OZYMANDIAS

I met a traveller from an antique land
Who said: Two vast and trunkless legs of stone
Stand in the desert . . . Near them, on the sand,
Half sunk, a shattered visage lies, whose frown,
And wrinkled lip, and sneer of cold command,
Tell that its sculptor well those passions read
Which yet survive, stamped on these lifeless things,
The hand that mocked them, and the heart that fed:
And on the pedestal these words appear:
"My name is Ozymandias, king of kings:
Look on my works, ye Mighty, and despair!"
Nothing beside remains. Round the decay
Of that colossal wreck, boundless and bare
The lone and level sands stretch far away.

PERCY BYSSHE SHELLEY

MARC REISNER

CADILLAC DESERT

The American West and Its Disappearing Water

REVISED AND UPDATED

PENGUIN BOOKS

For Konrad and Else Reisner

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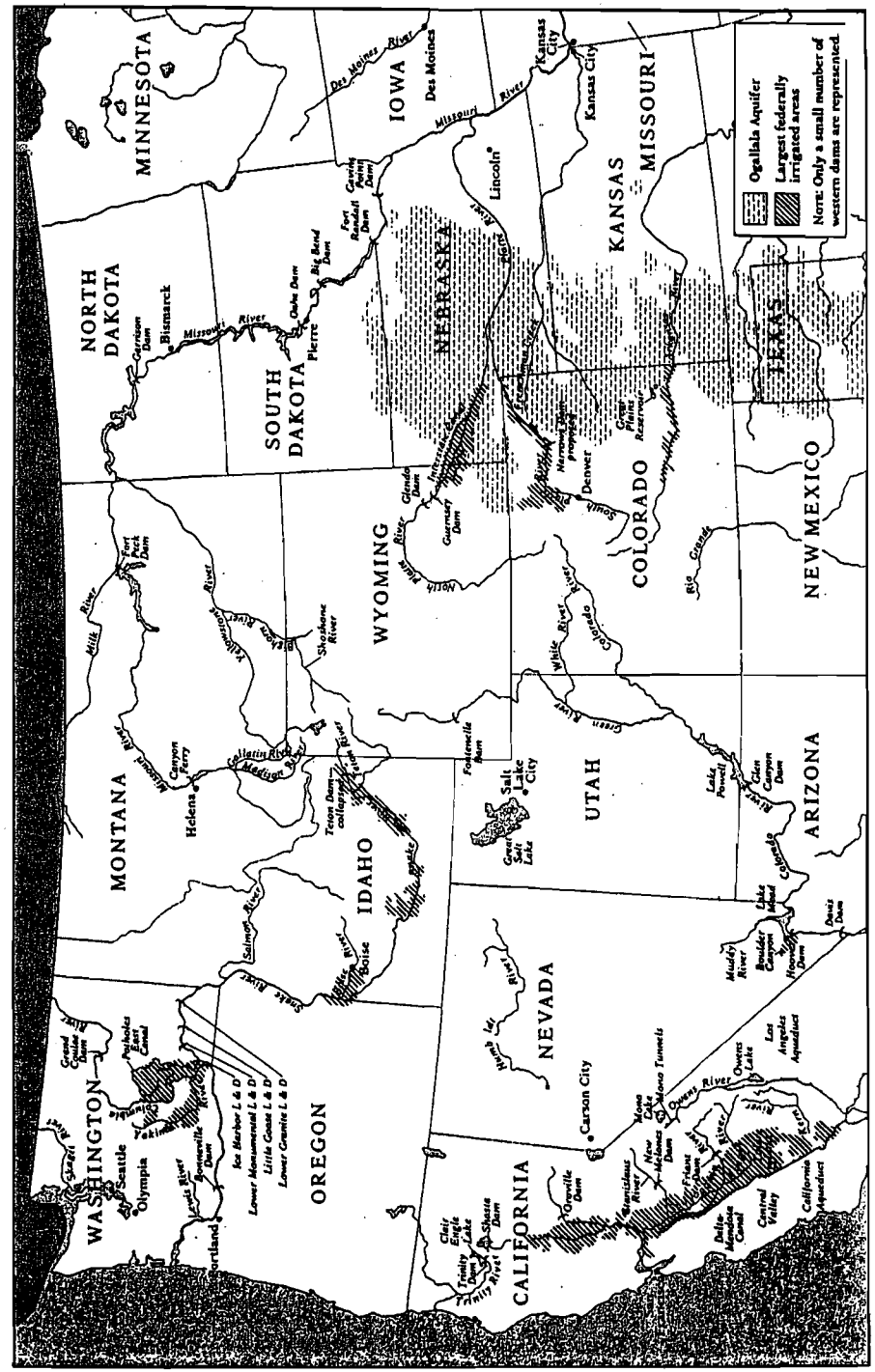

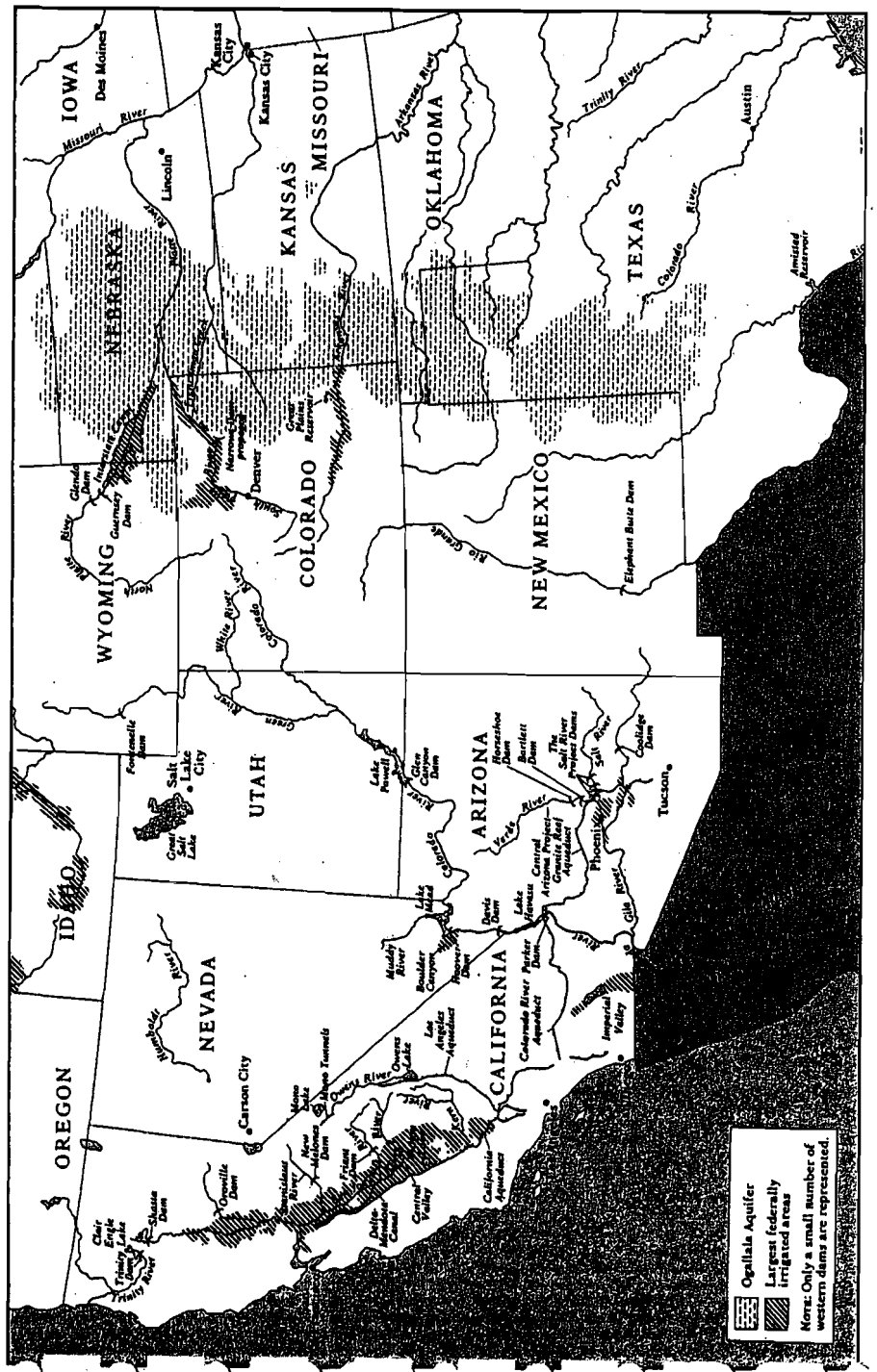

INTRODUCTION

A Semidesert with a Desert Heart

One late November night in 1980 I was flying over the state of Utah on my way back to California. I had an aisle seat, and since I believe that anyone who flies in an airplane and doesn't spend most of his time looking out the window wastes his money, I walked back to the rear door of the airplane and stood for a long time at the door's tiny aperture, squinting out at Utah.

Two days earlier, a fierce early blizzard had gone through the Rocky Mountain states. In its wake, the air was pellucid. The frozen fire of a winter's moon poured cold light on the desert below. Six inches away from the tip of my nose the temperature was, according to the pilot, minus sixty-five, and seven miles below it was four above zero. But here we were, two hundred highly inventive creatures safe and comfortable inside a fat winged cylinder racing toward the Great Basin of North America, dozing, drinking, chattering, oblivious to the frigid emptiness outside.

Emptiness. There was nothing down there on the earth—no towns, no light, no signs of civilization at all. Barren mountains rose duskily from the desert floor; isolated mesas and buttes broke the wind-haunted distance. You couldn't see much in the moonlight, but obviously there were no forests, no pastures, no lakes, no rivers; there was no fruited plain. I counted the minutes between clusters of lights. Six, eight, nine, eleven—going nine miles a minute, that was a lot of uninhabited distance in a crowded century, a lot of emptiness amid a civilization whose success was achieved on the pretension that natural obstacles do not exist.

Then the landscape heaved upward. We were crossing a high, thin cordillera of mountains, their tops already covered with snow. The Wasatch Range. As suddenly as the mountains appeared, they fell away, and a vast gridiron of lights appeared out of nowhere. It was clustered thickly under the aircraft and trailed off toward the south, erupting in ganglionic clots that winked and shimmered in the night. Salt Lake City, Orem, Draper, Provo: we were over most of the population of Utah.

That thin avenue of civilization pressed against the Wasatches, intimidated by a fierce desert on three sides, was a poignant sight. More startling than its existence was the fact that it had been there only 134 years, since Brigham Young led his band of social outcasts to the old bed of a drying desert sea and proclaimed, "This is the place!" *This* was the place? Someone in that first group must have felt that Young had become unhinged by two thousand horribly arduous miles. Nonetheless, within hours of ending their ordeal, the Mormons were digging shovels into the earth beside the streams draining the Wasatch Range, leading canals into the surrounding desert which they would convert to fields that would nourish them. Without realizing it, they were laying the foundation of the most ambitious desert civilization the world has seen. In the New World, Indians had dabbled with irrigation, and the Spanish had improved their techniques, but the Mormons attacked the desert full-bore, flooded it, subverted its dreadful indifference—moralized it—until they had made a Mesopotamia in America between the valleys of the Green River and the middle Snake. Fifty-six years after the first earth was turned beside City Creek, the Mormons had six million acres under full or partial irrigation in several states. In that year—1902—the United States government launched its own irrigation program, based on Mormon experience, guided by Mormon laws, run largely by Mormons. The agency responsible for it, the U.S. Bureau of Reclamation, would build the highest and largest dams in the world on rivers few believed could be controlled—the Colorado, the Sacramento, the Columbia, the lower Snake—and run aqueducts for hundreds of miles across deserts and over mountains and through the Continental Divide in order to irrigate more millions of acres and provide water and power to a population equal to that of Italy. Thanks to irrigation, thanks to the Bureau—an agency few people know—states such as California, Arizona, and Idaho became populous and wealthy; millions settled in regions where nature, left alone, would have countenanced thousands at best; great valleys and hemispherical basins metamorphosed from desert blond to semitropic green.

On the other hand, what has it all amounted to?

Stare for a while at a LANDSAT photograph of the West, and you will see the answer: not all that much. Most of the West is still untrammeled, unirrigated, depopulate in the extreme. Modern Utah, where large-scale irrigation has been going on longer than anywhere else, has 3 percent of its land area under cultivation. California has twelve hundred major dams, the two biggest irrigation projects on earth, and more irrigated acreage than any other state, but its irrigated acreage is not much larger than Vermont. Except for the population centers of the Pacific Coast and the occasional desert metropolis—El Paso, Albuquerque, Tucson, Denver—you can drive a thousand miles in the West and encounter fewer towns than you would crossing New Hampshire. Westerners call what they have established out here a civilization, but it would be more accurate to call it a beachhead. And if history is any guide, the odds that we can sustain it would have to be regarded as low. Only one desert civilization, out of dozens that grew up in antiquity, has survived uninterrupted into modern times. And Egypt's approach to irrigation was fundamentally different from all the rest.

If you begin at the Pacific rim and move inland, you will find large cities, many towns, and prosperous-looking farms until you cross the Sierra Nevada and the Cascades, which block the seasonal weather fronts moving in from the Pacific and wring out their moisture in snows and drenching rains. On the east side of the Sierra-Cascade crest, moisture drops immediately—from as much as 150 inches of precipitation on the western slope to as little as four inches on the eastern—and it doesn't increase much, except at higher elevations, until you have crossed the hundredth meridian, which bisects the Dakotas and Nebraska and Kansas down to Abilene, Texas, and divides the country into its two most significant halves—the one receiving at least twenty inches of precipitation a year, the other generally receiving less. Any place with less than twenty inches of rainfall is hostile terrain to a farmer depending solely on the sky, and a place that receives seven inches or less—as Phoenix, El Paso, and Reno do—is arguably no place to inhabit at all. Everything depends on the manipulation of water—on capturing it behind dams, storing it, and rerouting it in concrete rivers over distances of hundreds of miles. Were it not for a century and a half of messianic effort toward that end, the West as we know it would not exist.

The word "messianic" is not used casually. Confronted by the desert, the first thing Americans want to do is change it. People say that

they "love" the desert, but few of them love it enough to live there. I mean in the real desert, not in a make-believe city like Phoenix with exotic palms and golf-course lawns and a five-hundred-foot fountain and an artificial surf. Most people "love" the desert by driving through it in air-conditioned cars, "experiencing" its grandeur. That may be some kind of experience, but it is living in a fool's paradise. To *really* experience the desert you have to march right into its white bowl of sky and shape-contorting heat with your mind on your canteen as if it were your last gallon of gas and you were being chased by a carload of escaped murderers. You have to imagine what it would be like to drink blood from a lizard or, in the grip of dementia, claw bare-handed through sand and rock for the vestigial moisture beneath a dry wash.

Trees, because of their moisture requirements, are our physiological counterparts in the kingdom of plants. Throughout most of the West they begin to appear high up on mountainsides, usually at five or six thousand feet, or else they huddle like cows along occasional streambeds. Higher up the rain falls, but the soil is miserable, the weather is extreme, and human efforts are under siege. Lower down, in the valleys and on the plains, the weather, the soil, and the terrain are more welcoming, but it is almost invariably too dry. A drought lasting three weeks can terrorize an eastern farmer; a drought of five months is, to a California farmer, a normal state of affairs. (The lettuce farmers of the Imperial Valley don't even *like* rain; it is so hot in the summer it wilts the leaves.) The Napa Valley of California receives as much Godwater—a term for rain in the arid West—as Illinois, but almost all of it falls from November to March; a weather front between May and September rates as much press attention as a meteor shower. In Nevada you see rainclouds, formed by orographic updrafts over the mountains, almost every day. But rainclouds in the desert seldom mean rain, because the heat reflected off the earth and the ravenous dryness can vaporize a shower in midair, leaving the blackest-looking cumulonimbus trailing a few pathetic ribbons of moisture that disappear before reaching the ground. And if rain does manage to fall to earth, there is nothing to hold it, so it races off in evanescent brown torrents, evaporating, running to nowhere.

One does not really conquer a place like this. One inhabits it like an occupying army and makes, at best, an uneasy truce with it. New England was completely forested in 1620 and nearly deforested 150 years later; Arkansas saw nine million acres of marsh and swamp forest converted to farms. Through such Promethean effort, the eastern half of the continent was radically made over, for better or worse. The West never can be. The only way to make the region over is to irrigate

it. But there is too little water to begin with, and water in rivers is phenomenally expensive to move. And even if you succeeded in moving every drop, it wouldn't make much of a difference. John Wesley Powell, the first person who clearly understood this, figured that if you evenly distributed all the surface water flowing between the Columbia River and the Gulf of Mexico, you would *still* have a desert almost indistinguishable from the one that is there today. Powell failed to appreciate the vast amount of water sitting in underground aquifers, a legacy of the Ice Ages and their glacial melt, but even this water, which has turned the western plains and large portions of California and Arizona green, will be mostly gone within a hundred years—a resource squandered as quickly as oil.

At first, no one listened to Powell when he said the overwhelming portion of the West could never be transformed. People figured that when the region was settled, rainfall would magically increase, that it would "follow the plow." In the late 1800s, such theories amounted to Biblical dogma. When they proved catastrophically wrong, Powell's irrigation ideas were finally embraced and pursued with near fanaticism, until the most gigantic dams were being built on the most minuscule foundations of economic rationality and need. Greening the desert became a kind of Christian ideal. In May of 1957, a very distinguished Texas historian, Walter Prescott Webb, wrote an article for *Harper's* entitled "The American West, Perpetual Mirage," in which he called the West "a semidesert with a desert heart" and said it had too dark a soul to be truly converted. The greatest national folly we could commit, Webb argued, would be to exhaust the Treasury trying to make over the West in the image of Illinois—a folly which, by then, had taken on the appearance of national policy. The editors of *Harper's* were soon up to their knees in a flood of vitriolic mail from westerners condemning Webb as an infidel, a heretic, a doomsayer.

Desert, semidesert, call it what you will. The point is that despite heroic efforts and many billions of dollars, all we have managed to do in the arid West is turn a Missouri-size section green—and that conversion has been wrought mainly with nonrenewable groundwater. But a goal of many westerners and of their federal archangels, the Bureau of Reclamation and Corps of Engineers, has long been to double, triple, quadruple the amount of desert that has been civilized and farmed, and now these same people say that the future of a hungry world depends on it, even if it means importing water from as far away as Alaska. What they seem not to understand is how difficult it will be just to hang on to the beachhead they have made. Such a surfeit of ambition stems, of course, from the remarkable record of success

we have had in reclaiming the American desert. But the same could have been said about any number of desert civilizations throughout history—Assyria, Carthage, Mesopotamia; the Inca, the Aztec, the Hohokam—before they collapsed.

And it may not even have been drought that did them in. It may have been salt.

The Colorado River rises high in the Rockies, a trickle of frigid snowmelt bubbling down the west face of Longs Peak, and begins its fifteen-hundred-mile, twelve-thousand-foot descent to the Gulf of California. Up there, amid mountain fastnesses, its waters are sweet. The river swells quickly, taking in the runoff of most of western Colorado, and before long becomes a substantial torrent churning violently through red canyons down the long west slope of the range. Not far from Utah, at the threshold of the Great Basin, the rapids die into riffles and the Colorado River becomes, for a stretch of forty miles, calm and sedate. It has entered the Grand Valley, a small oasis of orchards and cows looking utterly out of place in a landscape where it appears to have rained once, about half a million years ago. The oasis is man-made and depends entirely on the river. Canals divert a good share of the flow and spread it over fields, and when the water percolates through the soil and returns to the river it passes through thick deposits of mineral salts, a common phenomenon in the West. As the water leaves the river, its salinity content is around two hundred parts per million; when it returns, the salinity content is sixty-five hundred parts per million.

The Colorado takes in the Gunnison River, whose waters have also filtered repeatedly through irrigated, saline earth, and disappears into the canyonlands of Utah. Near the northernmost tentacle of Lake Powell, where the river backs up for nearly two hundred miles behind Glen Canyon Dam, it receives its major tributary, the Green River. The land along the upper Green is heavily irrigated, and so is the land beside its two major tributaries, the Yampa and the White. Some of *their* tributaries, which come out of the Piceance Basin, are saltier than the ocean. In Lake Powell, the water spreads, exposing vast surface acreage to the sun, which evaporates several feet each year, leaving all the salts behind. Released by Glen Canyon Dam, the Colorado takes in the Little Colorado, Kanab Creek, the Muddy, and one of the more misnamed rivers on earth, the Virgin. It pools again in Lake Mead, again in Lake Mojave, and again in Lake Havasu; it takes in the Gila River

and its oft-used tributaries, the Salt and the Verde, all turbid with alkaline leachate. A third of its flow then goes to California, where some of it irrigates the Imperial Valley and the rest allows Los Angeles and San Diego to exist. By then, the water is so salty that restaurants often serve it with a slice of lemon. If you pour it on certain plants, they will die.

Along the Gila River in Arizona, the last tributary of the Colorado, is a small agricultural basin which Spaniards and Indians tried to irrigate as early as the sixteenth century. It has poor drainage—the soil is underlain by impermeable clays—so the irrigation water rose right up to the root zones of the crops. With each irrigation, it became saltier, and before long everything that was planted died. The Spaniards finally left, and the desert took the basin back; for a quarter of a millennium, it remained desert. Then, in the 1940s, the Bureau of Reclamation reclaimed it again, building the Welton-Mohawk Project and adding an expensive drainage system to collect the sumpwater and carry it away. Just above the Mexican border, the drain empties into the Colorado River.

In 1963, the Bureau closed the gates of Glen Canyon Dam. As Lake Powell filled, the flow of fresh water below it was greatly reduced. At the same time, the Welton-Mohawk drain was pouring water with a salinity content of sixty-three hundred parts per million directly into the Colorado. The salinity of the river—what was left of it—soared to fifteen hundred parts per million at the Mexican border. The most important agricultural region in all of Mexico lies right below the border, utterly dependent on the Colorado River; we were giving the farmers slow liquid death to pour over their fields.

The Mexicans complained bitterly, to no avail. By treaty, we had promised them a million and a half acre-feet of water. But we hadn't promised them *usable* water. By 1973, Mexico was in a state of apoplexy. The ruin of its irrigated agricultural lands along the lower Colorado was the biggest issue in the campaign of presidential candidate Luis Echeverría, who was elected by a wide margin in that year. Still, the United States continued to do nothing. But 1973 also saw the arrival of OPEC. Some new geologic soundings in the Bay of Campeche indicated that Mexico might soon become one of the greatest oil-exporting nations in the world. When Echeverría threatened to drag the United States before the World Court at The Hague, Richard Nixon sent his negotiators down to work out a salinity-control treaty. It was signed within a few months.

Once we agreed to give Mexico water of tolerable quality, we had to decide how to do it. Congress's solution was to authorize a desali-

nation plant ten times larger than any in existence that will clean up the Colorado River just as it enters Mexico. What it will cost nobody knows; the official estimate in 1985 was $300 million, not counting the 40,000 kilowatts of electricity required to run it. Having done that, Congress wrote what amounts to a blank check for a welter of engineered solutions farther upriver, whose exact nature is still under debate. Those could cost another $600 million, probably more. One could easily achieve the same results by buying out the few thousand acres of alkaline and poorly drained land that contribute most to the problem, but there, once again, one runs up against the holiness of the blooming desert. Western Congressmen, in the 1970s, were perfectly willing to watch New York City collapse when it was threatened with bankruptcy and financial ruin. After all, New York was a profligate and sinful place and probably deserved such a fate. But they were not willing to see one acre of irrigated land succumb to the forces of nature, regardless of cost. So they authorized probably $1 billion worth of engineered solutions to the Colorado salinity problem in order that a few hundred upstream farmers could go on irrigating and poisoning the river. The Yuma Plant will remove the Colorado's salt—actually just enough of it to fulfill our treaty obligations to Mexico—at a cost of around $300 per acre-foot of water. The upriver irrigators buy the same amount from the Bureau for three dollars and fifty cents.

Nowhere is the salinity problem more serious than in the San Joaquin Valley of California, the most productive farming region in the entire world. There you have a shallow and impermeable clay layer, the residual bottom of an ancient sea, underlying a million or so acres of fabulously profitable land. During the irrigation season, temperatures in the valley fluctuate between 90 and 110 degrees; the good water evaporates as if the sky were a sponge, the junk water goes down, and the problem gets worse and worse. Very little of the water seeps through the Corcoran Clay, so it rises back up into the root zones—in places, the clay is only a few feet down—waterlogs the land, and kills the crops. A few thousand acres have already gone out of production—you can see the salt on the ground like a dusting of snow. In the next few decades, as irrigation continues, that figure is expected to increase almost exponentially. To build a drainage system for the valley—a giant network of underground pipes and surface canals that would intercept the junk water and carry it off—could cost as much as a small country's GNP. In 1985, the Secretary of the Interior put forth a figure of $5 billion for the Westlands region, and Westlands is only half the problem. Where would the drainwater go? The Westlands' drainwater, temporarily stored in a huge sump which was christened

a wildlife preserve, has been killing thousands of migrating waterfowl; the water contains not just salts but selenium, pesticides, and God knows what else. There is one logical terminus: San Francisco Bay. As far as northern Californians are concerned, the farmers stole all this water from them; now they want to ship it back full of crud.

As is the case with most western states, California's very existence is premised on epic liberties taken with water—mostly water that fell as rain on the north and was diverted to the south, thus precipitating the state's longest-running political wars. With the exception of a few of the rivers draining the remote North Coast, virtually every drop of water in the state is put to some economic use before being allowed to return to the sea. Very little of this water is used by people, however. Most of it is used for irrigation—80 percent of it, to be exact. That is a low percentage, by western standards. In Arizona, 87 percent of the water consumed goes to irrigation; in Colorado and New Mexico, the figure is almost as high. In Kansas, Nevada, Nebraska, North Dakota, South Dakota, and Idaho—in all of those states, irrigation accounts for nearly all of the water that is consumptively used.

By the late 1970s, there were 1,251 major reservoirs in California, and every significant river—save one—had been dammed at least once. The Stanislaus River is dammed fourteen times on its short run to the sea. California has some of the biggest reservoirs in the country; its rivers, seasonally swollen by the huge Sierra snowpack, carry ten times the runoff of Colorado's. And yet all of those rivers and reservoirs satisfy only 60 percent of the demand. The rest of the water comes from under the ground. The rivers are infinitely renewable, at least until the reservoirs silt up or the climate changes. But a lot of the water being pumped out of the ground is as nonrenewable as oil.

Early in the century, before the federal government got into the business of building dams, most of the water used for irrigation in California was groundwater. The farmers in the Central Valley (which comprises both the Sacramento and the San Joaquin) pumped it out so relentlessly that by the 1930s the state's biggest industry was threatened with collapse. The growers, by then, had such a stranglehold on the legislature that they convinced it, in the depths of the Depression, to authorize a huge water project—by far the largest in the world—to rescue them from their own greed. When the bonds to finance the project could not be sold, Franklin Delano Roosevelt picked up the unfinished task. Today, the Central Valley Project is still the most mind-boggling public works project on five continents, and in the 1960s the state built its own project, nearly as large. Together, the California Water Project and the Central Valley Project have captured

enough water to supply eight cities the size of New York. But the projects brought into production far more land than they had water to supply, so the growers had to supplement their surface water with tens of thousands of wells. As a result, the groundwater overdraft, instead of being alleviated, has gotten worse.

In the San Joaquin Valley, pumping now exceeds natural replenishment by more than half a trillion gallons a year. By the end of the century it could rise to a trillion gallons—a mining operation that, in sheer volume, beggars the exhaustion of oil. How long it can go on, no one knows. It depends on a lot of things, such as the price of food and the cost of energy and the question whether, as carbon dioxide changes the world's climate, California will become drier. (It is expected to become much drier.) But it is one reason you hear talk about redirecting the Eel and the Klamath and the Columbia and, someday, the Yukon River.

The problem in California is that there is absolutely no regulation over groundwater pumping, and, from the looks of things, there won't be any for many years to come. The farmers loathe the idea, and in California "the farmers" are the likes of Exxon, Tenneco, and Getty Oil. Out on the high plains, the problem is of a different nature. There, the pumping of groundwater is regulated. But the states have all decided to regulate their groundwater out of existence.

The vanishing groundwater in Texas, Kansas, Colorado, Oklahoma, New Mexico, and Nebraska is all part of the Ogallala aquifer, which holds two distinctions: one of being the largest discrete aquifer in the world, the other of being the fastest-disappearing aquifer in the world. The rate of withdrawal over natural replenishment is now roughly equivalent to the flow of the Colorado River. This was the region called the Dust Bowl, the one devastated by the Great Drought; that was back before anyone knew there was so much water underfoot, and before the invention of the centrifugal pump. The prospect that a region so plagued by catastrophe could become rich and fertile was far too tantalizing to resist; the more irrigation, everyone thought, the better. The states knew the groundwater couldn't last forever (even if the farmers thought it would), so, like the Saudis with their oil, they had to decide how long to make it last. A reasonable period, they decided, was twenty-five to fifty years.

"What are you going to do with all that water?" asks Felix Sparks, the former head of the Colorado Water Conservation Board. "Are you just going to leave it in the ground?" Not necessarily, one could reply, but fifty years or a little longer is an awfully short period in which to exhaust the providence of half a million years, to consume as much

nonrenewable water as there is in Lake Huron. "Well," says Sparks, "when we use it up, we'll just have to get more water from somewhere else."

Stephen Reynolds, Sparks's former counterpart in New Mexico—as state engineer, the man in charge of water, he may have been the most powerful person in the state—says much the same thing: "We made a conscious decision to mine out our share of the Ogallala in a period of twenty-five to forty years." In the portions of New Mexico that overlie the Ogallala, according to Reynolds, some farmers withdraw as much as five feet of water a year, while nature puts back a quarter of an inch. What will happen to the economy of Reynolds's state when its major agricultural region turns to dust? "Agriculture uses about 90 percent of our water, and produces around 20 percent of the state's income, so it wouldn't necessarily be a knockout economic blow," he answers. "Of course, you are talking about drastic changes in the whole life and culture of a very big region encompassing seven states.

"On the other hand," says Reynolds, half-hopefully, "we may decide as a matter of national policy that all this agriculture is too important to lose. We can always decide to build some more water projects."

More water projects. During the first and only term of his presidency, Jimmy Carter decided that the age of water projects had come to a deserved end. As a result, he drafted a "hit list" on which were a couple of dozen big dams and irrigation projects, east and west, which he vowed not to fund. Carter was merely stunned by the reaction from the East; he was blown over backward by the reaction from the West. Of about two hundred western members of Congress, there weren't more than a dozen who dared to support him. One of the projects would return five cents in economic benefits for every taxpayer dollar invested; one offered irrigation farmers subsidies worth more than $1 million each; another, a huge dam on a middling California river, would cost more than Hoover, Shasta, Glen Canyon, Bonneville, and Grand Coulee combined. But Carter's hit list had as much to do with his one-term presidency as Iran.

Like millions of easterners who wonder how such projects get built, Jimmy Carter had never spent much time in the West. He had never driven across the country and watched the landscape turn from green to brown at the hundredth meridian, the threshold of what was once called the Great American Desert—but which is still wet compared to the vast ultramontane basins beyond. In southern Louisiana, water is the central fact of existence, and a whole culture and set of values

have grown up around it. In the West, lack of water is the central fact of existence, and a whole culture and set of values have grown up around it. In the East, to "waste" water is to consume it needlessly or excessively. In the West, to waste water is *not* to consume it—to let it flow unimpeded and undiverted down rivers. Use of water is, by definition, "beneficial" use—the term is right in the law—even if it goes to Fountain Hills, Arizona, and is shot five hundred feet into 115-degree skies; even if it is sold, at vastly subsidized rates, to farmers irrigating crops in the desert which their counterparts in Mississippi or Arkansas are, at that very moment, being paid not to grow. To easterners, "conservation" of water usually means protecting rivers from development; in the West, it means building dams.

More water projects. In the West, nearly everyone is for them. Politicians of every stripe have sacrificed their most sacred principles on the altar of water development. Barry Goldwater, scourge of welfare and champion of free enterprise, was a lifelong supporter of the Central Arizona Project, which comes as close to socialism as anything this country has ever done (the main difference being that those who are subsidized are well-off, even rich). Former Governor Jerry Brown of California attended the funeral of E. F. Schumacher, the English economist who wrote *Small Is Beautiful*, then flew back home to lobby for a water project that would cost more than it did to put a man on the moon. Alan Cranston, once the leading liberal in the U.S. Senate, the champion of the poor and the oppressed, successfully lobbied to legalize illegal sales of subsidized water to giant corporate farms, thus denying water—and farms—to thousands of the poor and oppressed.

In the West, it is said, water flows uphill toward money. And it literally does, as it leaps three thousand feet across the Tehachapi Mountains in gigantic siphons to slake the thirst of Los Angeles, as it is shoved a thousand feet out of Colorado River canyons to water Phoenix and Palm Springs and the irrigated lands around them. It goes 444 miles (the distance from Boston to Washington) by aqueduct from the Feather River to south of L.A. It goes in man-made rivers, in siphons, in tunnels. In a hundred years, actually less, God's riverine handiwork in the West has been stood on its head. A number of rivers have been nearly dried up. One now flows backward. Some flow through mountains into other rivers' beds. There are huge reservoirs where there was once desert; there is desert, or cropland, where there were once huge shallow swamps and lakes.

It still isn't enough.

In 1971, the Bureau of Reclamation released a plan to divert six million acre-feet from the lower Mississippi River and create a river in reverse, pumping the water up a staircase of reservoirs to the high plains in order to save the irrigation economy of West Texas and eastern New Mexico, utterly dependent on groundwater, from collapse. Since the distance the water would have to travel is a thousand miles, and the elevation gain four thousand feet, and since six million acre-feet of water weigh roughly 16.5 trillion pounds, a lot of energy would be required to pump it. The Bureau figured that six nuclear plants would do, and calculated the cost of the power at one mill per kilowatt-hour, a tiny fraction of what it costs today. The whole package came to $20 billion, in 1971 dollars; the benefit-cost ratio would have been .27 to 1. For each dollar invested, twenty-seven cents in economic productivity would be returned. "That's kind of discouraging," says Stephen Reynolds. "But when you consider our balance-of-payments deficits, you have to remember that we send $100 billion out of this country each year just to pay for imported oil. The main thing we export is food. The Ogallala region produces a very large share of our agricultural exports."

More water projects. In the early 1960s, the Ralph M. Parsons Corporation, a giant engineering firm based in Pasadena, California, released a plan to capture much of the floor of the Yukon and Tanana rivers and divert it two thousand miles to the Southwest through the Rocky Mountain Trench. The proposal, called the North American Water and Power Alliance, wasn't highly regarded by Canada, which was the key to the "alliance," but in the West it was passionately received. Ten years later, as environmentalism and inflation both took root, NAWAPA seemed destined for permanent oblivion. But then OPEC raised the price of oil 1,600 percent, and Three Mile Island looked as if it might seal fission's doom. California was hit by the worst drought in its history; had it lasted one more year, its citizens might have begun migrating back east, their mattresses strapped to the tops of their Porsches and BMWs. All of a sudden the hollowness of our triumph over nature hit home with striking effect. With hydroelectricity now regarded by many as salvation, and with nearly half the irrigated farmland in the West facing some kind of doom—drought, salt, or both combined—NAWAPA, in the early 1980s, began to twitch again. The cost estimate (phony, of course) had doubled, from $100 billion to $200 billion, but by then we were spending that much in a single year on defense. The project could produce 100,000 megawatts of electricity; it could rescue California, the high plains, and Arizona and still have enough water left to turn half of Nevada green. The new

Romans were now saying that it wasn't a matter of *whether* NAWAPA would be built, but when.

Perhaps they are right. Perhaps, despite the fifty thousand major dams we have built in America; despite the fact that federal irrigation has, for the most part, been a horribly bad investment in free-market terms; despite the fact that the number of free-flowing rivers that remain in the West can be counted on two hands; perhaps, despite all of this, the grand adventure of playing God with our waters will go on. Perhaps it will be consummated on a scale of which our forebears could scarcely dream. By encouraging millions of people to leave the frigid Northeast, we could save a lot of imported oil; by doubling our agricultural exports, we could pay for the oil we import today. As the ancient, leaking water systems and infrastructure of the great eastern cities continue to decay, we may see an East-West alliance develop: you give us our water projects, we'll give you yours. Perhaps, in some future haunted by scarcity, the unthinkable may be thinkable after all.

In the West, of course, where water is concerned, logic and reason have never figured prominently in the scheme of things. As long as we maintain a civilization in a semidesert with a desert heart, the yearning to civilize more of it will always be there. It is an instinct that followed close on the heels of food, sleep, and sex, predating the Bible by thousands of years. The instinct, if nothing else, is bound to persist.

The lights of Salt Lake City began to fade, an evanescent shimmer on the rear horizon. A few more minutes and the landscape was again a black void. We were crossing the Great Basin, the arid heart of the American West. The pilot announced that the next glow of civilization would be Reno, some six hundred miles away. I remembered two things about Reno. The annual precipitation there is seven inches, an amount that Florida and Louisiana and Virginia have received in a day. But even though gambling and prostitution are legal around Reno, water metering, out of principle, was for a long time against the law.

CHAPTER ONE

A Country of Illusion

The American West was explored by white men half a century before the first colonists set foot on Virginia's beaches, but it went virtually uninhabited by whites for another three hundred years. In 1539, Don Francisco Vásquez de Coronado, a nobleman who had married rich and been appointed governor of Guadalajara by the Spanish king, set out on horseback from Mexico with a couple of hundred men, driving into the uncharted north. Coronado was a far kinder conquistador than his ruthless contemporaries Pizarro and De Soto, but he was equally obsessed with gold. His objective was a place called Cibola, seven cities where, legend had it, houses and streets were veneered with gold and silver. All he found, somewhere in northwestern Arizona, were some savage people living in earthen hovels, perhaps descendants of the great Hohokam culture, which had thrived in central Arizona until about 1400, when it mysteriously disappeared. Crestfallen, but afraid of disgracing the Spanish crown, Coronado pushed on. Tusayan, Cicuye, Tiguex, Quivira—no gold. His fruitless expedition took him from the baking desert canyons of south-central Arizona up to the cool ponderosa highlands of the Mogollon Rim, then down again into the vast, flat, treeless plains of West Texas and Oklahoma and Kansas. He returned, miraculously, a couple of years later, having lost half his men and some of his sanity when his horse stepped on his skull as he was exercising it. Since the climate of the American West is often compared, by those who don't know better, with that of Spain, it is instructive to quote part of the letter

Coronado wrote to Viceroy Mendoza as he was recovering along the Rio Grande:

> After traveling seventy-seven days from Tiguex over these barren lands, our Lord willed that I should arrive in the province called Quivira [Kansas], to which the guides El Turco and the other savage were taking me. They had pictured it as having stone houses many stories high; not only are there none of stone, but, on the contrary, they are of grass, and the people are savage like all I have seen and passed up to that place. They have no woven fabrics, nor cotton with which to make them. All they have is tanned skins of the cattle they kill, for the herds are near the place where they live, a fair-sized river. [The Indian guides' reward for their misleading travelogue was to be garroted to death.] . . .
>
> The natives gave me a piece of copper which an Indian chief wore suspended from his neck. I am sending it to the viceroy of New Spain, for I have not seen any other metal. . . . I have done everything within my power to serve you, as your faithful sergeant and vassal, and to discover some country where God our Lord might be served by extending your royal patrimony. . . . The best country I have discovered is this Tiguex River [the Rio Grande] and the settlement where I am now camping. But they are not suitable for colonizing, for, besides being four hundred leagues from the North Sea and more than two hundred from the South Sea, thus prohibiting all intercourse, the land is so cold, as I have informed Your Majesty, that it seems impossible for anyone to spend the winter here, since there is no firewood, nor any clothing with which the men may keep themselves warm, except the skins which the natives wear. . . .

The greatest irony of Coronado's adventure was that he must have passed within a few miles of the gold and silver lodes at Tombstone and Tubac, Arizona. A few of his party, on a side excursion, discovered the Grand Canyon, but they were unimpressed by its beauty, and guessed the width of the Colorado River far below them at eight feet or so. The Rio Grande, which would later sustain the only appreciable Spanish settlements outside of California, didn't impress them, either. When he returned to Guadalajara, Coronado was put on trial for inept leadership, which, though an utterly unfounded charge, was enough to discourage would-be successors who might have discovered the

precious metals that would have induced Spain to lay a far stronger claim on the New World. His expedition also lost a few horses, which found their way into the hands of the native Americans. The two dominant tribes of the Southwest, the Apache and Comanche, soon evolved into the best horsemen who ever lived, and their ferocity toward incursionists made them formidable adversaries of the Spaniards who tried to settle the region later.

The Spanish did make a more than desultory try at establishing a civilization in California, which was more to their liking than the remainder of the West. (And, in fact, the huge California land grants doled out by the king established a pattern of giant fiefdoms that persists there to this day.) But they never found gold in California, so the territory didn't seem worth a fight. Challenged by the first American expeditionary force in 1842, Mexico ceded the entire territory six years later—just a few months before a man named James Marshall was to discover a malleable yellow rock in the tailrace of Sutter's Mill on the American River above Sacramento.

In 1803, the United States of America consisted of sixteen states along the Atlantic Seaboard, three-quarters of whose area were still untrammeled wilderness, and a vast unmapped tract across the Appalachian Mountains—which would metamorphose, more quickly than anyone might have expected, into the likes of Cleveland and Detroit. In that same year, the new First Consul of France, Napoleon Bonaparte, sat in Paris wrestling with a question: what to conquer? France had recently acquired a million square miles of terrain in North America from Spain—Spain having gotten it originally from France—and the prospect of a huge colonial empire in the New World was tempting. On the other hand, here was Europe—settled, tamed, productive—waiting for civilized dominion by the French. For what would history remember him better—the conquest of Russia or the conquest of buffalo?

The new President of the United States was Thomas Jefferson, an ardent Francophile, but, above all, a practical man. Jefferson knew better than anyone that a French presence in the New World could only be considered a threat. Jefferson was also exceedingly clever, and he was not above a little ruse. "The day that France takes possession of Louisiana," he wrote in a message to his ministers in Paris, "we must marry ourselves to the British fleet and nation." Having said that, Jefferson, through the offices of a Franco-American gunpowder manufacturer named du Pont de Nemours, then inaugurated a hallowed presidential tradition known as the intentional leak. Reading

the "intercepted" message, Napoleon lost his half-formed resolve to create an empire on two continents. The result was the Louisiana Purchase.

Napoleon had no idea what he had sold for $15 million, and Jefferson had no idea what he had bought. For fifteen years, however, he had been trying to send an expedition to the unknown country west of the Mississippi River, and now, for the first time, he was able to persuade Congress to put up the money. In 1804, Jefferson's personal secretary, a private, moody, and sensitive young man named Meriwether Lewis, together with a bluff and uncomplicated army captain named William Clark, left St. Louis with a party of fifty men. Poling, tugging, and, at times, literally carrying a fifty-foot bateau up the whipsawing braided channels of the Missouri River, they arrived at the villages of the Mandan tribe, in what has come to be North Dakota, in the early winter. When the ice broke in the spring, some of the party returned to St. Louis with the boat. The thirty-one others, accompanied by a Shoshone Indian girl named Sacajawea, who had been captured and enslaved by the Mandans, and her newborn baby, continued westward on horseback and on foot. Guided by Sacajawea—whose usefulness as an interpreter was only a small part of the Lewis and Clark expedition's fabulous luck—they pressed across the plains to the beginning of the true Missouri at Three Forks, Montana. From there, they struggled over the Continental Divide and found the Salmon River, whose alternative name, the River of No Return, is an indication of the experiences they had trying to follow it. In despair, the party gave up and turned northward, finding the Clearwater River, which offered them an easier path westward. The Clearwater led them to the Snake, and the Snake led them to the Columbia—a huge anomaly of a river in the pale desert east of the Cascades. Entering the Columbia gorge, they made an almost instantaneous transition from arid grasslands to rain forest as the river sliced through the Cascade Range—a type of transition utterly fantastic to an easterner. From there, it was a short hop to the Pacific, where the party spent the winter, fattening on seafood. In August of 1806, they were back in St. Louis.

The country Lewis and Clark saw amazed, appalled, and enchanted them. Above all, it bewildered them. They had seen the western plains at their wettest—in the springtime of an apparently wet year—but still there were few rivers, and full ones were fewer. The sky was so immense it swallowed the landscape, but the land swallowed up the provenance of the sky. There was game—at times a ludicrous abundance of it—but there were no trees. To an easterner, no trees meant

no possibility of agriculture. If the potential wealth of the land could be judged by the layers of fat on its inhabitants, it was worthwhile to note that the only fat Indians seen by Lewis and Clark were those on the Pacific Coast, sating themselves on salmon and clams. Reading their journals, one gets the impression that Lewis and Clark simply didn't know what to think. They had never seen a landscape like this, never guessed one could even exist. Each "fertile prairie" and "happy prospect" is counterweighted by a "forbidding plain." Louisiana, though penetrated, remained an enigma.

The explorers who followed Lewis and Clark were more certain of their impressions. In the same year the expedition returned, General Zebulon Montgomery Pike crossed the plains on a more southerly course, through what was to become Kansas and Colorado. There he saw "tracts of many leagues . . . where not a speck of vegetable matter existed" and dismissed the whole country as an arid waste. "These vast plains of the western hemisphere may become in time as celebrated as the sandy deserts of Africa," wrote Pike. Major Stephen Long, who followed Pike a decade later, had a similar impression. Long referred to the whole territory between the Mississippi and the Rocky Mountains as the Great American Desert—a phrase and an image that held for almost half a century. The desert might have sat there even longer in the public mind, ineradicable and fixed, had not a member of the Lewis and Clark expedition by the name of John Colter noticed, in the rivers and streams tumbling out of the Rocky Mountains, a plenitude of beaver.

The settlement of the American West owed itself, as much as anything, to a hat. The hat was made of beaver felt, and, during the 1820s and 1830s, no dedicated follower of fashion would settle for anything less. Demand was great enough, and beavers east of the Mississippi were scarce enough, that a cured plew could fetch $6 to $10—at the time, a week's wages. If one was reckless, adventurous, mildly to strongly sociopathic, and used to living by one's wits, it was enough money to make the ride across the plains and winters spent amid the hostile Blackfoot and Crow worth the danger and travail. The mountain men never numbered more than a few hundred, but their names—Bridger, Jackson, Carson, Colter, Bent, Walker, Ogden, Sublette—are writ large all over the American West. Supreme outdoorsmen, they could read important facts in the angle and depth of a bear track; they could hide from the Blackfoot in an icy stream, breathing through a hollow stem, and live out a sudden blizzard in the warm corpse of an eviscerated mountain sheep. As trappers, they were equally proficient—so profi-

cient that within a few years of their arrival in the Rocky Mountain territory, the beavers had already begun to thin out. But that was all the more reason for the more restless of them, especially those backed by eastern money, to go off exploring unknown parts for more beaver streams. And no explorer in the continent's history was more compulsive and indefatigable than Jedediah Smith.

In 1822, when he joined the Rocky Mountain Fur Trading Company, Smith was twenty-two years old, and had never seen the other side of the Rockies. Within two years, however, he was in charge of an exploratory party of trappers heading into utterly unfamiliar territory along the Green River. They found beaver there in fabulous numbers, and Smith, feeling unneeded, decided to see what lay off to the north and west. With six others, he set a course across the Great Basin toward Great Salt Lake. The landscape was more desolate than anything they had seen. If the Great American Desert was on the other side of the mountains, then what would you call this? Game was pitifully scarce. The herds of buffalo had vanished, and the only creatures appearing in numbers were rattlesnakes and jackrabbits. The few human beings encountered were numbingly primitive. They built no lodges, used the crudest tools, made no art. They subsisted, from all appearances, on roots and insects; a live gecko made a fine repast. Mark Twain, encountering some of the last of the wild Digger Indians half a century later, called them "the wretchedest type of mankind I have ever seen." But they were, as Twain noted, merely a reflection of the landscape they found themselves in.

Smith's party skirted Great Salt Lake and continued westward, becoming the first whites, and probably the first humans, to cross the Bonneville Salt Flats—a hundred miles of horrifyingly barren terrain. They then struck across what is now eastern Oregon, eventually reaching a British fort near the Columbia River. Sensing something less than a generous welcome (the British still wanted at least a piece of this subcontinent), the party turned around, and was back on the Green River by July of 1825, in time for the trappers' first rendezvous.

The rendezvous was the first all-male ritual in the non-Indian West—a kind of Baghdad bazaar leavened by fighting, fornication, and adventure stories that would have seemed outlandish if they hadn't, for the most part, been true. Trappers arrived from hundreds of miles around with their pelts, which they traded for whiskey sold by St. Louis entrepreneurs at $25 the gallon, for ammunition, and for staples such as squaws. There was usually carnage, inhibited mainly by the water the traders had added to the whiskey. At the Green River rendezvous, however, Smith and two of his partners, David Jackson

and William Sublette, forsook the festivities for serious business. They had decided to take over the Missouri Fur Trading Company from its owner, General William Ashley, who had amassed a substantial fortune in an astonishingly short time. When the deal was consummated, Smith was given the assignment he coveted—to be in charge of finding new sources of pelts.

Within days of returning from Oregon, Smith was already heading out with a party of fourteen men from Cache Valley, Utah, in search of virgin beaver streams. They followed the languid Sevier River through the red-and-blond deserts of southwestern Utah, then jumped across to the Virgin River, which led them to the Colorado above the present site of Hoover Dam. Unknowingly, they were breaking the Mormon Outlet Trail, by which the secrets of successful irrigation would migrate to California and Arizona and be applied with such ambition that, within a scant century and a half, there would be proposals to import irrigation water from Alaska along the same route. By the time they reached the Colorado River, winter was already near; they had trapped only a few beaver, and didn't feel like turning back. Anxious to find warmth and food, Smith decided to lead the party across the Mojave Desert toward the ocean coast. "A complete barrens" was his description, "a country of starvation." After several exhausting days (they had to carry all their water), the explorers sighted two tall ranges to the west. They crossed the pass between them and found themselves in the Los Angeles Basin, at Mission San Gabriel Archangel in Spanish California. The padres' reception was friendly, but the Spanish governor's was not. Ever since hearing about the expedition of "Capitán Merrie Weather," his attitude toward Yankees had tilted toward paranoia. Exiled from the basin, Smith led his party up the San Joaquin Valley and into the Sierra Nevada, where, along the Stanislaus River, they found beaver in urban concentrations. After a few weeks of trapping, Smith loaded hundreds of plews on horses, selected his two toughest men, and set off across the spine of the Sierra Nevada into what is now Nevada.

Of all the routes across the Great Basin, the one he chose is the longest and driest. U.S. Highway 6 now runs parallel and slightly south; the trip is so desolate and frightening that many motorists will not take it, even in an air-conditioned car loaded with water jugs; they go north, along Interstate 80, which stays reassuringly in sight of the Humboldt River. In six hundred miles of travel, Smith's party crossed three small inconstant streams. That they survived at all is a miracle. "My arrival caused a considerable bustle in camp," he wrote in his diary after arriving in time for the second rendezvous on the Bear

River in Utah. "A small cannon, brought up from St. Louis, was loaded and fired for a salute. . . . Myself and party had been given up for lost."

Two weeks after the rendezvous, Smith was, incredibly, on the way to California again, anxious to relieve the men who had remained on the Stanislaus and to trap out the beaver of the Sierra Nevada before someone else discovered them. His route was pretty much the same as the time before. While crossing the Colorado, however, his party was ambushed by a band of Mojave Indians; nine of the nineteen men survived, among them Smith. Fleeing across the desert, they finally reached southern California, where Smith left three wounded men to recover. The rest of the party then joined the trappers they had left the year before. (How they managed to find each other is a subject Smith passes over lightly in his diary.) Both groups, by now, were bereft of supplies. Selecting his two friendliest surviving men, Smith rode across the Central Valley to the missions at Santa Clara and San Jose to barter plews for food, medicine, clothing, and ammunition. As soon as the members of the party were sighted, they were dragged off to jail in Monterey. Bail was set at $30,000, an amount calculated to ensure that they would remain there at the governor's whim. Smith's luck, however, seemed to ricochet between the abominable and sublime; a wealthy sea captain from New England, who was holding over in Monterey, was so impressed by Smith's courage that he arranged to post the entire amount.

Freed but banished forever from California, Smith gathered the remnants of his expedition, and they wandered up the Sacramento Valley, trapping as they went. It was by then the middle of winter, and the snowpack in the Sierra was twelve feet deep; crossing the range was out of the question. Smith decided to venture back toward the ocean. Crossing the Yolla Bolly and Trinity mountains, the party found itself in a rain forest dominated by a gigantic species of conifer they had never seen. Reaching the Pacific near the mouth of the river that now bears Smith's name, they slogged northward through country which can receive a hundred inches of rain during six winter months. At the mouth of the Umpqua River, they stopped to rest. Smith went off to reconnoiter in an improvised canoe. While he was gone, a band of the Umpqua tribe stole into camp and murdered all but three of the men. Fleeing through the tangled forest beneath giant trees, two of the survivors found Smith, and they raced off together in the direction of Fort Vancouver on the Columbia River. They arrived there in August of 1828, emaciated and in shock. Their last surviving companion straggled in after them; he had found his way alone.

The British, by then well established in Oregon, considered the

attack ominous enough to demand a reprisal. An expedition was dispatched for the Umpqua Valley, where the marauding band was cornered; thirty-nine horses and Smith's seven hundred beaver pelts were seized. Although the British were still smarting from the War of 1812, the commander refused to let Smith compensate him for his trouble; instead, he paid him $3,200 for the horses and pelts. He also offered the Americans a long rest at the fort, since it would take most of the winter for them to tell all their tales. In the spring of 1829, the assembled force of Fort Vancouver watched in disbelief as Smith and Arthur Black, the last of the four survivors who still retained their nerve, strode confidently through the gates and up the Columbia River, en route to the June rendezvous. "They are sporting with life or courting danger to madness," remarked the commander, who never went out with fewer than forty men. Within twelve weeks, Smith and Black were back among their companions in Jackson Hole.

After six years of hair-raising adventures, Jedediah Smith decided to relax and devote a season to tranquil pursuits—trapping beaver on icy mountain streams in territory claimed by Indians and grizzly bears—and then returned to St. Louis to see what opportunity lay there. But civilization stank in his nostrils, and wilderness coursed through his blood. After a brief stay in the frontier capital, Smith was back on the Santa Fe Trail, guiding pioneers westward. It was there, at the age of thirty, that his life came to an abrupt end, a Comanche tomahawk embedded in his skull. He is memorialized today across a region the size of Europe, though modern explorers in a Prowler or a Winnebago may not realize that half a dozen Smith Rivers and a landscape of Smith Parks, Passes, Peaks, and Valleys in eleven states are mostly named after the same Smith.

The "useful" role ascribed to the mountain men is that they opened the door to settlement of the West. It might be more accurate, however, to say that they slammed it shut. The terrors they endured were hardly apt to draw settlers, and their written accounts of the region had to lie heavy on a settler's mind: plains so arid that they could barely support bunchgrass; deserts that were fiercely hot and fiercely cold; streams that flooded a few weeks each year and went dry the rest; forests with trees so large it might take days to bring one down; Indians, grizzly bears, wolves, and grasshopper plagues; hail followed by drought followed by hail; no gold. You could live off the land in better years, but the life of a trapper, a hunter, a fortune seeker—the only type of life that seemed possible in the West—was not what the vast majority of Americans sought.

There were those who believed, in the 1830s, that the Louisiana

Purchase had been a waste of $15 million—that the whole billion acres would remain as empty as Mongolia or the Sahara. And then, just a generation later, there were those who believed a billion people were destined to settle there. It seemed there was only one person in the whole United States with the wisdom, the scientific detachment, and the explorer's insight to dissect both myths and find the truth that lay buried within.

John Wesley Powell belonged to a subspecies of American which flourished briefly during the nineteenth century and went extinct with the end of the frontier. It was an estimable company, one that included the likes of Mark Twain, John Muir, Abraham Lincoln, William Dean Howells, and Hamlin Garland. They were genuine Renaissance men, though their circumstances were vastly different from those of Jefferson or Benjamin Franklin. The founding fathers, the most notable among them, were urban gentlemen or gentlemen farmers who grew up in a society that, though it sought to keep Europe and its mannerisms at arm's length, had a fair amount in common with the Old World. They lived in very civilized style, even if they lived at the edge of a frontier. Powell, Howells, Lincoln, and the others were children of the real frontier. Most grew up on subsistence farms hacked out of ancient forests or grafted onto tallgrass prairie; they lacked formal education, breeding, and refinement. Schooled by teachers who knew barely more than they did, chained to the rigors of farm life, they got their education from borrowed books devoured by the embers of a fireplace or surreptitiously smuggled into the fields. What they lacked in worldliness and schooling, however, they more than made up in vitality, originality, and circumambient intelligence. John Wesley Powell may be one of the lesser-known of this group, but he stood alone in the variety of his interests and the indefatigability of his pursuits.

Powell's father was a poor itinerant preacher who transplanted his family westward behind the breaking wave of the frontier. As a boy in the 1840s, Powell moved from Chillicothe, Ohio, to Walworth County, Wisconsin, to Bonus Prairie, Illinois. Nothing was paved, little was fenced; the forests were full of cougars and the streams full of fish. To Powell, the frontier was a rapturous experience. Like John Muir, he got a vagabond's education, rambling cross-country in order to become intimate with forests and fauna, with hydrology and weather. In the summer of 1855, Powell struck out for four months

and walked across Wisconsin. Two years later he floated down the Ohio River from Pittsburgh to St. Louis. A few months later, he was gathering fossils in interior Missouri. The next spring he was rowing alone down the Illinois River and up the Mississippi and the Des Moines River to the middle of Iowa, then a wilderness. Between his peregrinations Powell picked up some frantic education—Greek, Latin, botany, a bit of philosophy—at Wheaton, Oberlin, and Illinois College, but he never graduated and he never stayed long. Powell learned on the run.

When the Civil War broke out, Powell enlisted on the Union side, fought bravely, and came out a major, a confidant of Ulysses Grant, and minus an arm, which was removed by a steel ball at the Battle of Shiloh. To Powell, the loss of an arm was merely a nuisance, though the raw nerve endings in his amputated stump kept him in pain for the rest of his life. After the war he tried a stint at teaching, first at Illinois Wesleyan and then at Illinois State, but it didn't satisfy him. He helped found the Illinois Museum of Natural History, and was an obvious candidate for the position of curator, but decided that this, too, was too dull an avenue with too visible an end. Powell, like the mountain men, was compulsively drawn to the frontier. In the United States of the late 1860s, there was but one place where the frontier was still nearly intact.

By 1869, the population of New York City had surpassed one million. The city had built a great water-supply aqueduct to the Croton River and was imagining its future subway system. Chicago, founded thirty years earlier, was already a big sprawling industrial town. The millionaires of San Francisco were building their palatial mansions on Nob Hill. New England was deforested, farms and settlements were spilling onto the prairie. However, on maps of the United States published in that year a substantial area remained a complete blank, and was marked "unexplored."

The region overlay parts of what is now Colorado, Utah, Arizona, New Mexico, and Nevada. It was about the size of France, and through the middle of it ran the Colorado River. That was about all that was known about it, except that the topography was awesome and the rainfall scarce. The region was known as the Plateau Province, and parties heading westward tended to avoid it at all costs.

Some of the Franciscan friars, who were as tough as anyone in the Old West, had wandered through it on the Old Spanish Trail. Otherwise, the Mormon Outlet Trail skirted the region to the west, the California and Oregon trails swung northward, and the El Paso-Yuma

Trail went south. From a distance, one could see multicolored and multistoried mesas and cliffs, saurian ridges, and occasionally a distant snowcapped peak. There were accounts of canyons that began without reason and were suddenly a thousand feet deep, eroded more by wind than by water. A distance that a bird could cover in an hour might require a week to negotiate. The days were hot and the nights were often frigid, owing to the region's high interior vastness, and water was almost impossible to find. Lacking wings, there was only one good way to explore it: by boat.

On the 24th of May, 1869, the Powell Geographic Expedition set out on the Green River from the town of Green River, Wyoming, in four wooden dories: the *Maid of the Canyon*, the *Kitty Clyde's Sister*, the *Emma Dean*, and the *No Name*. For a scientific expedition, it was an odd group. Powell, the leader, was the closest thing to a scientist. He had brought along his brother Walter—moody, sarcastic, morose, one of the thousands of psychiatric casualties of the Civil War. The rest of the party was made up mostly of mountain men: O. G. Howland, his brother Seneca, Bill Dunn, Billy Hawkins, and Jack Sumner, all of whom had been collected by Powell en route to Green River. He had also invited a beet-faced Englishman named Frank Goodman, who had been patrolling the frontier towns looking for adventure, and Andy Hall, an eighteen-year-old roustabout whose casual skill as an oarsman had impressed Powell when he saw him playing with a boat on the Green River. There was also George Bradley, a tough guy whom Powell had met by accident at Fort Bridger and who had agreed to come along in exchange for a discharge from the army, which Powell managed to obtain for him.

For sixty miles out of the town of Green River, the river was sandy-bottomed and amiable. There were riffles, but nothing that could legitimately be called a rapid. The boatmen played in the currents, acquiring a feel for moving water; the others admired the scenery. As they neared the Uinta Mountains, they went into a sandstone canyon colored in marvelous hues, which Powell, who had a knack for naming things, called Flaming Gorge. The river bore southward until it came up against the flanks of the range, then turned eastward and entered Red Canyon.

In Red Canyon, the expedition got its first lesson in how a few feet of drop per mile can turn a quiet river into something startling. Several of the rapids frightened them into racing for shore and lining or portaging, an awful strain with several thousand pounds of boats, supplies, and gear. After a while, however, even the bigger rapids were

not so menacing anymore—if, compared to what was about to come, one could call them big.

Beyond Flaming Gorge the landscape opened up into Brown's Park, but soon the river gathered imperceptible momentum and the canyon ramparts closed around them like a pair of jaws. A maelstrom followed. Huge scissoring waves leaped between naked boulders; the river plunged into devouring holes. The awestruck Andy Hall recited an alliterative verse he had learned as a Scottish schoolboy, "The Cataract of Lodore," by the English Romantic poet Robert Southey. Over Powell's objection—he did not like using a European name—the stretch became the Canyon of Lodore.

As they approached the first big rapid in the canyon, the *No Name* was sucked in by the accelerating current before anyone had a chance to scout. "I pass around a great crag just in time to see the boat strike a rock and rebounding from the shock careen and fill the open compartment with water," wrote Powell in his serialized journal of the trip. "Two of the men lost their oars, she swings around, and is carried down at a rapid rate broadside on for quite a few yards and strikes amidships on another rock with great force, is broken quite in two, and then men are thrown into the river, the larger part of the boat floating buoyantly. They soon seize it and down the river they drift for a few hundred yards to a second rapid filled with huge boulders where the boat strikes again and is dashed to pieces and the men and fragments are soon carried beyond my sight."

The three crew members survived, but most of the extra clothes, the barometers, and several weeks' worth of food were gone. The next day the party found the stern of the boat intact, still holding the barometers, some flour, and a barrel of whiskey that Powell, who was something of a prig, did not realize had been smuggled aboard. When they finally floated out of Lodore Canyon into the sunlit beauty of Echo Park, Powell wrote in his journal that despite "a chapter of disaster and toil . . . the canyon of Lodore was not devoid of scenic interest, even beyond the power of the pen to tell." And O. G. Howland, who nearly lost his life in Disaster Falls, wrote haughtily that "a calm, smooth stream is a horror we all detest now."

Desolation Canyon. Gray Canyon. They were now in territory even Indians hadn't seen. The landscape closed in and opened up. Labyrinth Canyon. Stillwater Canyon. They shot a buck and scared a bighorn lamb off a cliff, their first fresh meat in weeks. Powell, climbing a cliff with his one arm, got himself rimmed and required rescue by Bradley, who got above him, dangled his long johns, and pulled Powell up.

The country grew drier and more desolate. Fantastic mesas loomed in the distance, banded like shells. The Grand Mesa, to the east, the largest mesa in the world, rose to eleven thousand feet from desert badlands into an alpine landscape of forests and lakes. Wind-eroded shiprocks loomed over the rubblized beds of prehistoric seas. Battlements of sandstone rose in the distance like ruins of empire. Deep in uncharted territory the Colorado River, then known as the Grand, rushed in quietly from the northeast, carrying the snowmelt of Longs Peak and most of western Colorado. The river's volume had now doubled, but still it remained quite placid. Was it conceivable that they were near the end of its run? Powell was tempted to believe so, but knew better. There were four thousand feet of elevation loss ahead. On the 21st, after a short stop to rest and reseal the boats, they were on the water again, which was high, roiled, and the color of cocoa. In a few miles they came to a canyon, frothing with rapids. They lined or portaged wherever they could, ran if they had no alternative. Soon they were between vertical walls and the river was roaring mud. Cataracts launched them downriver before they had time to think; waves like mud huts threw them eight feet into the air. The scouts would venture ahead if there was room enough to walk, and return ashen-faced. The canyon relented a little at times, so they could portage, but the river did not. In one day, they made three-quarters of a mile in Cataract Canyon, portaging everything they saw.

During the daytime, the temperature would reach 106 degrees; at night the men shivered in their dank drawers. Some became edgy, prone to violent outbursts. Bradley's incendiary moods lasted through most of a day, and he would run almost anything rather than portage. Powell's instinctive caution infuriated Bradley, as did his indefatigable specimen gathering, surveying, and consignment of everything to notes. The pace was maddeningly uneven: they would do eight miles in a day, then a mere mile or two. Two months' worth of food remained, most of it musty bread, dried apples, spoiled bacon, and coffee. Once, Billy Hawkins got up in the middle of dinner, walked to the boats, and pulled out the sextant. He said he was trying to find the latitude and longitude of the nearest pie.

On the 23rd of July they passed a foul-smelling little stream coming in from the west; they called it the Dirty Devil. The big river quieted. The hunters took off up the cliffsides and returned with a couple of desert bighorn sheep, which were devoured with sybaritic abandon. The sheep were an omen. For the next several days, they floated on a brisk but serene river through a canyon such as no one had seen. Instead of the pitiless angular black-burned walls of Cataract Canyon,

they were now enveloped by rounded pink-and-salmon-colored sandstone, undulating ahead of them in soft contours. There were huge arched chasms, arcadian glens hung with maidenhair ferns, zebra-striped walls, opalescent green fractures irrigated by secret springs. Groping for a name that would properly convey their sense of both awe and relief, Powell decided on Glen Canyon. On August 1 and 2, the party camped in Music Temple.

By the 5th of August, they were down to fifteen pounds of rancid bacon, several bags of matted flour, a small store of dried apples, and a large quantity of coffee. Other than that they would have to try to live off the land, but the land was mostly vertical and the game, which had never been plentiful, had all but disappeared. They met the Escalante River, draining unknown territory in Utah, then the San Juan, carrying in snowmelt from southwestern Colorado.

The river on which they were floating was made up now of most of the mentionable runoff of the far Southwest. They were in country that no white person had ever seen, riding the runoff of a region the size of Iraq, and they approached each blind bend in the river with a mixture of anticipation and terror. Soon the soft sandstone of Glen Canyon was replaced by the fabulous coloration of Marble Canyon. Then, on August 14, the hard black rock of Cataract Canyon reemerged from the crust of the earth. "The river enters the gneiss!" wrote Powell. Downriver, they heard what sounded like an avalanche.

Soap Creek Rapids, Badger Creek Rapids, Crystal Creek Rapids, Lava Falls. Nearly all of the time, the creeks that plunge down the ravines of the Grand Canyon will barely float a walnut shell, but the flash floods resulting from a desert downpour can dislodge boulders as big as a jitney bus. Tumbled by gravity, the boulders carom into the main river and sit there, creating a dam, which doesn't so much stop the river as make it mad. Except for the rapids of the Susitna, the Niagara, and perhaps a couple of rivers in Canada, the modern Colorado's rapids are the biggest on the continent. Before the dams were built, however, the Colorado's rapids were *really* big. At Lava Falls, where huge chunks of basalt dumped in the main river create a thirty-foot drop, waves at flood stage were as high as three-story houses. There was a cycling wave at the bottom that, every few seconds, would burst apart with the retort of a sixteen-inch gun, drenching anyone on either bank of the river—two hundred feet apart. To run Lava Falls today, in a thirty-foot Hypalon raft, wrapped in a Mae West life jacket, vaguely secure in the knowledge that a rescue helicopter sits on the canyon rim, is a lesson in panic. The Powell expedition was running most of the canyon's rapids in a fifteen-foot pilot

boat made of pine and a couple of twenty-one-foot dories made of oak—with the rudest of life jackets, without hope of rescue, without a single human being within hundreds of miles. And Powell himself was running them strapped to a captain's chair, gesticulating wildly with his one arm.

The river twisted madly. It swung north, then headed south, then back north, then east—east!—then back south. Even Powell, constantly consulting sextant and compass, felt flummoxed. The rapids, meanwhile, had grown so powerful that the boats received a terrible battering from the force of the waves alone, and had to be recaulked every day. As they ran out of food and out of caulk, Powell realized that the men were also beginning to run out of will. There was mutiny in their whisperings.

August 25. They had come thirty-five miles, including a portage around a spellbinding rapid where a boulder dam of hardened lava turned the river into the aftermath of Vesuvius. (That, as it turned out, had been Lava Falls.) There were still no Grand Wash Cliffs, which would signal the confluence with the Virgin River and the end of their ordeal. They saw, for the first time in weeks, some traces of Indian habitation, but obviously no one had lived there in years. Occasionally they caught a glimpse of trees on the canyon rim, five thousand feet above. They were in the deepest canyon any of them had ever seen.

August 26. They came on an Indian garden full of fresh squash. With starvation imminent, they stole a dozen gourds and ate them ravenously. "We are three-quarters of a mile in the depths of the earth," wrote Powell. "And the great river shrinks into insignificance, as it dashes its angry waves against the walls and cliffs, that rise to the world above; they are but puny ripples and we but pigmies, running up and down the sands or lost among the boulders. . . . But," he added hopefully, "a few more days like this and we are out of prison."

August 27. The river, which had been tending toward the west, veered again toward the south. The hated Precambrian granite, which had dropped below the riverbed, surfaced again. Immediately came a rapid which they decided to portage. At eleven o'clock in the morning, they came to the worst rapids yet.

"The billows are huge," wrote Bradley. "The spectacle is appalling." It was, Jack Sumner wrote, a "hell of foam." The rapids was bookended by cliffs; there was no way to portage and no way to line. There wasn't even a decent way to scout.

After the party had had a meal of fried flour patties and coffee, O. G. Howland asked Powell to go for a walk with him. The major knew what was coming. It saddened him that if there was to be mutiny,

the leader would be Howland. He was a mountain man by nature and experience, but, after Powell, still the most literate and scientific-minded of the group. Nonetheless, Howland had been plagued by bad luck; it was he who had steered the *No Name* to its destruction in Lodore Canyon; he who had twice lost maps and notes in swampings. He had tested fate enough. In the morning, Howland told Powell, he and his brother Seneca, together with Bill Dunn, were going to abandon the boats and climb out of the canyon.

Powell did not sleep that night. He took reading after reading with his sextant until he was as positive as he dared be that they were within fifty miles of Grand Wash Cliffs. At the most, they ought to be four days from civilization, with the only remaining obstacle in view a wild twenty-second ride through a terrific rapid. Powell woke Howland in the middle of the night and poured out his conviction, but it was too late. His immediate reaction was two laconic sentences in his journal, but later he offered this version of what took place:

> We have another short talk about the morrow, but for me there is no sleep. All night long, I pace up and down a little path, on a few yards of sand beach, along by the river. Is it wise to go on? I go to the boats again, to look at our rations. I feel satisfied that we can get over the danger immediately before us; what there may be below I know not. From our outlook yesterday, on the cliffs, the cañon seemed to make another great bend to the south, and this, from our experience heretofore, means more and higher granite walls. I am not sure that we can climb out of the cañon here, and, when at the top of the wall, I know enough of the country to be certain that it is a desert of rock and sand, between this and the nearest Mormon town, which, on the most direct line, must be seventy-five miles away. True, the last rains have been favorable to us, should we go out, for the probabilities are that we shall find water still standing in holes, and, at one time, I almost conclude to leave the river. But for years I have been contemplating this trip. To leave the exploration unfinished, to say that there is a part of the cañon which I cannot explore, having already almost accomplished it, is more than I am willing to acknowledge, and I determine to go on.

August 28. Breakfast was as "solemn as a funeral." Afterward, Powell asked all of the men, for the last time, whether they planned to go ahead or climb out. The Howlands and Bill Dunn still intended

to walk out; the rest would remain. The party gave the three some guns and offered them their equal share of the remaining rations. They accepted the guns. "Some tears are shed," Powell wrote. "It is rather a solemn parting; each party thinks the other is taking the dangerous course." Billy Hawkins stole away and laid some biscuits on a rock the mutineers would pass on their way up the cliffs. "They are as fine fellows as I ever had the good fortune to meet," declared taciturn George Bradley, blinking away a tear.

As the others rowed cautiously toward the monster rapids in their two boats, the Howland brothers and Bill Dunn had already begun climbing up one of the canyon arroyos. Powell felt himself torn between watching them and the approaching rapids. They plunged down the first drop. The hydraulic wave at the bottom inundated them, but the water was so swift that they were out of it before the boat could fill. They were launched atop a pillow of water covering a rock, slid off, then rode out a landscape of haystacks. As the *Maid of the Canyon* circulated quietly in the whirlpool at rapids' end, *Kitty Clyde's Sister* wallowed up alongside. The roar of the rapids was almost submerged by the men's ecstatic shouts. They grabbed rifles and fired volley after volley into the air to show their erstwhile companions that it could be done. Unable to see around the bend in the river or to walk back up, they waited in the eddy for nearly two hours, hoping the others would rejoin them, but they never did.

A few miles below Separation Rapid, the party came to another rapid, Lava Cliffs, which, were it not now under the waters of Lake Mead, would perhaps be the biggest on the river. In a style so much like the man himself—exact and fastidious, yet felicitous and engaging—Powell wrote down what happened there:

> [O]n [the] northern side of the canyon [is] a bold escarpment that seems to be a hundred feet high. We can climb it and walk along its summit to a point where we are just at the head of the fall. Here the basalt is broken down again, so it seems to us, and I direct the men to take a line to the top of the cliff and let the boats down along the wall. One man remains in the boat to keep her clear of the rocks and prevent her line from being caught on the projecting angles. I climb the cliff and pass along to a point just over the fall and descend by broken rocks, and find that the break of the fall is above the break of the wall, so that we cannot land, and that still below the river is very bad, and that there is no possibility of a portage. Without waiting further to examine and determine what shall be done, I hasten

> back to the top of the cliff to stop the boats from coming down. When I arrive I find the men have let one of them down to the head of the fall. She is in swift water and they are not able to pull her back; nor are they able to go on with the line, as it is not long enough to reach the higher part of the cliff which is just before them; so they take a bight around a crag. I send two men back for the other line. The boat is in very swift water, and Bradley is standing in the open compartment, holding out his oar to prevent her from striking against the foot of the cliff. Now she shoots out into the stream and up as far as the line will permit, and then, wheeling, drives headlong against the rock, and then out and back again, now straining on the line, now striking against the rock. As soon as the second line is brought, we pass it down to him; but his attention is all taken up with his own situation, and he does not see that we are passing him the line. I stand on a projecting rock, waving my hat to gain his attention, for my voice is drowned by the roaring of the falls. Just at this moment I see him take his knife from its sheath and step forward to cut the line. He has evidently decided that it is better to go over with the boat as it is than to wait for her to be broken to pieces. As he leans over, the boat sheers again into the stream, the stem-post breaks away and she is loose. With perfect composure Bradley seizes the great scull oar, places it in the stern rowlock, and pulls with all his power (and he is an athlete) to turn the bow of the boat down stream, for he wishes to go bow down, rather than to drift broad-side on. One, two strokes he makes, and a third just as she goes over, and the boat is fairly turned; and she goes down almost beyond our sight, though we are more than a hundred feet above the river. Then she comes up again on a great wave, and down and up, then around behind some great rocks, and is lost in the mad, white foam below. We stand frozen with fear, for we see no boat. Bradley is gone! so it seems. But now, away below, we see something coming out of the waves. It is evidently a boat. A moment more, and we see Bradley standing on deck, swinging his hat to show that he is all right. But he is in a whirlpool. We have the stem-post of his boat attached to the line. How badly she may be disabled we know not. I direct Sumner and [Walter] Powell to pass along the cliff and see if they can reach him from below. Hawkins, Hall, and myself run to the other boat, jump aboard, push out, and away we go over the falls. A wave rolls over us and our boat is unmanage-

able. Another great wave strikes us, and the boat rolls over, and tumbles and tosses, I know not how. All I know is that Bradley is picking us up. We soon have all right again, and row to the cliff and wait until Sumner and Powell can come. After a difficult climb they reach us. We run two or three miles farther and turn again to the northwest, continuing until night, when we have run out of the granite once more.

August 30. At the confluence of the Colorado and the Virgin River, three Mormons and an Indian helper are seine-netting fish. They have been there for weeks, under orders from Brigham Young to watch for the Powell expedition. Since the members of the expedition have already been reported dead several times in the newspapers, the Mormons are really on the lookout for corpses and wreckage; they hope to salvage whatever journals and maps have survived in order that they might learn something about the unexplored portion of the region where they have banished themselves. Late in the morning, one of them flings a glance upriver and freezes. There are two boats coming down, and, unless they are ghosts, the people inside them seem to be alive.

It had taken three months and six days for the expedition to travel from Green River to Grand Wash Cliffs. Though wilder water than the Colorado is routinely run today, few river runners would dispute that the Powell expedition accomplished the most impressive feat of perilous river exploration in history. But the expedition ended, as fate would have it, on an ironically tragic note. While Powell and those who stayed with him were being fed and pumped for information by the Mormons, the Howland brothers and Bill Dunn were lying dead on the rim of the Grand Canyon, murdered by a band of Shivwits Indians. Later there were rumors that they had molested a Shivwits girl, but the Indian wars were raging and they may have been killed simply for taking the band by surprise. That the Shivwits shot Powell's companions full of holes contains a cold irony, for years later, after Powell had sat around many campfires with them, the Shivwits tribe would come to regard the one-armed major as their most faithful white friend.

When John Wesley Powell first left Council Bluffs, Iowa, in 1867, bound for Denver and the valley of the Green River, the region he crossed was virtually empty. It was like modern interior Alaska, after removing Fairbanks. Indians were more common than whites, and buffalo were much more prevalent than Indians. By the time he reached the ninety-

eighth meridian, about two-fifths of the way across Nebraska, the light dusting of settlers' towns and farms had thinned out to nothing. Before him were another five hundred miles of virgin plains, almost uninhabited by whites; then there was Denver, a rowdy little town that owed its existence mainly to furs and gold, and not much else until one got to Salt Lake and California.

On each successive trip west the changes took away Powell's breath. The breaking wave of settlement was eating up half a meridian a year; from one season to the next, settlements were thirty miles farther out. By the late 1870s, the hundredth meridian had been fatefully crossed. There were homes sprouting in central Nebraska, miles from water, trees, and neighbors, their occupants living in sod dugouts suggestive of termite mounds. Farms began to grow up around Denver, where a type of agriculture thoroughly alien to America's farmers—irrigation—was being experimented with. (Horace Greeley, the publisher of the New York *Herald Tribune*—the publisher whose words "Go west, young man" galvanized the nineteenth century—was mainly responsible for this; he had dispatched his agricultural editor, Nathan Meeker, to a spot north of Denver to found a utopian irrigation colony which, not surprisingly, became Greeley, Colorado. The colony appeared to be a success, even forgetting the large annual contribution from Greeley.) On their way across the plains, travelers could see huge rolling clouds of dust on the southern horizon, caused by cattle drives from Texas to railheads at Dodge and Kansas City. The plains were being dug up; the buffalo were being annihilated to starve the Indians and make way for cows; the vanishing tribes were being herded like cattle onto reservations.

This enormous gush of humanity pouring into a region still marked on some maps as the Great American Desert was encouraged by wishful thinking, by salesmanship, that most American of motivating forces, and, most of all, by natural caprice. For a number of years after 1865, a long humid cycle brought uninterrupted above-average rainfall to the plains. Guides leading wagon trains to Oregon reported that western Nebraska, usually blond from drought or black from prairie fires, had turned opalescent green. Late in the 1870s, the boundary of the Great American Desert appeared to have retreated westward across the Rockies to the threshold of the Great Basin. Such a spectacular climatic transformation was not about to be dismissed as a fluke, not by a people who thought themselves handpicked by God to occupy a wild continent. A new school of meteorology was founded to explain it. Its unspoken principle was divine intervention, and its motto was "Rain Follows the Plow." Since the rains coincided with

the headlong westward advance of settlement, the two must somehow be related. Professor Cyrus Thomas, a noted climatologist, was a leading proponent. "Since the territory [of Colorado] has begun to be settled," he announced in declamatory tones, "towns and cities built up, farms cultivated, mines opened, and roads made and travelled, there has been a gradual increase in moisture. . . . I therefore give it as my firm conviction that this increase is of a permanent nature, and not periodical, and that it has commenced within eight years past, and that it is in some way connected to the settlement of the country, and that as population increases the moisture will increase." Ferdinand V. Hayden, who was Thomas's boss and one of the most famous geographers and geologists of his time, also subscribed to the theory. (Hayden happened to be a notable rival of John Wesley Powell, who believed otherwise.) The exact explanations varied. Plowing the land exposed the soil's moisture to the sky. Newly planted trees enhanced rainfall. The smoke from trains caused it. Vibrations in the air created by all the commotion helped clouds to form. Dynamiting the air became a popular means of inducing rain to fall. Even the Secretary of Agriculture came out for a demonstration in Texas. "The result," he reported, "was—a loud noise!"

The notion that settlement was changing the climate on the flat, loamy, treeless plains rang irresistibly true to the subsistence farmer from the East who spent more time clearing his land of rocks and stumps than plowing and harvesting. Hamlin Garland, the writer, was the son of such a subsistence farmer, a man hounded out of Wisconsin by trees and hills. "More and more," Garland was to remember, "[my father] resented the stumps and ridges which interrupted his plow. Much of his quarter section remained unbroken. There were ditches to be dug and young oaks to be uprooted in the forest. . . . [B]itterly he resented his uptilted, horse-killing fields, and his complaining words sank so deep in the minds of his sons that for years thereafter they were unable to look upon any rise of ground as an object to be admired."

The Irish potato famine, a bad drought in the Ohio Valley, the reflexive restlessness which, Alexis de Tocqueville thought, set Americans apart from the Europeans they had recently been—all of these, too, were behind the flood. When Hamlin Garland's family settled in Iowa, they had no neighbors within sight. A year later, they were surrounded, fencepost to fencepost. "All the wild things died or hurried away, never to return," wrote Garland mournfully. "The tender plants, the sweet flowers, the fragrant fruits, the busy insects . . . prairie

wolves [that] lurked in the grass and swales . . . all of the swarming lives which had been native here for countless centuries were utterly destroyed." If poor immigrants arrived in Iowa and found land too expensive, they could either return East and look for some hardscrabble farm they could afford—in West Virginia, perhaps, or New Hampshire—or continue on to Nebraska. Since rain was bound to follow the plow, they went to Nebraska. Merchants in St. Louis and other railhead cities, who dreamed of markets expanding in three directions at once, became cheerleaders for the New Meteorology. So did land speculators, who figured that even if it was nonsense, they could buy out the burned-out homesteaders for a pittance and convert their farms to rangeland. But nothing did away with the Great American Desert quite as effectively as the railroads.

In 1867, the Kansas Pacific did not reach the Pacific—few of the railroads which veiled themselves in oceanic mists ever did—but it did reach as far as Abilene, Kansas. The Atchison, Topeka, and Santa Fe Railroad was already to La Junta, Colorado, and branching south to Santa Fe. The Union Pacific made Cheyenne, and two years later it met the Central Pacific at Promontory, Utah, spanning the continent. The Southern Pacific linked Texas to San Francisco. The Northern Pacific hitched Montana to Duluth. The initial result of such unparalleled expansion was an ocean of debt. The federal government had arranged the loans, but what was a loan worth if you didn't see how you could raise the income to pay it back? Of course, there was a way for the government to help with that problem: after all, it did own plenty of land.

During the four decades following the Civil War, 183 million acres went out of the public domain into railroad ownership. To call it a bonanza is to understate the matter significantly. The railroad land grants were a gift the size of California plus the major part of Montana. The deeded lands usually paralleled the railroad's track; reproduced on maps, they resembled jet streams flowing in reverse. Anyone who bought land from the railroads would be utterly dependent on them for getting his harvests to eastern markets and receiving supplies in return. When the time came to set rates, the railroads could charge pretty much what they pleased. But first they had to seduce the settlers who were still content to battle stumps in Kentucky or endure peonage in Germany and Ireland. J. J. Hill, the founder of the Great Northern, said as much himself. "You can lay track through the Garden of Eden," he told an acquaintance. "But why bother if the only inhabitants are

Adam and Eve?" The upswing in precipitation, and the crypto-science that explained it, were exactly what was needed. From there it became a job for advertising.

The creative juices flowed. A publicist working for the Rio Grande and Western Railroad noticed, while gazing at a map of the territory of Deseret—now Utah—a faint resemblance to the cradle of civilization. The Rio Grande and Western promptly published a map of Deseret that contained an inset map of Palestine ("The Promised Land!"), calling attention to their "striking similarity." "Follow prairie dogs and Mormons," went a pamphlet of the Burlington line, "and you will find good land." (It failed to mention that prairie dogs, which build their homes underground, cannot do so in wet or soggy ground, and therefore loathe any place receiving a decent amount of rain.) A Northern Pacific circular proclaimed, with no evident sense of shame, that not a single case of illness had been recorded in Montana during the previous year, except for indigestion caused by overeating.

Many of the railroads published their own newspapers, full of so-called testimonials from alleged Kansas farmers who were raising a hundred bushels of corn to the acre, from settlers who had traded rags for riches in five years. "Why emigrate to Kansas?" asked a testimonial in *Western Trail*, the Rock Island Railroad's gazette. "Because it is the garden spot of the world. Because it will grow anything that any other country will grow, and with less work. Because it rains here more than in any other place, and at just the right time." The railroads were careful to conceal their ties with the land-sales companies they owned, and with the journalists to whom they gave free passage and free meals, if not paychecks. One such journalist, Frederick Goddard, produced a popular publication entitled *Where to Emigrate and Why*. The Laramie Plains of Wyoming, he said, were a good place, "as ready today for the plow and spade as the fertile prairies of Illinois." (The Laramie Plains are five thousand feet higher than Illinois; the growing season is at least fifty days shorter; there is about a third as much rain.) Western Nebraska was also a delight. A few patches of drift sand, perhaps, but calling it a desert was preposterous. By drift sand, Goddard may have meant the Sand Hills, a fifteen-thousand-square-mile expanse of thirsty dunes which, to this day, remains mostly uninhabited and unfarmed.

"The utmost care has been exercised to admit nothing . . . that cannot be depended upon as correct." "All claims may be fully sustained, upon investigation." "If hard work doesn't agree with you, or you can't get on without luxuries, stay where you are. If you don't have enough capital to equip and stock a farm, if you are susceptible

to homesickness, if you do not have pluck and perseverance, stay where you are." At a time when a five-course dinner in a fancy restaurant cost $1.25, the Union Pacific and the Burlington spent $1 million on advertising for Nebraska alone. Even so, sooner or later the railroads were bound to run out of settlers—long before they ran out of land. Then it became a problem of moving the more intrepid ones westward so that others could fill their places. The strategy used most often had to do with the effects of western climate on health. In 1871, the Union Pacific described the climate throughout eastern Kansas as "genial and healthy." With irresistible logic, the railroad asked, "What doth it profit a man to buy a farm . . . if he and his family lose their health?" That was enough to bring pioneers from the malarial swamps of Louisiana. Eleven years later, when eastern Kansas was filling up with settlers and five million acres of Union Pacific land remained unsold at the other end of the state, the climate in eastern Kansas suddenly turned unhealthy. For their own benefit, the railroad began advising settlers to "get to the higher elevations of the state."

Meanwhile, in Europe, an enormous harvest of souls was waiting to be converted. Western railroad agents frequently showed up in port cities, where they held court under striped awnings and dazzled groups of murmuring listeners with claims they wouldn't dare utter in the States. Swedes, who seemed to have a tendency toward homesickness, were promised a free passage back to Europe if they returned to port with a small quota of relatives in tow. The steamship companies, which were having trouble filling their expensive ships—partly because they had a chronic inclination to explode—were happy to cooperate. When a new ship docked in New York harbor, the mob of land-sales agents rushing aboard was like a migration in reverse. The terms of sale—10 percent down, 7 percent interest, interest alone required for the first three years—could have been regarded as usurious, since deflation was the chronic economic ailment of the time. But terms like this were not to be found in Europe. Neither, for that matter, was land.

The number-one allies of the railroads in their efforts to bring settlers to the West were the politicians, newspaper editors, and territorial jingoists who were already there. No one excelled William Gilpin in this role. Gilpin, who had been a member of John C. Frémont's expedition to Oregon in 1843, was the prototypical nineteenth-century Renaissance man of the American West: soldier, philosopher, orator, lawyer, geographer, governor, author, windbag, and booby. In an essay—"Geopolitics with Dew on It"—published in *Harper's* magazine in 1943, Bernard DeVoto called Gilpin's thinking typical of

what passed, in nineteenth-century America, for science: "a priori, deduced, generalized, falsely systematized, and therefore wrong." He might have added "dotty." Imagining himself in space, Gilpin saw the North American continent as a "vast amphitheater, opening toward heaven"—an enormous continent-wide bowl formed by the Rockies and the Appalachian ridges which was ready, as far as Gilpin was concerned, "to receive and fuse harmoniously whatever enters within its rim." A capitalist-expansionist mystic as only the nineteenth century could offer up, Gilpin thundered to a meeting of the Fenian Brotherhood in Denver, "What an immense geography has been revealed! What infinite hives of population and laboratories of industry have been set in motion! . . . North America is known to our own people. Its concave form and homogeneous structure are revealed."

The hives of population of which Gilpin spoke were the 1,310,000,000 people who, he was convinced, could fit comfortably within his continental bowl—and because they *could* fit, then it was weakness of will to settle for anything less. Obviously, a desert had no place in such a galvanic vision. "The PLAINS are not *deserts*," Gilpin shouted in one of his books, which was modestly titled *The Continental Railway, Compacting and Fusing Together All the World's Continents*, "but the OPPOSITE, and the cardinal basis for the future empire now erecting itself upon the North American continent." Empire was a passion with Gilpin, as it was with his mentor, Senator Thomas Hart Benton of Missouri. Benton, in addition to being the father of John C. Frémont's wife, was the father of Manifest Destiny, which was to become the rationalization for those excesses that its companion doctrine, Social Darwinism, could not excuse.

While Benton sat in Missouri flogging pioneers westward, Gilpin stood in Colorado welcoming them and shrieking for more. And there was no scarcity of Bentons and Gilpins in the states between. Kansas's Board of Agriculture was reporting a statewide average of 44.17 inches of precipitation in 1888 and 43.99 inches in 1889. It has never rained that much in Kansas since. There was also a Kansas Bureau of Immigration, which announced that the climate in Kansas was, without exception, the most desirable in the United States. Summer might linger into November, and then "at the close of February we are reminded by a soft gentle breeze from the South, that winter is gone." At the same time, a story began to circulate among disillusioned settlers about a mule standing in a field of Kansas corn. It grew so hot that all the corn around him began to pop, and mistaking it for a blizzard, he froze to death.

Nebraska had its Bureau of Immigration, too, which specialized

in isothermal belts. These were longitudinal and latitudinal bands within which, by natural laws, the most advanced muscular and mental development, as well as the most heroic achievements of invention and creative genius, were invariably produced. The most significant isothermal belt in America ran right through Nebraska. As evidence, you had only to look at Colorado, which was farther south and west and full of dirty Spaniards and Indians. Coloradans, of course, shrugged off this type of thing: they were busy describing their own miracles.

Capitalists, newspaper editors, lonely pioneers, local emperors of Gilpin's ilk—all had a stake in retreating deserts. But they were not the only ones. Abolitionists, for example, did, too. In the 1850s, when Kansas seemed likely to be the next state admitted to the Union, something approaching warfare broke out between those who would have made it a free state and those who would have tolerated slavery. Horace Greeley, an avowed abolitionist with considerable interest in the West, found the climate in Kansas wonderful and the rainfall abundant. In such a state, Greeley said in his influential editorials, a 160-acre homestead could produce an ample living. A plantation, of course, demanded more land—but if Kansas was full of yeoman farmers working 160-acre plots, plantations and slaves were not likely to intrude.

One hundred and sixty acres. If anything unifies the story of the American West—its past and its present, its successes and its dreadful mistakes—it is this mythical allotment of land. Its origins are found in the original Homestead Act of 1862, which settled on such an amount—a half-mile square, more often referred to as a quarter section—as the ideal acreage for a Jeffersonian utopia of small farmers. The idea was to carve millions of quarter sections out of the public domain, sell them cheaply to restless Americans and arriving immigrants, and, by letting them try to scratch a living out of them, develop the nation's resources and build up its character.

In the West, the Homestead Act had several later incarnations. The Desert Lands Act, the Timber Culture Act, and the Timber and Stone Act were the principal ones. Neither Congress nor the General Land Office, which was responsible for administering the acts, could ever comprehend that the relative success of the land program east of the Mississippi River had less to do with the perseverance of the settlers or the wisdom of the legislation than with the forgiving nature of the climate. In the East, virtually every acre received enough rainfall, except during years of extraordinary drought, to grow most anything

that didn't mind the soil and the temperature. (Unlike much of the West, which suffers through months of habitual drought, the East gets precipitation year-round; in the spring and early summer, when crops need water most, much of the East is exceptionally wet.) Since the growing season, except in the extreme north, was at least five months long, even an ignorant or lazy farmer could raise *some* kind of crop.

In the West, even if you believed that the rainfall was magically increasing, you still had to contend with high altitudes (the western plains, the Snake River Valley, and most of the irrigable lands in the Great Basin would float over the tops of all but the highest Appalachian Mountains) and, as a result, chronic frost danger even in May and September. Then there were the relentless winds, hailstones bigger than oranges, tornadoes, and breathtaking thunderstorms. There were sandy lands that would not retain moisture and poorly drained lands that retained too much; there were alkaline lands that poisoned crops.

The General Land Office bureaucrats sat in Washington pretending that such conditions did not exist. Their job, as they perceived it, was to fill little squares with people. They extended no credit, provided no water, offered no services. And the permutations of the Homestead Act that found their way into the western versions of the law sometimes *added* to the farmers' burdens. Under the Timber Culture Act, for example, you had to plant one-quarter of your quarter section with trees, a stipulation inserted because it was thought that trees increased the rainfall. In West Texas, where, meteorologically speaking, all that is predictable is the wind, you would have to spend most of your time replanting your fallen-down trees. Under the Desert Lands Act, which applied to land so arid even the government realized that farming was hopeless without irrigation, you had to demonstrate "proof of irrigation" before you could own the land. Unless you owned reasonably flat land immediately adjacent to a relatively constant stream which did not, as most western rivers do for much of their length, flow in a canyon, complying with the Desert Lands Act was almost out of the question. A mutual irrigation effort by the inhabitants of a valley was, perhaps, a possibility. That was what the Mormons had done, but they were a close-knit society linked by a common faith and a history of persecution.

The members of Congress who wrote the legislation, the land office agents who doled out land, and the newspaper editors who celebrated the settlers' heroism had, in a great many cases, never laid eyes on the land or the region that enclosed it. They were unaware that in Utah, Wyoming, and Montana—to pick three of the colder and drier states—there was not a single quarter section on which a farmer could

subsist, even with luck, without irrigation, because an unirrigated quarter section was enough land for about five cows. The Indians accepted things as they were; that is why they were mostly nomadic, wandering toward greener grass and fuller herds and flowing water. If whites were going to insist on living there—fixed, settled, mortgaged, fenced—the best they could do with the land was graze it. But in those three states, an economical grazing unit was, say, twenty-five hundred to five thousand acres, depending on the circumstances. To amass that much land you had to cheat—on a magnificent scale. If you didn't, you had to overgraze the land and ruin it, and many millions of acres were damaged or ruined in exactly this way. Many settlers were tasting property ownership for the first time in their lives, and all they had in common was greed.

Speculation. Water monopoly. Land monopoly. Erosion. Corruption. Catastrophe. By 1876, after several trips across the plains and through the Rocky Mountain states, John Wesley Powell was pretty well convinced that those would be the fruits of a western land policy based on wishful thinking, willfulness, and lousy science. And by then everything he predicted was happening, especially land monopoly, water monopoly, graft, and fraud.

Homesteads fronting on streams went like oranges aboard a scurvy-ridden ship. The doctrine of riparian rights, which had been unthinkingly imported from the East, made it possible to monopolize the water in a stream if you owned the land alongside it. But if the stream was anything larger than a creek, only the person who owned land upstream, where it was still small, could manage to build a dam or barrage to guarantee a summer flow; then he could divert all he wanted, leaving his downstream neighbors with a bed of dry rocks. Riparian doctrine alone, therefore, made it possible for a tiny handful of landowners to monopolize the few manageable rivers of the West. When their neighbors saw their predicament and sold out, they could monopolize the best land, too.

As for the Desert Lands Act and the Timber and Stone Act, they could not have promoted land monopoly and corruption more efficiently if they had been expressly designed for that purpose. A typical irrigation scene under the Desert Lands Act went as follows: A beneficiary hauled a hogshead of water and a witness to his barren land, dumped the water on the land, paid the witness $20, and brought him to the land office, where the witness swore he had seen the land irrigated. Then, with borrowed identification and different names, another land application was filed, and the scene was repeated. If you could pull it off six or seven times, you had yourself a ranch. Foreign

sailors arriving in San Francisco were offered a few dollars, a jug of whiskey, and an evening in a whorehouse in exchange for filing a land claim under the Timber and Stone Act. Before shipping out, the sailors abdicated title; there were no restrictions on transfer of ownership. Whole redwood forests were acquired in such a manner.

Then there was the Swamplands Act, or Swamp and Overflow Act—a Desert Lands Act of the bulrushes. If there was federal land that overflowed enough so that you could traverse it at times in a flat-bottomed boat, and you promised to reclaim it (which is to say, dike and drain it), it was yours. Henry Miller, a mythical figure in the history of California land fraud, acquired a large part of his 1,090,000-acre empire under this act. According to legend, he bought himself a boat, hired some witnesses, put the boat and witnesses over county-size tracts near the San Joaquin River where it rains, on the average, about eight or nine inches a year. The land became his. The sanitized version of the story, the one told by Miller's descendants, has him benefiting more from luck than from ruse. During the winter of 1861 and 1862, most of California got three times its normal precipitation, and the usually semiarid Central Valley became a shallow sea the size of Lake Ontario. But the only difference in this version is that Miller didn't need a wagon for his boat; he still had no business acquiring hundreds of thousands of acres of the public domain, yet he managed it with ease.

One of the unforeseen results of the homestead legislation was a high rate of employment among builders of birdhouses. In most instances, you were required to display an "erected domicile" on your land. The Congress, after all, was much too smart to give people land without requiring them to live on it. In a number of instances, the erected domicile was a birdhouse, put there to satisfy a paid witness with a tender conscience. It is quite possible that the greatest opportunity offered by the homestead legislation in the West was the opportunity to earn a little honest graft. By conservative estimates, 95 percent of the final proofs under the Desert Lands Act were fraudulent. "Whole townships have been entered under this law in the interest of one person or firm," thundered Binger Hermann, a commissioner of the General Land Office, about the Timber and Stone Act. Not long afterward, Hermann himself was fired for allowing unrestricted fraud.

Mark Twain might have written it off to the human condition, but Powell, who subscribed to a more benevolent view of humanity, wrote it off to the conditions of the desert and the failure to understand them. Americans were making a Procrustean effort to turn half a continent

into something they were used to. It was a doomed effort. Even worse, it was unscientific.

The document that Powell hoped would bring the country to its senses was called *A Report on the Lands of the Arid Region of the United States, with a More Detailed Account of the Lands of Utah.* Published in 1876, the volume was seven years in preparation—though Powell took time out for a second expedition down the Colorado, in 1871, and for his usual plethora of intermittent pursuits. Powell's *Report* is remarkably brief, a scant two hundred pages in all. Unlike many of his rivals, such as the bombastic Ferdinand V. Hayden, Powell was more interested in being right than in being long. But his portrait of the American West has revolutionary implications even today.

At the beginning, Powell reconfirmed his view, which he had already submitted to an unbelieving Congress, that two-fifths of the United States has a climate that generally cannot support farming without irrigation. On top of that, irrigation could reclaim only a fraction of it. "When all the waters running in the streams found in this region are conducted on the land," Powell said, "there will be but a small portion of the country redeemed, varying in the different territories perhaps from *one to three percent*" (emphasis added). Powell regarded the theory that increased rainfall accompanied human settlement as bunk, but, typically, he disposed of it in a sympathetic and felicitous way: "If it be true that increase of the water supply is due to increase in precipitation, as many have supposed, the fact is not cheering to the agriculturalist of the arid region. . . . Any sudden great change [in climate] is ephemeral, and usually such changes go in cycles, and the opposite or compensating change may reasonably be anticipated. . . . [W]e shall have to expect a speedy return to extreme aridity, in which case a large portion of the agricultural industries of these now growing up would be destroyed."

The whole problem with the Homestead Acts, Powell went on, was that they were blind to reality. In the West, a 160-acre *irrigated* farm was too *large*, while a 160-acre *unirrigated* farm was too *small*. Most western valley soil was fertile, and a good crop was a near certainty once irrigation water was applied; in the milder regions the growing season was very long and two crops were possible, so one could often subsist on eighty irrigated acres or less. That, in fact, was about all the irrigated land one family could be expected to work. Remove the irrigation water, however, and things were drastically different. Then even a whole section was too small a piece of land. Under most circumstances, Powell claimed, no one could make a living through dry-

land ranching on fewer than 2,560 acres—four full sections. And even with that much land, a settler's prospects would be dicey in times of drought, because the land might lie utterly bare. Therefore, every pasturage farm should ideally have a water right sufficient to irrigate twenty acres or so during emergencies.

Having thrown over the preeminent myths about agriculture in the American West, Powell went on to the truly revolutionary part of his report. Under riparian water law, to give everyone a water right for twenty irrigated acres was impossible if you gave everyone a neat little square of land. Some squares would contain much greater stream footage than others, and their owners would have too much water compared with the others. The property boundaries would therefore have to be gerrymandered to give everyone a sufficient piece of the stream. That was one way you could help avert the monopolization of water. Another way was to insist that people *use* their water rights, not hold on to them in the hope that cities would grow up and one could make a killing someday selling water to them. An unused water right should revert—let us say after five years—to the public trust so someone else could claim it.

Doing all this, Powell reasoned, might help assure that water would be used equitably, but not necessarily efficiently. Ideally, to get through drier months and times of drought, you needed a reservoir in a good location—at a low altitude, and on the main branch of a stream. That way you could get more efficient storage of water—a dam only twice as large, but lower down, might capture five times as much water as a smaller one upstream. Also, you could then irrigate the lower valley lands, which usually have better soil and a longer growing season. In any event, an on-stream storage reservoir was, from the point of view of irrigation, preferable to small shallow ponds filled with diverted streamwater, the typical irrigation reservoirs of his day; the ponds evaporated much greater amounts of water and displaced valuable cropland.

But who, Powell asked, was building on-stream reservoirs? Practically no one. Homesteaders couldn't build them at all, let alone build them right, nor could groups of homesteaders—unless perhaps they were Mormons. Such dams required amounts of capital and commitment that were beyond the limits of aggregations of self-interested mortals. Private companies probably couldn't build good irrigation projects, either, nor even states. Sooner or later, the federal government would have to get into the irrigation business or watch its efforts to settle the West degenerate into failure and chaos. Once it realized that, it would have to undertake a careful survey of the soil characteristics so as not to waste a lot of money irrigating inferior land with drainage problems. And (he implied rather than stated) the government ought to put J. W. Powell in charge; the General Land Office, which would otherwise be responsible, was, as anyone could see, "a gigantic illustration of the evils of badly directed scientific work."

Having gone this far, Powell figured he might as well go the whole route. Fences, for example, bothered him. What was the sense of every rancher enclosing his land with a barbed-wire fence? Fenced lands tended to be unevenly grazed, and fences were obvious hazards to cattle in winter storms. Fencing was also a waste of time and money, especially in a region where rainfall could skid from twenty to six inches in successive years and someone was lucky to survive at all, let alone survive while constantly repairing and replacing fences. Individually fenced lands were a waste of resources, too; it takes a lot more tin, Powell reasoned, to make five eight-ounce cans than to make one forty-ounce can. The sensible thing was for farms to be clustered together and the individually owned lands treated as a commons, an *ejido*, with a single fence around the perimeter.

States bothered Powell, too. Their borders were too often nonsensical. They followed rivers for convenience, then struck out in a straight line, bisecting mountain ranges, cutting watersheds in half. Boxing out landscapes, sneering at natural reality, they were wholly arbitrary and, therefore, stupid. In the West, where the one thing that really mattered was water, states should logically be formed around watersheds. Each major river, from the glacial drip at its headwaters to the delta at its mouth, should be a state or semistate. The great state of Upper Platte River. Will the Senator from the state of Rio Grande yield? To divide the West any other way was to sow the future with rivalries, jealousies, and bitter squabbles whose fruits would contribute solely to the nourishment of lawyers.

While Powell knew that his plan for settling the American West would be considered revolutionary, he saw a precedent. After all, what was the difference between a cooperative irrigation district and a New England barn-raising? One was informal, the other organized and legalized, but otherwise they were the same thing. Communal pasturelands might be a gross affront to America's preoccupation with private property rights, but they were common in Europe. In the East, where inland navigation was as important as irrigation was in the West, you already had a strong federal presence in the Corps of Engineers. If anything was revolutionary, it was trying to graft English common law and the principles and habits of wet-zone agriculture onto a desert landscape. There was not a desert civilization in the

world where that had been tried—and most of those civilizations had withered even after following sensible rules.

Powell was advocating cooperation, reason, science, an equitable sharing of the natural wealth, and—implicitly if not explicitly—a return to the Jeffersonian ideal. He wanted the West settled slowly, cautiously, in a manner that would work. If it was done intelligently instead of in a mad, unplanned rush, the settlement of the West could help defuse the dangerous conditions building in the squalid industrial cities of the East. If it was done wrong, the migration west might go right into reverse.

The nation at large, however, was in no mood for any such thing. It was avid for imperial expansion, and the majority of its citizens wanted to get rich. New immigrants were arriving, dozens of boatloads a day, with that motive burning in their brains. To them America was not so much a democratic utopia as a gold mine. If monopolists reigned here, they could accept that; someday *they* would be monopolists, too. Forty years earlier, Alexis de Tocqueville had captured the raw new country's soul: "To clear, to till, and to transform the vast uninhabited continent which is his domain, the American requires the daily support of an energetic passion; that passion can only be the love of wealth; the passion for wealth is therefore not reprobated in America, and, provided it does not go beyond the bounds assigned to it for public security, it is held in honor." In Powell's day, that passion for wealth had if anything grown more intense. A pseudoscientific dogma, Social Darwinism, had been invented to give predatory behavior a good name. Darwin could not be taught in the schools; but a perversion of Darwin could be practiced in real life.

The unpeopled West, naturally, was where a great many immigrants hoped to find their fortunes. They didn't want to hear that the West was dry. Few had ever seen a desert, and the East was so much like Europe that they imagined the West would be, too. A tiny bit semiarid, perhaps, like Italy. But a desert? Never! They didn't want to hear of communal paturelands—they had left those behind, in Europe, in order that they could become the emperors of Wyoming. They didn't want the federal government parceling out water and otherwise meddling in their affairs; that was another European tradition they had left an ocean away. Agricultural fortunes were being made in California by rampant capitalists like Henry Miller, acreages the size of European principalities were being amassed in Texas, in Montana. If the federal government controlled the water, it could also control the land, and then the United States might become a nation of small farmers after all—which was exactly what most Americans *didn't*

want. For this was the late nineteenth century, when, as Henry Adams wrote, "the majority at last declared itself, once and for all, in favor of the capitalistic system with all its necessary machinery . . . the whole mechanical consolidation of force . . . ruthlessly . . . created monopolies capable of controlling the new energies that America adored."

It was bad enough for Powell that he was pulling against such a social tide. He also had to deal with the likes of William Gilpin, who had traded his soapbox for the governor's mansion in Denver; he had to fight with the provincial newspapers, the railroads, and all the others who were already there and had a proprietary interest in banishing the Great American Desert; he had to deal with western members of Congress who could not abide anyone calling their states arid (although a hundred years later, when the Bureau of Reclamation had become their prime benefactor, members of Congress from these same states would argue at length over whose state was the *more* arid and hostile).

Powell seemed at first to have everything going in his favor. The West was coming hard up against reality, as more hundreds of thousands of settlers ventured each year into the land of little rain. His exploits on the Colorado River had made him a national hero, the most celebrated adventurer since Lewis and Clark. He was on friendly if not intimate terms with a wide cross-section of the nation's elite—everyone from Henry Adams to Othniel C. Marsh, the great paleontologist, to Carl Schurz, the Interior Secretary, to Clarence King, the country's foremost geologist, to numerous strategically placed members of Congress. By 1881, he was head of both the Bureau of Ethnology and the Geologic Survey, two prestigious appointments that made him probably the most powerful, if not the most influential, scientist in America. But none of this prestige and power, none of these connections, was a match for ignorance, nonsense, and the nineteenth century's fulsome, quixotic optimism. When he testified before Congress about his report and his irrigation plan, the reception from the West—the region with which he was passionately involved, the region he wanted to *help*—was icily hostile. In his biography of Powell, Wallace Stegner nicely characterized the frame of mind of the typical western booster-politician when he surveyed Powell's austere, uncompromising monument of facts:

> What, they asked, did he know about the West? What did he know about South Dakota? Had he ever been there? When? Where? For how long? Did he know the average rainfall of the

James River Valley? Or the Black Hills? . . . [Did he] really know anything about the irrigable lands in the Three Forks country in Montana? They refused to understand his distinction between arid and subhumid, they clamored to know how their states had got labelled "arid" and thus been closed to settlement. . . . [W]hat about the artesian basin in the Dakotas? What about irrigation from that source? So he gave it to them: artesian wells were and always would be a minor source of water as compared to the rivers and the storm-water reservoirs. He had had his men studying artesian wells since 1882. . . . If all the wells in the Dakotas could be gathered into one county they would not irrigate that county.

Senator Moody [of South Dakota] thereupon remarked that he did not favor putting money into Major Powell's hands when Powell would clearly not spend it as Moody and his constituents wanted it spent. We ask you, he said in effect, your opinion of artesian wells. You think they're unimportant. All right, the hell with you. We'll ask somebody else who will give us the answer we want. Nothing personal.

The result, in the end, was that Powell got some money to conduct his Irrigation Survey for a couple of years—far less than he wanted, and needed—and then found himself frozen permanently out of the appropriations bills. The excuse was that he was moving too slowly, too deliberately; the truth was that he was forming opinions the West couldn't bear to hear. There was inexhaustible land but far too little water, and what little water there was might, in many cases, be too expensive to move. Having said this, held to it, and suffered for it, Powell spent his last years in a kind of ignominy. Unable to participate in the settlement of the West, he retreated into the Bureau of Ethnology, where his efforts, ironically, helped prevent the culture of the West's original inhabitants from being utterly trampled and eradicated by that same settlement. On September 23, 1902, he died at the family compound near Haven, Maine, about as far from the arid West as he could get.

Powell had felt that the western farmers would stand behind him, if not the politicians themselves; there he made one of the major miscalculations of his life. "Apparently he underestimated the capacity of the plains dirt farmer to continue to believe in myths even while his nose was being rubbed in unpleasant fact," Stegner wrote. "The press and a good part of the public in the West was against him more

than he knew. . . . The American yeoman might clamor for government assistance in his trouble, but he didn't want any that would make him change his thinking."

What is remarkable, a hundred years later, is how little has changed. The disaster that Powell predicted—a catastrophic return to a cycle of drought—did indeed occur, not once but twice: in the late 1800s and again in the 1930s. When that happened, Powell's ideas—at least his insistence that a federal irrigation program was the only salvation of the arid West—were embraced, tentatively at first, then more passionately, then with a kind of desperate insistence. The result was a half-century rampage of dam-building and irrigation development which, in all probability, went far beyond anything Powell would have liked. But even as the myth of the welcoming, bountiful West was shattered, the myth of the independent yeoman farmer remained intact. With huge dams built for him at public expense, and irrigation canals, and the water sold for a quarter of a cent per ton—a price which guaranteed that little of the public's investment would ever be paid back—the West's yeoman farmer became the embodiment of the welfare state, though he was the last to recognize it. And the same Congress which had once insisted he didn't need federal help was now insisting that such help be continued, at any cost. Released from a need for justification, released from logic itself, the irrigation program Powell had wanted became a monster, redoubling its efforts and increasing its wreckage, both natural and economic, as it lost sight of its goal. Powell's ideal was a future in which the rivers of the American West would help create a limited bounty on that tiny fraction of the land which it made sense to irrigate. It is hard to imagine that the first explorer of the Colorado River would have welcomed a future in which there might be no rivers left at all.