

The Measurement That Built America

The little-appreciated U.S. public-land survey not only opened up our frontier but made possible our freedoms

Andro Linklater

November/December 2002 | Volume 53, Issue 6

LOOK OUT THE AIRPLANE WINDOW ON A flight from Los Angeles to Chicago, and you can see below one of the most astonishing man-made constructs on earth. It is more extensive than the Great Wall of China, yet it remains almost invisible unless you're looking for it. Once you begin to recognize it, however, the clues are everywhere: the checkerboard arrangement of the orchards and fields of California's Great Central Valley; the rectangular farms in the canyons of the Sierra Nevada; the graph-paper grid of streets in Phoenix and Salt Lake City; the great plaid pattern of corn and soy across the prairies. All are aligned with the cardinal points of the compass, so that the lines run north to south and east to west.

These are the visible indicators of the United States public-land survey, a continuing project nearly as old as the nation itself. Since 1785 it has covered more than three million square miles from the Appalachians to the Pacific Ocean, shaping farms and cities and doing more to alter the American landscape in that time than wind or weather. But its invisible influence is more far-reaching yet. The survey created a structure of landownership unlike any other in history and laid the foundation for the development of a society unique in its democracy and enterprise. And, almost incidentally, it ensured that the United States would be one of the last nations in the world to resist the metric system.

On September 30, 1785, Thomas Hutchins, the first official geographer of the United States, unrolled a 22-yard-long surveyor's chain on the west bank of the Ohio River. The government needed to raise money to pay off the mountain of debt it had accumulated in achieving its independence, and this land beyond the Appalachians was virtually its only asset. Before the sale could take place, however, the wilderness had to be measured out and mapped. This was Hutchins's job. The Northwest Ordinance that had been passed in May that year called for "disposing of lands in the western territory" and required him to lay out lines running east to west 6 miles apart; they were to be cut at right angles by north-south lines 6 miles apart. This would create a grid of squares, known as townships, each covering 36 square miles. The townships were to be divided into 36 one-mile-square sections, which would be sold at auction. Hutchins was performing a piece of magic, the transformation of wilderness into property.

The pattern of squares had been Thomas Jefferson's idea, proposed in 1784. The simplicity of the shape made it truly democratic. It was easily measured out, and its area could readily be checked by any potential buyer. In Jefferson's ideal society, based on a romantic idea of Saxon England populated by independent yeoman farmers, as many people as possible would own land. He wrote in *Notes on the State of Virginia* that "the proportion which the aggregate of the other classes of citizens bears in any state to that of its husbandmen [farmers], is the proportion of its unsound to its healthy parts, and is a good-enough barometer whereby to measure its degree of corruption." From the start, therefore, the survey was expected not simply to raise money but to shape a society.

The equipment was basic: a theodolite or a transit (at that date, little more than a telescope with built-in compass), through which the surveyor could take a sighting on a distant mark to find its direction, and a Gunter's chain—a standard surveyor's chain exactly 66 feet long—to measure out the distance. Preceded by axmen who hacked a path through the trees, the foreman took the front end of the chain and marched toward the mark;

when the chain was fully stretched, he cried, "Tally!," stuck a tally pin in the ground, and waited for the hindman to join him, gathering up the chain. So they moved across the country, like caterpillars, hunching up and stretching out, through forests, over swamps, up mountains, and down ravines.

"Before going a mile," one surveyor wrote of the hilly forests in eastern Ohio, "I discovered it was impossible to do accurate chaining in such a broken country, where the hills were so steep it was often with difficulty they could be climbed." William Burt, who ran part of the survey through the mosquito-infested swamps and prickly undergrowth of Michigan, was made of sterner stuff. "Dear Companion," he wrote to his wife, Phebe, in 1840, "I am now... about 40 or 50 miles from any Settlement in the midst of a swamp about twelve miles in diameter, but

expect to get out tomorrow as I can see high Beech and maple Land to the North. My Coat and Pantiloons are most gone. If you could make me a frock [long coat] and a pair of Pantiloons of the strongest kind of Bedticking they would I think stand the Brush." In Kansas a young surveyor was taking a sighting in 1854, when, he reported, "a party of Indians fired on me and my men. A shell struck a tree against which I was leaning."

Despite the difficulties, by the end of the nineteenth century most of the country had been squared off into townships and sections, half-sections, and quarter-sections, down to a quarter-quarter section of 40 acres. Each parcel of land was identified on a surveyor's map, registered at a federal land office, and made available for purchase. This was what underpinned the legends of the frontier. The survey guaranteed the pioneers in their covered wagons legal possession of their land; it substantiated the claims of gold miners; it settled the feuds of cowboys and farmers; it financed the construction of the railroads. "The magnitude of the greatest land-measurement project in history is mind-boggling," wrote the geographer Hildegard B. Johnson in 1977. "One marvels at the determination with which these men threw and retraced their lines. Still their role is largely ignored in the history of the frontier."

In 1862 Lincoln introduced the Homestead Act, which gave anyone 160 acres so long as he or she built a cabin and worked the soil for five years. Parcels of land were given free to socially valuable people like Army veterans and teachers. State universities were founded on the proceeds of the sale of lands the federal government had given to the states, and railroad companies made their profits largely from the squares of land the government gave to them on either side of the track. In all, more than a billion acres entered private ownership.

The process had profound consequences. Most eighteenth-century Americans thought of those living on the frontier as one step removed from savagery—"our own semi-barbarous citizens" was how Jefferson described them—but early-nineteenth-century writers like James Fenimore Cooper began to extol them for their self-reliant enterprise, and a generation later they came to be taken as the very essence of what it meant to be American. In his famous 1893 essay "The Significance of the Frontier in American History," Frederick Jackson Turner argued that "the frontier promoted the formation of a composite nationality for the American people... that restless nervous energy, that dominant individualism working for good and for evil, and withal that buoyancy and exuberance which comes with freedom—these are traits of the frontier."

Turner's thesis has repeatedly been attacked on the grounds that the movement westward was too piecemeal and irregular to constitute the pushing back of a frontier. Far from being individualistic, it was usually communal. Yet his thesis refuses to die, because a distinctive American spirit did indeed arise from the expansion into the West. To contemporary observers, the origin of that spirit was obvious. It had little to do with the frontier family's experience in the wilderness and everything to do with its acquisition of landed property.

As early as 1813 the traveler John Melish commented approvingly, "Every industrious citizen of the United States has the power to become a freeholder ... and the land being purely his own, there is no setting limits to his prosperity. No proud tyrant can lord it over him." Writing 20 years later from a less admiring viewpoint, Frances Trollope, the mother of the British novelist Anthony Trollope, expressed fear for the survival of civilized behavior when anyone could acquire land. "Any man's son may become the equal of any other man's son, and the consciousness of this is certainly a spur to exertion," she conceded in *The Domestic Manners of the Americans*. "On the other hand, it is also a spur to that coarse familiarity, untempered by any shadow of respect, which is assumed by the grossest and lowest in their intercourse with the highest and most refined."

THIS WAS WHAT UNDERPINNED THE LEGENDS OF THE FRONTIER, GUARANTEEING POSSESSION OF THE LAND, SUBSTANTIATING CLAIMS, SETTLING FEUDS.

It is easy to mock Mrs. Trollope, but if Jefferson's romantic view of the Saxons is discounted, the only model that history had so far provided for owning land was vertical, with the highest classes occupying the most, the lowest holding the least, and every social gradation from aristocrat to peasant determined largely by acreage. Now for the first time an entire society was being created, peacefully and legally, around a horizontal model of land distribution. In an era when land was the primary source of wealth and the key indicator of social class, the possibility that anyone could own it struck European visitors as revolutionary. In their eyes, that was what made America unique. A survey drawing from the 1780s shows its makers and their chain. Opposite, the chain itself.

Supporting evidence comes from an intriguing anomaly in Turner's thesis. He and his followers thought of the frontier as moving west, but in the early part of the nineteenth century, convoys of canvas-covered wagons also headed south, to Alabama, Mississippi, and Louisiana. By rights the frontier spirit should also have emerged there in the Deep South, with the same enterprising activity. Instead, a socially divided, hierarchical culture developed, markedly lacking in economic enterprise.

Most visitors blamed the South's idleness on its slave economy, but that wasn't the only thing that made the Southern frontier different. Throughout the region a nexus of fraud and corruption and the complications of earlier land grants made by French and Spanish governments prevented U.S. public land surveyors from establishing the kind of grid that was spreading into the Midwest. Surveys were forged, boundary markers moved, land officials bribed, and only those with deep pockets and smart lawyers could regard their titles to property as secure. In 1816 one local expert reckoned that "the titles in Kentucky will be Disputed for a Century to Come yet, when it's an old Settled Country." That lack of security kept the South from developing the sort of vigorous land market that flourished in the North, where financial institutions in New York and Boston created loans, bonds, and credit arrangements of ever-increasing sophistication to finance deals. And the Southern economy languished for much of the nineteenth century.

Significantly, one Southern state did escape the pattern. Stephen Austin, who brought hundreds of American families to Texas while it was still under Mexican rule, was so disgusted by the confusion of Kentucky's survey that he measured out the Americans' property accurately and in rectangles. As a result, much of Texas's public land came to be divided into plain, easily surveyed squares or oblongs that could be bought and sold without difficulty. When oil was discovered in Texas, late in the nineteenth century, real estate financing was available from institutions and individuals that had already done well in the land market.

The losers in all this were the American Indians. Almost every Indian war fought by the U.S. government from the Battle of Fallen Timbers in 1794 to the massacre at Wounded Knee in 1890 had its origins in the urge to pry ownership of land from its original occupants, and almost every Indian defeat was followed by a treaty in which they ceded territory to the U.S. government. Immediately afterward the surveyors would arrive with their chains and compasses, and in their wake would come the settlers. "It would be difficult to describe the avidity with which the American rushes forward to secure this immense booty," Alexis de Tocqueville wrote in *Democracy in America*. "Before him lies an immense continent and he urges onward as if time pressed and he was afraid of finding no room for his exertions."

Yet, as Jefferson anticipated, the survey also gave even the farthest-flung pioneers an interest in a law-based society, for once their square parcels had been registered at the land office, the whole panoply of the law guaranteed their rights to them. And because they received their property from the U.S. government, they had a stake not just in their immediate society but in America itself, a sense of identification that immediately struck the English émigré Morris Birkbeck when he settled in Illinois in the 1820s. "Here, every citizen, whether by birthright or adoption is part of the government," he wrote, "identified with it, not virtually but in fact."

WHAT JEFFERSON NEVER FORESAW WAS THAT THE SQUARED-OFF LAND WOULD BECOME A SOURCE OF CAPITAL, ENABLING SETTLERS TO BORROW, LEND, INVEST.

What Jefferson never foresaw was that the squared-off land would become a source of capital, enabling settlers to borrow, lend, and invest in other enterprises. A generation after Hutchins started measuring out its wilderness, the state of Ohio possessed "33 printing-offices, 27 banks, 12 cotton mills, 8 paper mills, 3 nail factories, an almost infinite number of stores, grist merchants and sawmills." This rural capitalism grew to fit in seamlessly with the industrial age in the 1850s and with the expansion of the railroad system across the

country, financed by the federal government's lavish grants of public-survey squares that the railroad companies could then sell to settlers. Thus Jefferson's yeoman farmers inexorably became part of the capitalist world that went with the democratic distribution of land.

Equally inexorably, so too did the measurements used in the survey. Having decimalized the dollar, Jefferson enthusiastically proposed decimalizing American weights and measures. As a painless way of introducing the change, he argued that the survey's squares be measured in decimal units (a township would have measured 10 by 10 new decimal miles, each mile being about 6,086 old feet long, and subdivided into tenths, one-hundredths, and one-thousandths). It comes as something of a surprise to discover that George Washington, Alexander Hamilton, and James Madison all supported Jefferson's scheme for decimalizing.

But the measures that were eventually chosen for use in the survey, and that thus came to be adopted by every settler in the new Western lands, were archaic Saxon units based on the number 4. The length of the standard surveyor's chain is usually described as 22 yards, but more important it was also 4 rods, each 16½ feet long. In sixth-century Anglo-Saxon England, the cultivation of an area measuring 4 square rods was reckoned as a day's work; 40 days' work made an acre, and 640 acres made a square mile. This ancient system was perfectly suited to the U.S. public-land survey because when it came to measuring out squares, a system based on 4 made life very simple.

The 640 acres that made up a section of a township could be divided into quarters, eighths, and sixteenths and still leave a whole number: 40, to be exact. This numerical neatness ensured that 40 acres became the basic unit on which Jefferson's great landed democracy was built. Owning a 40 was the bottom rung on the property ladder, and to a surveyor nothing could be easier to measure. A 40-acre square was merely 20 chains by 20. Railroads sold land by the 40-acre lot. After the Civil War freed slaves were reckoned to be self-sufficient with "40 acres and a mule." A nineteenth-century pioneer described how to pace it out on the prairie before the survey had even arrived: A walk 440 yards south, toward the midday sun, by 440 yards west, toward the setting sun, made a 40, and the claim could be registered later when the surveyor's map was drawn up. The heroes of John Steinbeck's *The Grapes of Wrath* were the dirt-poor farmers who scraped a living on dry, dusty forties in 1930s Oklahoma.

The survey was unified by running a number of carefully calculated north-south lines (known as principal meridians) and east-west lines (principal baselines) far enough to connect the work of one survey team with another. For example, the fifth principal meridian begins in Arkansas and runs all the way north to the Canadian border, connecting surveys in about 10 different states. Since the earth is not flat, the north end of a township is about 20 yards narrower than the 6 miles it is supposed to be. And the next township north is narrower still. The cure is to remeasure after four or five townships, bringing the distance back to 6 miles with a so-called correction line. In the Midwest, where roads tend to follow the survey lines, this produced a dead end and a sharp 90-degree turn after 24 or 36 miles of straight driving. You can tell by the skidmarks that it takes drivers by surprise.

The surveyor's chain shaped urban America too. The average city block with surrounding streets covered 5 acres (5 chains by 10), and in Philadelphia, Salt Lake City, and innumerable other cities, the central square measured 10 acres (10 chains by 10). When Ferdinand R. Hassler was authorized by Congress in 1836 to produce the first federally approved set of weights and measures, he publicly declared his preference for the 10-based metric system, but he conceded that the choice "of a set of standards in general depends upon the individual use made of them." For the United States, that could only mean the 4-based measures that the survey had spread throughout the nation. Every attempt to replace the U.S. Customary System of weights and measures with the metric system has failed, so far, because that Customary System is built into the very structure and values of American society.

This is the significance of what you see from the airplane window, an enterprise so massive, so integral to the United States, that it almost disappears into the landscape.

RELATED STORIES

The Frémonts Open the West

by Steve Inskeep

With five major exploring expeditions west of the Mississippi, John C. Frémont redefined the country — with the help of his wife's promotional skills.

A Tent On The Porch

by Wilfred M. McClay

First heard just a century ago at the Chicago fair, Frederick Jackson Turner's epochal essay on the Western frontier expressed a conflict in the American psyche that tears at us still

Indians In The Land

by William Cronon

Did the Indians have a special, almost noble, affinity with the American environment—or were they despoilers of it? Two historians of the environment explain the profound clash of cultures between Indians and whites that has made each group almost incomprehensible to the other.

Does The West Have A Death Wish?

by Dyan Zaslowsky

Before there were Western states, there were public lands—over a billion acres irrevocably reserved for the people of the United States. The Sagebrush Rebels are the most recent in a series of covetous groups bent on “regaining” what was never theirs.

“To A Distant And Perilous Service”

by Richard Reinhardt

Westward with the course of empire Colonel Jonathan Drake Stevenson took his way in 1846. With him went the denizens of New York's Tammany wards, oyster cellars, and gin mills—the future leaders of California.

“full Speed Ahead And Damn The Tomorrows”

by Ray Allen Billington

Our Frontier Heritage of Waste

History Comes To The Plains

by Wallace Stegner

The old frontier began to die as the “medicine line” of the 49th Parallel was drawn

© Copyright 1949-2023 **American Heritage Publishing Co** All Rights Reserved. To license content, please contact licenses [at] americanheritage.com.

AMERICAN HERITAGE

Trusted Writing on History, Travel, and American Culture Since 1949