern California, especially in Los Angeles, which barely registers. However well intended, this misleading picture of evenly distributed clients reflects ignorance of cartographic principles as well as population geography.

Then as now, the most numerous thematic map in the U.S. was the daily weather map.⁶⁶ Thematic in its consistent construction on a common base map, the weather map was also temporally systematic, albeit not in the Edneyian sense of large-scale maps based on systematic land-survey measurements. Observers collected data twice daily, at 8 a.m. and 8 p.m., and telegraphed their readings to Washington, where clerks prepared four maps describing the atmosphere's current state and recent change. Because telegraphy was expensive, Weather Bureau offices around the

now, standards and interagency coordination were essential ingredients in efficient and effective government mapping.

A Concluding Caveat

However sketchy, the foregoing snapshot demonstrates substantial change in government mapping and commercial cartography during the nineteenth century. By 1900, a horizontal control network was in place; a refined vertical control network was under development; a systematic topographic survey had covered more than a quarter of the country; the commercial sector had demonstrated versatility and initiative in exploiting relevant technology; and mapping had asserted its rhetorical power in promoting commerce, land development, and globalism. The next century would witness further change as a result of photogrammetry, satellite platforms, digital computing, and telecommunications networks. More important, perhaps, government would assert greater control over coverage, reliability, and public access. Although advances in geometric accuracy, thematic coverage, publication quality, and interactive analysis might suggest overwhelmingly beneficial progress in mapmaking and map use, scholars must not ignore the map's historical role as a tool of the state, not the individual. As mapping becomes an increasingly powerful instrument of surveillance and regulation, its benefits to individuals, communities, and society at large will depend, more than ever, on the goodwill and prudence of the people in charge.

Notes

1. Henry Gannett, "The Mother Maps of the United States," *National Geographic Magazine* 4 (1892): 101-16; quotation on 101-02.
2. In the early twentieth century, the Government Printing Office published the copyright catalog weekly, and an entry usually appeared one to ten weeks after a map's publication. Our copyright information covers only the sixty-five weekly catalogs published from January 1900 through March 1901. This range of weekly catalogs reliably accounts for almost all maps published during 1900. Each entry typically has three dates: the date represented by the map, the date of publication, and the date on which the Copyright Office received copies of the map for registration. Tabulations in this paper reflect the date of publication stated by the copyright owner. Late registrations for maps published in prior years and recorded in issues of the catalog published during 1900 suggest that our sample missed few maps—not more than a half dozen, at most—published during 1900 and registered for copyright after March 1901. Even so, the catalog offers an incomplete record because not all maps eligible for copyright are registered. For further discussion of trends in copyright registration for maps, see James L. Cerny, "Awareness of Maps as Objects for Copyright," *American Cartographer* 5 (1978): 45-56.
3. M.J. Blakemore and J.B. Harley, "Concepts in the History of Cartography: A Review and Perspective," *Cartographica* 17:4 (1980): 1-120, esp. 26-28.
4. An especially useful source is Harry Granick, *Underneath New York*, with introduction by Robert E. Sullivan Jr. (New York: Henry Holt and Co., 1947; Fordham University Press, 1991). Granick describes the use and development of a wide variety of underground facilities ranging from subway, railways, and pneumatic messaging tubes to electric, gas, water, telephone, telegraph, and alarm systems, all in use at the turn of the century. Although not self-consciously carto-

strong geologic bias, which George Coffey attempted to rise above in his generalized national soils map, published in 1912. Broader notions of pedogenesis, imported from Russia around 1914, soon made these early surveys obsolete.⁶⁹

Mathematical Cosmography

According to Edney, the manufacture of precision surveying instruments not only made triangulation less expensive as well as more exact but cost mathematical cosmography much of its seventeenth-century mystique and stature.⁷⁰ Moreover, completion of national and regional triangulation networks and large-scale systematic surveys led to a “fragmentation” whereby mathematical cosmography survives as a distinct cartographic mode only in remote, poorly mapped parts of the globe. Although this interpretation is consistent with the historical roots of Edney’s taxonomy, several late-nineteenth century developments warrant comment.

In 1900, the Coast and Geodetic Survey was but a year away from its official adoption of the U.S. Standard Datum.⁷¹ Based on the Clarke Spheroid of 1866, which approximated the generalized shape of North America with a manageable set of equations, the new datum provided a common, consistent, and—for its time—reliable system of latitudes, longitudes, distances, and directions. The culmination of decades of measurement and calculation, the datum reflected extension and refinement of the higher-order survey network begun in 1871, when Congress added geodesy to the Coast Survey’s mandate. Notable additions to the higher-order triangulation network included the Eastern Oblique Arc, from the Bay of Fundy to New Orleans, in 1889; the West Coast Arc, from Canada to Mexico, in 1890; the Transcontinental Arc along the 39th parallel, in 1895; and the extension of the Texas Arc northward to the Transcontinental Arc and westward to the West Coast Arc, by 1900. Additional work in progress included a gravitational survey begun in 1875, a magnetic survey initiated in 1877, and a leveling survey, intended to refine and extend the network of elevation bench marks.

Because of fluctuations in funding and leadership, progress was far from uniform. Even so, early-twentieth-century commentary was favorable and optimistic. Describing job opportunities at the Coast and Geodetic Survey, John Hayford rejoiced that “the days of the spoils system are passed [and] success is now won by the young man by the same methods as in any other large organization.”⁷² Writing in *Science*, Survey superintendent Otto Tittmann praised the cooperation of other government agencies so that a “homogeneous system of vertical coordinates for the whole country can be established which shall stand side by side with [the] geographical coordinates [of latitude and longitude].”⁷³ Then, as

26. These maps are listed, respectively, as entry 160 in volume 24 and entry 205 in volume 25 of the Catalogue of Title Entries of Books and Other Articles.
27. This proportion is consistent with a trend suggested by an earlier study focused on maps of Pennsylvania, which found that prospecting and mining accounted for 13 percent and 2 percent of the map copyrights registered for the periods 1870-74 and 1920-24. Mark Monmonier, "Private-sector Mapping in Pennsylvania: A Selective Cartographic History for 1870 to 1974," *Proceedings of the Pennsylvania Academy of Science* 55 (1981): 69-74.
28. "Report of the Topographer of the Post-Office Department," in U.S. Post Office Department, *Annual Report of the Post-Office Department for the Fiscal Year Ended June 30, 1900* (Washington, D.C., 1900): 81-82.
29. The 1896 date is somewhat arbitrary. In 1893, Congress approved funding for an experiment in rural free delivery, and in 1896, additional funding allowed expansion of the service first to five and later to eighty-two routes. Gerald Cullinan, *The Post Office Department* (New York: Frederick A. Praeger, 1968): 194-95.
30. For descriptions of varied underground facilities, all requiring maps for their construction and operation, and all in use, perhaps less extensively or in a more rudimentary form, in 1900, see Granick, *Underneath New York*.
31. For examples, see John W. Reps, *The Making of Urban America: A History of City Planning in the United States* (Princeton: Princeton University Press, 1965); *Town Planning in Frontier America* (Columbia: University of Missouri Press, 1980); and *Views and Viewmakers of Urban America: Lithographs of Towns and Cities in the United States* (Columbia: University of Missouri Press, 1984).
32. Edney, "Cartography without 'Progress,'" 60.
33. For an insightful examination of wax engraving and competing cartographic reproduction processes, see David Woodward, *The All-American Map: Wax Engraving and Its Influence on Cartography* (Chicago: University of Chicago Press, 1977).
34. Jeffrey C. Patton, "The American School Atlas: 1784-1900," *Cartographic Perspectives* 33 (Spring 1999): 4-32.
35. Susan Schulten, "The Transformation of World Geography in American Life, 1880-1950," Ph.D. diss., University of Pennsylvania, 1995.
36. *Ibid.*, 331-39.
37. For discussion of the development of popular cartography at the National Geographic Society, see *Ibid.*, 390-97. For the article accompanying the map, in the January 1900 issue, see John Barrett, "The Philippine Islands and Their Environment," *National Geographic Magazine* 11 (1900): 1-14.
38. Mark Monmonier, *Maps with the News: The Development of American Journalistic Cartography* (Chicago: University of Chicago Press, 1989): 77-83, 109.
39. R.B. Southard, "The Development of U.S. National Mapping Policy," *American Cartographer* 10 (1983): 5-15; quotation on 6.
40. John P. Snyder, *Flattening the Earth: Two Thousand Years of Map Projections* (Chicago: University of Chicago Press, 1993): 118; and Gustavus A. Weber, *The Coast and Geodetic Survey: Its History, Activities and Organization* (Baltimore: Johns Hopkins Press, 1923): 1-14.
41. In 1970, the agency became a part of the National Ocean Service, under NOAA (National Oceanic and Atmospheric Administration). In 1991, the name reverted to Coast and Geodetic Survey, its appellation in 1900, and in December 1994, the name changed once again, when yet another reorganization created separate NOS divisions with "office" rank for the Office of Coast Survey, the Office of National Geodetic Survey, and several other functions. See <http://chartmaker.ncd.noaa.gov/ocs/text/hist.html> (3 November 1999).
42. U.S. Coast and Geodetic Survey, *Catalogue of Charts, Coast Pilots, and Tide Tables, 1908* (Washington, 1908): 13-16. Because the catalog lists dates, and charts were rarely revised more frequently than every eight years, the 1908 listing provides a reliable picture of the range of scales available in 1900. The catalog also offered for sale a number of older maps of historical value, some prepared as early as 1843, with the caveat "not adapted for use of navigation."
43. Weber, *The Coast and Geodetic Survey*, 79.
44. Snyder, *Flattening the Earth*, 118-19. Also see Ferdinand Rudolph Hassler, "On the Mechanical Organisation of a Large Survey, and the Particular Application to the Survey of the Coast," *Transactions of the American Philosophical Society* n.s., 2 (1825): 385-408. For its sailing charts, published at a smaller scale than the coast charts, the survey relied on the Mercator projection, which offered the unique and valuable property of straight rhumb lines; see U.S. Coast and Geodetic Survey, *Catalogue of Charts*.

- graphic, Granick includes facsimiles of eight maps and mentions additional maps as well.
5. Matthew Edney, "Cartography without 'Progress': Reinterpreting the Nature and Historical Development of Mapmaking," *Cartographica* 30:2/3 (1993): 54-68.
 6. *Ibid.*, 57.
 7. *Ibid.*, 63.
 8. *Ibid.*, 63.
 9. For a concise description of global positioning principles and their conceptual and historical connection to earlier geodetic surveying and navigation technologies, see Mark Monmonier, *Technological Transition in Cartography* (Madison: University of Wisconsin Press, 1985): 26-38 and 46-75.
 10. International Correspondence Schools Staff, *City Surveying* (Scranton, Pa.: International Textbook Company, 1907): 55.
 11. International Correspondence Schools Staff, *Mapping*, parts I and II. (Scranton, Pa.: International Textbook Company, 1906): II-65.
 12. *Ibid.*
 13. *Ibid.*, II-60.
 14. *Ibid.*, II-62.
 15. *Ibid.*, II-63.
 16. Erwin Raisz, *General Cartography* (New York: McGraw-Hill Book Company, 1938); and Arthur H. Robinson, *Elements of Cartography* (New York: John Wiley and Sons, 1953). A slogan on the dust cover of Robinson's book ("presents cartography as an intellectual art and science rather than as a sterile system of drafting and drawing procedures") signals a new approach, based in part on subject-testing and emphasizing thematic cartography and small-scale maps. The first edition of Robinson's textbook was only marginally more systematic than either Raisz's book or a British work published a year earlier and marketed in North America; see F.J. Monkhouse and H.R. Wilkinson, *Maps and Diagrams: Their Compilation and Construction* (London: Methuen and Company, 1952). By contrast, all three books say far more about statistical and other thematic maps than earlier texts on mapping, such as Arthur Hinks's *Maps and Survey*, first published in 1913; see Arthur Hinks, *Maps and Survey* (Cambridge: University Press, 1913). Perhaps the earliest comparatively comprehensive cartographic textbook is Max Eckert's, *Die Kartenwissenschaft: Forschungen und Grundlagen zu einer Kartographie als Wissenschaft*, 4 books in 2 vols. (Berlin: Walter de Gruyter, 1921-25).
 17. For a concise overview of insurance underwriters' maps, see Walter W. Ristow, "United States Fire Insurance and Underwriters Maps, 1852-1968," *Quarterly Journal of the Library of Congress* 25 (1968): 194-218. For a description of the Library of Congress collection of fire insurance maps, see U.S. Library of Congress, Reference and Bibliography Section, Geography and Map Division, *Fire Insurance Maps in the Library of Congress*, with an introduction by Walter W. Ristow (Washington, D.C.: Library of Congress, 1981). Also see R. Philip Hoehn, *Union List of Sanborn Fire Insurance Maps Held by Institutions in the United States and Canada* (Santa Cruz, Calif.: Western Association of Map Libraries, 1976).
 18. For additional insight on the early-twentieth-century fire insurance industry, see Diane L. Oswald, *Fire Insurance Maps: Their History and Applications* (College Station, Tex.: Lacewing Press, 1997).
 19. For a concise history of the Sanborn-Perris Company, see Ristow, "United States Fire Insurance and Underwriters Maps." Two companies accounted for the remaining fifty-three registrations: E. Hexamer and Son, a Philadelphia firm that copyrighted thirty-four updated maps for portions of that city, and Henry Bennett of Cedar Rapids, Iowa, who claimed copyright for nineteen maps of various Iowa communities. The copyright catalog clearly identifies fire insurance maps, and no other entries are worded to suggest, even remotely, other insurance maps.
 20. For a concise overview of land ownership maps, see Norman J. W. Thrower, "The County Atlas in the United States," *Surveying and Mapping* 21 (1961): 365-73.
 21. Michael P. Conzen, "The County Land-Ownership Map in America: Its Commercial Development and Social Transformation, 1814-1939," *Imago Mundi* 36 (1984): 9-31.
 22. *Ibid.*, 26.
 23. These maps are listed, respectively, as entry 284 in volume 23 and entry 298 in volume 24 of the *Catalogue of Title Entries of Books and Other Articles*.
 24. These maps are listed, respectively, as entry 291 in volume 23 and entry 197 in volume 26 of the *Catalogue of Title Entries of Books and Other Articles*.
 25. These maps are listed, respectively, as entry 2 in volume 23 and entry 132 in volume 24 of the *Catalogue of Title Entries of Books and Other Articles*.

45. John P. Snyder, *Map Projections Used by the U.S. Geological Survey*, Geological Survey bulletin no. 1532. (Washington, D.C.: Government Printing Office, 1982): 126.
46. The Geological Survey was not the Interior Department's first mapping endeavor. Surveys of publicly owned lands began in 1785, when the government initiated the rectangular township-and-range survey. Although the General Land Office (now the Bureau of Land Management) prepared cadastral (property) maps for much of the western and central United States, these maps were less complete and detailed than the Geological Survey's topographic maps. See Edney, Matthew, "Politics, Science, and Government Mapping Policy in the United States, 1800–1925," *American Cartographer* 13 (1986): 295–306; Morris M. Thompson, *Maps for America: Cartographic Products of the U.S. Geological Survey and Others* (Washington, D.C., 1979): 11; and Norman J. W. Thrower, *Original Survey and Land Subdivision: A Comparative Study of the Form and Effect of Contrasting Cadastral Surveys* (Chicago: Rand McNally, 1966): 1–8.
47. Gannett, "Mother Maps of the United States," 101.
48. *Ibid.*, 110.
49. *Ibid.*, 114.
50. For a concise history of the survey of Indian Territory, see R.T. Evans, et al., *United States Geological Survey: History of the Topographic Branch (Division), Preliminary Draft* (Washington, D.C.: U.S. Geological Survey, c.1955): 95–100. A handwritten note states, "This draft was prepared about 1950–55, primarily by R.T. Evans. Subsequent efforts by [Gerald] Fitzgerald to have it augmented by others and made more complete were not successful, as it did not advance

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