

## Population, Immigration, and the Drying of the American Southwest

By Kathleene Parker

This *Backgrounder* offers an historical overview of the critical issue of water in the American Southwest, where the water situation is becoming increasingly dire during a prolonged — but not uncharacteristic — drought in the arid region. We also examine the demographic trends that drive high rates of U.S. and, as a result, Southwest population growth. We present evidence that indicates there is insufficient water for the region's current population, much less the larger future populations that will result if immigration continues at its present high rate.

Key findings include:

- The Southwest is the fastest growing region in the United States, the world's fourth-fastest-growing nation.
- The United States is one of the world's most populous nations, joining China and India as the only nations with more than 300 million people.
- Immigration is responsible for virtually all of the population growth in California. In other states of the Southwest, immigration has caused between 30 and 60 percent of population growth.
- Immigration has been responsible for more than half the population growth in the American Southwest in this decade.
- If current trends — especially immigration — continue, the U.S. population could approach 500 million by mid-century, and one billion by the end of this century or shortly thereafter. The United States is one of just eight nations that will fuel half of all population growth through 2050, with major implications for the United States and for the global environment.
- This growth occurs despite the recommendations of two presidential commissions that the United States should move toward population stabilization; limiting immigration is key to their recommendations.
- The nation's high growth rate has continued despite a roughly replacement-level birth rate since 1972.
- The Southwest has been hit by a prolonged drought, although one of far less severity than others common to the region in the past. Global warming likely will increase the frequency and severity of droughts.
- When the critical water lifeline to the Southwest, the Colorado River, was divided up among the region's states under the 1922 Colorado River Compact, more water was apportioned than exists most years. These numbers have grown worse with drought, which could become the norm with global warming.
- Reservoirs “bank” the region's limited water supplies for use in drought. Lake Mead and Lake Powell — the Colorado River reservoirs that are the major water banking accounts on which most of the Southwest is dependent — are rapidly drawing down their water principal and could run dry early this century.

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## Introduction

The adage in the American Southwest is that water flows uphill toward money. This point is seemingly confirmed by burgeoning Las Vegas, resting a relative stone's throw from Death Valley, or by originally Pacific-bound water flowing instead over or through the Rocky Mountains toward the Atlantic. Today, water flows to where people demand it rather than to where nature intended, a tradition begun in the early 1900s and the sole reason the Southwest has attained the population it has today — although that achievement may not be sustainable.

The Southwest is the fastest-growing region of the world's fourth-fastest-growing nation, part of a demographic trend that — with little acknowledgement, media coverage, or national debate or discussion — has quietly moved our nation into the forefront of global population giants. Few ask if the nation's high growth rate — which continues despite a decades-long, near-replacement birth rate and which quickly transformed the Southwest from one of the most sparsely populated regions in the world to one holding the nation's second largest city and another larger than Paris — is sustainable.

In a repetition of ancient Southwestern history, the Southwest — which is almost solely dependent on the water from just two major rivers, the Rio Grande and the Colorado — is in a situation requiring nearly optimal precipitation all of the time to support its population in a region infamous for delivering anything but optimal precipitation. That the population of the Southwest has mushroomed from a mere few hundred thousand people in 1900 to tens of millions just over a century later leads back to the unanswered question of whether population-growth trends that have worked in the past — when they happened in a largely empty, undeveloped region — will work indefinitely in the future in a highly urbanized Southwest. That, in turn, leads back to national decisions and policies, including long-ignored recommendations by presidential commissions that U.S. population growth should be slowed — and immigration tightly controlled — for a variety of social, economic, and environmental reasons.

In the Southwest today, roughly 60 million people live amid a region strewn with the ruins of civilizations that may have been brought to their knees by severe droughts of a type experienced frequently in the region over the last 2,000 years. Such droughts serve as stark reminders of just how inhospitable the American Southwest can be. And the previous catastrophic droughts occurred in times free from the influence of global warming and the increasing aridity that many scientists predict it will bring. Plus, the Southwest faces an-

other threat that will complicate all resource issues, but particularly the challenge of making water flow uphill toward money: mushrooming and unpredictable energy costs.

It is in this setting that warnings have been made that Lake Mead, the largest reservoir in the United States, could feasibly run dry, with catastrophic economic and other implications to the Southwest. That warning came from one of several studies raising concerns about the Southwest's water future and is perhaps an indicator that national acknowledgement and discussion of the demographic implications of high legal and illegal immigration — major drivers of Southwest and national growth — are long overdue.

## Devastating Non-Drought

During the summer of 2002, *Time* magazine ran an article on the drought-racked area around Durango, Colo.<sup>1</sup> Drought in Durango and in the surrounding Four Corners area, where the states of Colorado, Utah, New Mexico, and Arizona intersect, was rated “exceptional” by the National Weather Service, the worst level of drought. Of note, this occurred amid the usually lush, green foothills of the towering San Juan Mountains of the Colorado Rockies, a range known for usually high rain and snowfall amounts.

The historic mining town and tourist center, surrounding farms and ranches, and the greater Four Corners area were ground zero for a prolonged drought that had stretched intermittently from Arizona, New Mexico, and Texas north to the Canadian border. While particularly severe in 2002, the drought began teasing the region in 1995 and continues in areas of the Southwest to this day.

Beginning in the mid-1990s and hitting various regions of the West at varying intensities and in shifting patterns, drought spawned wildfires in Arizona, New Mexico, Colorado, Montana, northern California, Washington, Oregon, and Idaho. In Colorado in 2002, it left many usually dependable large, high-altitude reservoirs that are important to the Colorado River and the Rio Grande nearly empty.

But drought around Durango took on special meaning. Durango is a Spanish word meaning well-watered place and indeed the town itself — located in a sheltered valley on the banks of the usually dependable Animas River — continued to be adequately watered. *Time* focused on Durango's golf course — sprinklers going at all hours—and outdoor water misters working full time to cool patrons at a local patio bar even as criti-

cal reservoirs shrank and nearby farms and ranches were drying up, taking peoples' incomes with them.

Such situations are spawned, in part, by Western water law's 19th century foundations. It is structured so that those who do not put to "beneficial use" all the water to which they hold rights are threatened with the loss of those rights. Hence another term for the law is "use it or lose it." If the use is wasteful in drought, so be it.

In another example of attitudes prevalent in the Southwest, Durango moved forward, despite the drought, on land-development projects it hoped would increase its population by 160 percent in the next couple of decades — from 15,000 to 40,000 within city boundaries, plus tens of thousands more residents hoped for in outlying areas of La Plata County.

So in 2002, even in foothills so seared by drought that what should have been bright summer green was instead a winter-like brown nearly devoid of plant growth, Durango remained a cool, heavily irrigated oasis, albeit often occupied by wildlife that, like humans, moved into town for coolness, water, and food. Usually shy deer, for example, took up residence in one homeowner's backyard and refused to leave.

But then, as if drought was not bad enough, wildfires hit. Due to the severity of the drought and a multitude of forest mismanagement issues, the fires were of such size and intensity that they were described with words such as "apocalyptic" and "biblical" and commanded worldwide media attention as they raged.

In a region where high-intensity wildfires of only a few thousand acres were the norm through much of the 20th century, 2002 spawned fires of many tens of thousands of acres from central Arizona to near Denver, Colo., where a fire of 135,000 acres burned. Earlier, in drought-parched 2000, the 48,000-acre Cerro Grande Fire — also called the Millennium Fire because of its turn-of-the-century timing and because it was considered the first in a new generation of "super fires" that will likely be common for a variety of reasons in the future — plowed through Los Alamos, N.M., the largest fire in the state's history at the time. The 1996 Dome Fire, also near Los Alamos and the previous record-holder in New Mexico, was a mere 16,642 acres. The massive Cerro Grande blowup, which included an appalling high-speed, four-mile run through heavy timber in just three hours, threatened the Atomic City's huge nuclear weapons lab and forced the evacuation of 18,000 townspeople, literally as the fire churned into town. Returning residents — looking aghast at miles of mountains burned black and devoid of any signs of life — commented that it looked like an atomic bomb had

exploded. The grim poetry of that fact was not lost on the citizens of this town, which made the atomic bombs dropped on Japan during World War II.

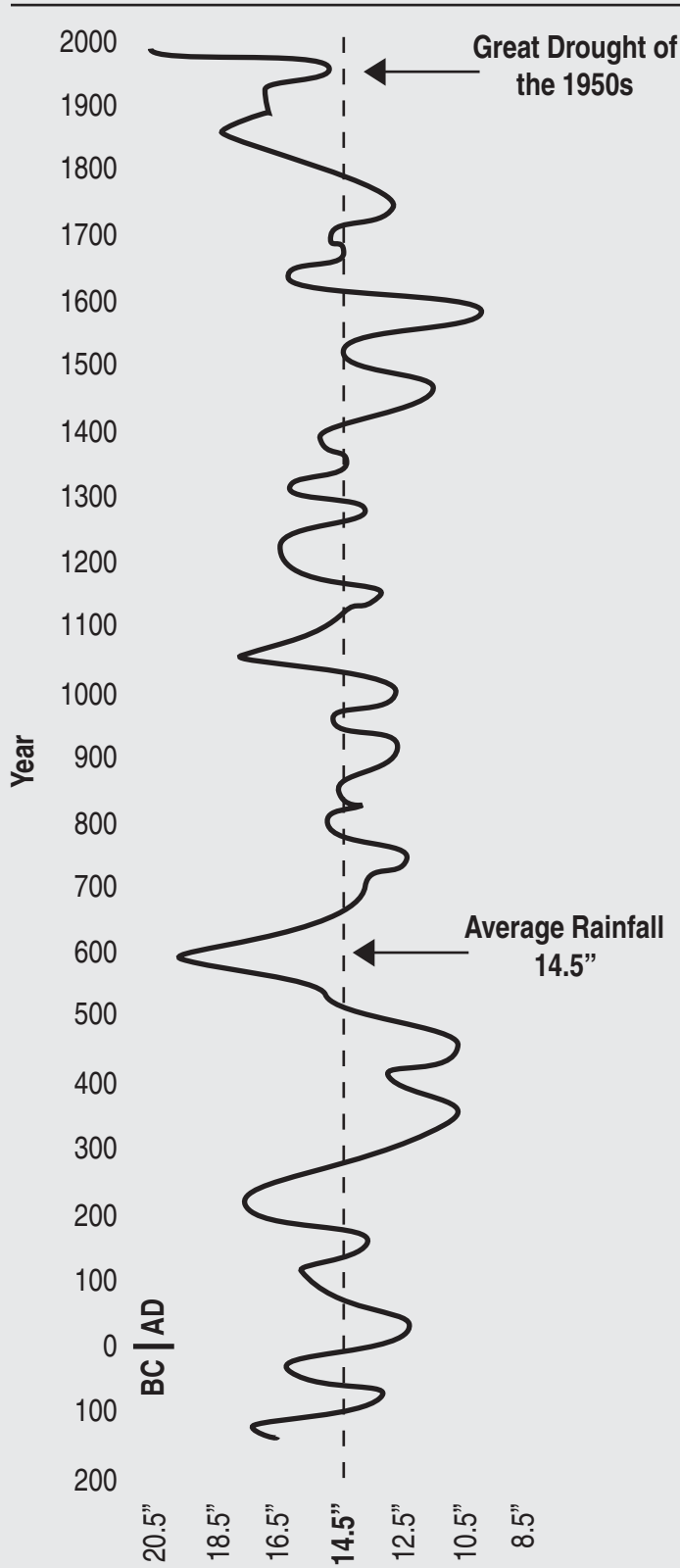
Later, in June 2002, with usually lush, green southwest Colorado seared to a drought-driven crisp, the Missionary Ridge Fire — one of the largest wildfires in Colorado history — was ignited high on the side of a mountain a few miles north of Durango by a spark somehow created by a passing car. By the time the fire had done its worst, over 70,000 acres were blackened across many miles and five river drainages, thousands of people were displaced, dozens of homes burned, and one firefighter was dead. The fire moved through a mountain valley so powerfully that it spawned fire tornadoes that picked up vehicles — parked in a dry lake bed for protection from the flames — and tossed them about like toys. In coming weeks, some were found miles into the surrounding mountains.

Such fires are partly a measure of more than a century of timber mismanagement, including fire suppression; the harvesting of mature, highly fire-resistant trees while leaving small, highly flammable trees to grow; and livestock overgrazing that increased significantly in the region with the arrival of the railroads in the 1880s. Railroads brought in large numbers of animals that grazed away grasses essential to fuel the cool ground fires that remove forest-floor litter and what would otherwise become an over-proliferation of young trees. But the Missionary Ridge and other enormous fires that summer were also the product of the severity of a drought termed the worst since the legendary drought of the 1950s, although some statisticians insist that the 2002 drought was the worst in 100 years.

Little wonder with the previous winter's snowpack in the 13,000-foot and 14,000-foot peaks of the San Juan Mountains around Durango averaging only 8 percent of normal and, in some cases, barely measurable in areas that should have had 140 to 180 inches of snow. During the 2001-2002 winter, snow mostly did not fall in the towering mountains vital to recharging the critical Colorado and Rio Grande systems, an event that could become far more frequent in a global warming-parched Southwest.<sup>2</sup>

By early spring 2002, major and usually dependable reservoirs were showing indications they might dry up. One particularly stark illustration of the situation occurred mid-summer as swarms of enormous firefighting helicopters mopping up the Missionary Ridge Fire used their giant buckets to dip water from the rapidly shrinking Vallecito Reservoir about 25 miles northeast of Durango. Usually over 12 miles long and two or three miles wide, the beautiful reservoir had shrunk to a rel-

Figure 1. Rainfall over 2,000 years in New Mexico



Source: Jennifer McKee, "History Calls This a Rainy Spell," *Albuquerque Journal*, May 1, 2002.

ative pond near the dam where a lone water skier of questionable intelligence dodged the dipping buckets and helicopter downdrafts. At nearby Lemon Dam, residents used the summer's grim reality of reservoirs turned to dust flats to churn out "donuts" behind speeding cars.

It was in that setting that the author of the *Time* article called Durango — and by implication, the Southwest — "oblivious to the lessons of history," as he pointed to Mesa Verde National Park about 30 miles to the west of Durango. Mesa Verde protects the famous cliff and other dwellings of the Puebloan people, who lived in often spectacular towns in the Four Corners area until the late 13th century when, as *Time* put it, "the combination of a 30-year drought, a population explosion, and overuse of natural resources forced them out."

The same happened to other Puebloan peoples throughout the Four Corners area and the rest of the Southwest. During those grim times, there was evidence of famine, warfare, and perhaps starvation-triggered cannibalism and certainly evidence of forced migrations of thousands of residents — including at Mesa Verde — toward regions with more dependable water supplies, such as along the Rio Grande. (The Hohokum inspired the naming of the modern-day city of Phoenix, which rose from the ruins of the Hohokum's long-ago towns. The Hohokum built an elaborate system of irrigation canals that utilized the waters of the Salt River for agriculture, with archeological evidence showing that during the drought, famine was an issue for the Hohokum, especially their children. Much of today's massive Salt River Water Project follows the path of the Hohokum's long-ago canals.)

The 2002 drought must be placed in the context of that Southwestern history. The lesson is that the "horrible" or "devastating" droughts of recent years that created a drought-driven apocalypse across thousands of square miles in usually sheltered mountain environments look like walks in the park compared with the historical and prehistoric droughts that show what the Southwest can really deliver.

In the Southwest, 1956 is remembered as the worst of the infamous "Fifties Drought." The mighty Rio Grande petered out south of

Albuquerque near Elephant Butte Dam and evaporated to nothing amid sun-baked mudflats. Only after crews dug a deep, straight trench through which it could flow — an action repeated in 2002 — was the “grand river” able to again trickle feebly into Elephant Butte, one of the most critical reservoirs along the Rio Grande.

However, by the standards of the Southwest as determined by tree-ring studies and other data, 1956 or 2002 do not even show up as dry years. Both, based on research data that looked at 2,000 years of precipitation history, had average precipitation. Indeed, the last few hundred years have been much damper in the Southwest than the norm, with the 20th century the wettest century in nearly 2,000 years, even despite the 1950s drought and the earlier 1930s drought. Meanwhile, 1976 to 2001, despite the drought beginning in the mid-1990s, was the wettest quarter-century in 2,000 years.

But that could be ending. In a May 2002 *Albuquerque Journal* article, Henri Grissino-Mayer of the University of Tennessee, a broadly recognized authority on climate and forestry issues, was interviewed. By examining tree-ring data in the region’s ancient ponderosa pine and other trees, he and other experts determined that a catastrophic 40-year drought in the mid-1500s covered much of the continent and hit the Southwest hard.<sup>3</sup>

“There’s no way that large human populations would be able to live in that,” Grissino-Mayer told reporter Jennifer McKee. “It was not a good time.”

Severe droughts occurred in the late 1300s (when Mesa Verde was abandoned) and later dominated much of the 1400s and the mid-1700s, with the drought of 1680 marginally worse than the 1950s drought. That helped trigger a successful uprising against the Spaniards by the captive Pueblo people who had been forced to turn most of their harvests over to their conquerors. Of note, such historical droughts were likely triggered by routine temperature changes in the Pacific and Atlantic, known as decadal oscillations, which brought about decades-long mega-droughts. It is critical to note that these are a normal part of Southwest weather trends.

That brings us to the giant plumbing system — wrongly still thought of as rivers by some — that today laces the American Southwest. It also raises the issue of what, by comparison, the non-drought of 1995 to 2009 has done to that plumbing system.

### “Whiskey’s for drinkin’, water’s for fightin’ over.” — Mark Twain

The cities and towns of the Southwest rest amid five deserts — the Mojave, the Sonoran, the Painted, the Chihuahuan, and the Great Basin — and derive their water from two river drainages: the Colorado and the Rio Grande, which depression-era humorist Will Rogers said was the only river he had ever seen that looked like it needed to be irrigated.

The limiting factor for almost every enterprise has been water, with the region’s 19th century history dotted with violence and shoot outs over the precious resource. Today, fish and other species are more frequently the victims as rivers are sucked dry by mushrooming human demands while the Southwest’s rivers function more as elaborate plumbing systems than as rivers. But that plumbing system is what has paved the way for 60 million residents in a land that in 1925 would have been hard-pressed to have sufficient water for a few million.

Old timers used to watch the rivers to determine whether the May-to-June spring snowmelt had begun or whether late summer rains had hit the high country. Today, river flows more accurately reflect the demands of downstream cities and irrigation districts. For example, coincidental to this writing, the flow in the Rio was cut overnight at upstream dams, dropping from over 4,000 cubic feet per second to 500 cubic feet per second so that search teams could more easily hunt for a drowning victim at Albuquerque. When irrigation season begins in agricultural areas around Hatch, where New Mexico’s famous chilies are grown, and Las Cruces, one of the two largest pecan-producing regions in the nation, the Rio flows full-bore as the U. S. Army Corps of Engineers and the U. S. Bureau of Reclamation release water from upstream reservoirs to meet the stipulations of a complicated web of agreements that — like engineering and technology — today govern rivers. On the Colorado, spring floods have been so dramatically reduced downstream of Lake Powell’s Glen Canyon Dam that the Department of Interior has briefly re-created flood-like conditions via high water releases from the dam in an attempt to restore Grand Canyon riparian areas harmed by the lack of flooding. As Marc Reisner said in his defining book, *Cadillac Desert*, “[I]n 100 years, actually less, God’s riverine handwork in the West has been stood on its head.”<sup>4</sup>

There is also the issue of the feast-or-famine problem on the region’s rivers. The water in the Southwest’s rivers comes from high-altitude snowmelt during spring or arrives during the monsoons in July and

August. The rainy season, while characterized by great explosions of thunder and brilliant pyrotechnic displays of lightning, usually consists not of days of drenching rain typical of monsoons elsewhere, but mostly of noisy afternoon thunderstorms that release huge inundations for a few minutes. Manmade dams that straddle many a Southwestern canyon capture and store or “bank” the water, like saving for a rainy day — or in this case, a non-rainy day.

The other facet of water “plumbing” in the Southwest is trans-basin or trans-mountain diversion via tunnels bored through mountains or through pumping water over mountains.

The only other water source in the Southwest — one in crisis — is underground water, or aquifers. For example, Tucson was almost solely dependent upon its aquifer before the Central Arizona Project (CAP). But even with 135,000 acre feet of CAP water, due to the greater metropolitan area’s high growth, the poor quality of the CAP water (which resulted in some municipal entities refusing to use it), and other factors, its aquifer continues to be stressed.<sup>5</sup> The aquifer under Albuquerque was pitched in the 1950s as “bigger than Lake Erie,” yet today it is being mined, or drawn down, faster than nature can recharge it. At Palm Springs, Calif., the ground has subsided over a foot due to ground water removal.

So the Southwest is still mostly dependent on two major river drainages that are dammed, diverted, and exploited almost to extinction before they ever reach the sea.

The main stem of the Rio Grande flows out of the San Juan Mountains of southwestern Colorado on the east side of the Continental Divide into Colorado’s San Luis Valley. From there it flows south past Taos, Espanola, Los Alamos, and Santa Fe, N.M., then through Albuquerque, Truth or Consequences, and Las Cruces, N.M., and El Paso, Texas, before turning southeast toward distant Brownsville, Texas. It drains 234,737 square miles and is 1,885 miles long, of which 1,254 miles form the border with Mexico.

But the Rio Grande is not really grand at all. It’s a pathetic excuse for a river when compared to those in damper climates, with a volume 1/20th that of the Colorado River and only 1/100th that of the Mississippi. With the recent drought, and with increasing frequency, it fails to reach the Gulf of Mexico.

The Southwest’s main lifeblood, the Colorado, is 1,450 miles long and drains one-fifth of the Western United States, or 240,000 square miles. It has two main tributaries: the San Juan, flowing out of southwestern Colorado and northwestern New Mexico, and the

Green, from Wyoming and northern Utah. (Flaming Gorge Reservoir, on the Green, stores what would otherwise become Colorado River water for use in north-eastern Utah and southwestern Wyoming.) The Colorado supplies water to 38 million users, most in southern California, and irrigates over three million acres of often-critical farmland.

The Colorado River has its origins in the Never Summer Mountains in southern Wyoming and northern Colorado. But the Colorado River, bound for the Pacific Coast’s distant Gulf of California (which most years it no longer reaches), barely flows out of the Never Summer before it meets its first diversion, with water taken for use along Colorado’s Front Range, on the east — or Atlantic — side of the Continental Divide. (Water falling on the Rocky Mountains is divided between the West Slope and the East Slope; water on the West Slope flows toward the Pacific, water on the East Slope flows toward the Atlantic.) In northern Colorado, burgeoning Denver, Aurora, Greeley, Fort Collins, and Colorado Springs use water originally diverted nearly a century ago for agriculture. In just Colorado, 17 diversions take portions of the river from the Colorado drainage to flow instead into the Atlantic watershed.<sup>6</sup>

The Southwest is blanketed with a complicated web of dozens upon dozens of water-storage projects strewn across the landscape like an elaborate net of jewels, from the mountain valleys of Colorado to the cactus-carpeted deserts of Arizona and Nevada. Morrow Point, Blue Mesa, Crystal, Dallas Creek, and McPhee are a few of the larger projects that dot just western Colorado. Navajo Dam stores water from the San Juan River for use on the massive Navajo Irrigation Project that presents contrasts of green fields amid stark grey desert bluffs near Farmington, N.M. The dam also provides water for massive coal-fired power plants near Shiprock that generate much of the power for the Southwest. And there are other federal diversions, such as the San Juan-Chama project, New Mexico’s ace-in-the-hole for burgeoning Albuquerque, and the controversial Animas-La Plata project to provide water to satisfy a complicated web of Native American water rights claims and as a water subsidy for urban growth and energy development near Durango, Colo., and Farmington, N.M.<sup>7</sup>

Downstream, the Colorado and San Juan rivers meet at Lake Powell, Ariz. Part of the Colorado River Storage Project authorized in the 1950s, Lake Powell was designed for storage mostly for the Upper Basin states of Colorado, Utah, New Mexico, and Wyoming — even though the reservoir sits downstream from them — illustrating the complicated legal and engineering system for water in the Southwest. Second in size in man-made

reservoirs in the United States only to Lake Mead, Lake Powell holds 24,322,000 acre-feet of water when full.

Construction on Lake Powell's Glen Canyon Dam began February 11, 1959, and was dedicated by Lady Bird Johnson on September 22, 1966. The waters of the Colorado began to be stored at Glen Canyon on September 13, 1963, and reached full capacity on June 22, 1980 — 17 years later. It is 186 miles long and 25 miles wide when full.

After the Grand Canyon — a proposal to put reservoirs there was turned back by environmentalists in the 1960s and 1970s — rests Lake Mead, at the southern tip of Nevada, amid sun-scorched desert bluffs, absent any hint of vegetation. The largest reservoir in the United States, Lake Mead extends 110 miles upstream from Hoover Dam on the Colorado to the east and another 35 miles up the Virgin River to the north. It holds over 28 million acre-feet of water when full and covers 247 square miles. (An acre-foot is the amount of water needed to cover an acre of ground to a depth of one foot.)

Hoover Dam, that miracle of depression-era engineering made more spectacular by the refrigeration processes required to allow such huge amounts of concrete to set up in desert heat, held the largest electric-powered generating station in the world in 1936 — and was one of over 30 hydroelectric facilities along the Colorado.<sup>8</sup> It was the world's largest concrete structure until the completion of Grand Coulee Dam in 1945. Today, it is the world's 35th largest hydroelectric plant.

But this is a desert. At Lake Powell alone, between 450,000 and 500,000 acre-feet of water are lost to evaporation a year, although exact losses are hard to pin down because water also soaks into sandstone formations that line the reservoir.<sup>9</sup> Meanwhile, Lake Mead loses roughly 800,000 acre-feet,<sup>10</sup> meaning the two reservoirs lose over one million acre-feet a year, roughly one-tenth of the Colorado's annual flow.<sup>11</sup> High evaporation also occurs at a chain of desert reservoirs downstream at Lake Havasu (Parker Dam), Lake Mohave (Katherine Davis Dam), and Imperial Reservoir (Imperial Dam), the latter of which diverts more than 20 percent of the Colorado's water into a major national breadbasket, California's Imperial Valley. It is at Lake Havasu that 335 miles of aqueduct begins so that Tucson and Phoenix can take their portion of the desert river via the Central Arizona Project. Designed in some measure by then-U.S. Sen. Barry Goldwater (R-Ariz.), it is the largest and most expensive aqueduct ever built in the United States. Another one billion gallons of water a day is pumped from the same project into southern California cities and to a handful of Native American tribes.

But that is only a small part of the California water story.

### “Go West young man!”—Horace Greeley

By the early 1900s, Los Angeles, which just a few decades earlier had been nothing but one of several tiny farming communities dotting the Los Angeles Basin, had grown to roughly 100,000 people, too many to support in the arid seaside basin without new water sources, a familiar refrain for the cities of the Southwest to this day. Key personalities in Los Angeles, such as Fred Eaton and William Mulholland, began eyeing the waters of the lush Owens Valley, 250 miles to the north in central California.

In September 1907, a bond issue passed in Los Angeles paved the way for the construction of a massive aqueduct — hailed as a “Titanic Project to Give a City a River,” by the *Los Angeles Times* — to divert water from the Owens Valley into the Los Angeles Basin. As Marc Reisner said in *Cadillac Desert*, “[N]o one had ever built anything so large across such merciless terrain.”<sup>12</sup>

The Los Angeles Aqueduct, spanned 223 miles, 53 of those through tunnels. Owens Valley waters first spilled into the Los Angeles Basin on November 5, 1913. Soon, the project that Los Angeles loved was increasingly loathed by the people of the Owens Valley as the Southwestern tradition of greening one valley at the expense of another hit its stride. Owens Valley residents even attempted to blow up the aqueduct in the early 1920s when the valley's beautiful Owens Lake — at one time one of California's largest lakes — began to disappear, taking with it many of the valley's farms.

But conservationist president Teddy Roosevelt did not worry. There was enough water in the Owens Valley for two million people, far more than would ever live in Los Angeles, he was sure, representative of a tradition of politicians who do not understand exponential population growth. The Owens River was not alone among Southwestern rivers to disappear from the landscape — so too have the Gila and Santa Cruz in Arizona and Colorado's Arkansas River east of Pueblo.

By the 1920s, with the Owens Valley being sucked dry and the city's population continuing to mushroom, the City of Los Angeles — or, more accurately, the 13 cities in the Los Angeles Basin that formed the Metropolitan Water District — were seeking water from the Colorado River. Construction of a new diversion conceived by William Mulholland began in 1933. Beginning at Lake Havasu at Parker Dam, the Colorado River Aqueduct diverted part of the Southwest's premier river

242 miles through the Mojave Desert into the greater Los Angeles basin by 1941. It was the largest public works project in Southern California during the Great Depression, employing 30,000 people. It consisted of two reservoirs, five pumping plants, 63 miles of canals, 92 miles of tunnels, and 84 miles of buried conduit and siphon and had the capacity to move 1.3 million acre-feet of water a year. Years later, in 1992, the American Society of Civil Engineers christened it one of the nation's seven greatest engineering wonders.

More Colorado River water was diverted into the San Diego Basin via the All American Canal, a U.S. Bureau of Reclamation Project begun in the 1930s and completed in 1942. Taking water from the Colorado at Imperial Dam near Yuma, Ariz., it moved water west into Southern California's Imperial Valley for agriculture in what is to this day the largest irrigation canal in the world, with water also diverted into the greater San Diego area.

Another major diversion (not from the Colorado River), the California Aqueduct, was constructed in the 1960s. It carries water 715 miles from Northern California's Sierra Nevada via the Central Valley and over the Tehachapi Mountains into the West Los Angeles Basin. Meanwhile, additional water was diverted from the Owens Valley in the 1960s via the second phase of the Los Angeles Aqueduct.

Such diversions reflect a pattern. First, population grows around some natural water supply until population and demand exceed that supply, and then the town or city must seek new water supplies, often via diversion. The new project sparks a new explosion of growth, especially as previously worthless land becomes valuable with the addition of water. Within two or three decades, however, a city's water supplies are again insufficient for its rising population and new water sources must be found. The problem today is that cities and other water users, such as agriculture, are competing for the same dwindling resources.

Southern California's seemingly insatiable thirst already was causing other states to worry by the early 1920s and the seven Colorado River Basin states — Colorado, Wyoming, New Mexico, Utah, Arizona, Nevada, and California — met under the auspices of the federal government at Santa Fe in 1922 to forge agreements to legally apportion the waters of the Colorado. Congress recognized the Colorado River Compact in 1922.

The apportionment, or division, was to occur between the Upper Basin states (Colorado, New Mexico, Utah, and Wyoming) and Lower Basin states (Arizona, Nevada, and California — specifically Southern

California), with half the river (minus Mexico's portion) to each, with the states within those two regions to divide the resulting allotment among themselves. The dividing point between Upper and Lower Basins was at Lees Ferry, just upstream of the Grand Canyon.

But the allocation so critical to the future of the Southwest was based on a gaffe of proportions only now being understood. It was believed in 1922 that most years the Colorado River would carry 16.4 million acre-feet of water. The Upper Basin states of Colorado, Utah, Wyoming, New Mexico, and part of Arizona were allocated 7.5 million acre-feet a year; Lower Basin states California, Nevada and the rest of Arizona were allocated 7.5 million acre-feet, with the remaining water from the mythical 16.4 million acre-feet promised to Mexico.

But the 16.4 million-acre-foot estimate was based on rosy optimism springing from measurements of the river during what later research showed was one of the wettest periods along the river in 400 years. Soon after the signing, flows began to change on the river and the states slowly realized that they had apportioned at least 1.3 million acre-feet of water more than usually flows in the Colorado.<sup>13</sup>

Recent tree-ring studies have shed an even grimmer light on the Colorado River Compact's mistaken assumptions. These studies of precipitation in the Southwest over the last few hundred years indicate that it is likely the river's flow — even without global warming — will be on average three million acre-feet less than allocated, not the million-or-so shortage originally assumed. Based on actual stream-gage readings, the flow of the Colorado River has averaged only 14.2 million acre-feet per year since 1950 (overall an uncharacteristically damp period). The Southwest may well have to get by on about 13.5 million acre-feet — a stark reality that was beginning to dawn by the 1990s as reservoirs dwindled in size like leaking bathtubs.<sup>14</sup>

Almost simultaneously the region's already rapidly growing population began to explode after 1990, delighting real estate agents, land speculators, developers, and politicians, but worrying those who study climate and water supplies. This happened directly via birthrates and arriving immigrants and indirectly via United States residents migrating into the Southwest.

What would Teddy Roosevelt think of a Los Angeles metro area today of 18 million people when he thought it would never reach two million? What would he think of other Southwest cities of millions where only villages stood in 1900?

While the population statistics may not be that large by the standards of more hospitable lands, they are staggering for an arid land of limited carrying capacity:<sup>15</sup>



# Center for Immigration Studies

- The population of Los Angeles was 102,000 in 1900. By 2006, the population in Los Angeles proper was 3,849,378 with the greater metro area today at more than 18 million people.
- San Diego’s population in 1900 was 17,000. In 2000, it was 1,256,951 with its greater metropolitan area at 2,941,454.
- California as a whole is the most populous state and for much of the 1990s it was the world’s fastest growing “nation.” If immigration policy is not changed, its population of 38 million is projected to grow to 60 million by 2050, with roughly half of those (in Southern California) dependent on the already inadequate waters of the Colorado River, even as California continues to confront its worst drought in 88 years. Projections put its population by 2060 at 75 million, although some recent data show that, due to a decrease in the birth rate among Hispanics, this might be lowered somewhat.<sup>16</sup>
- Phoenix had 5,554 citizens in 1900. By 2006, it was 1,512,986, with its greater metro area including an astounding four million people sprawled over the Salt River Valley where temperatures in summer routinely exceed 100 degrees. Covering well over 400 square miles, Phoenix is larger in physical size than Paris, San Francisco, Chicago, and Washington, DC, combined.
- Tucson, south of Phoenix, had a mere 7,531 souls by 1900. By 2006, it was 518,956, with the greater Tucson metro area today holding a million people.
- Denver — by some definitions not part of the Southwest, but deriving much of its water from the Colorado River system — was 133,859 people in 1900. By 2006, it was 588,249, with the greater metro area at 2,464,866.
- Las Vegas hails itself as the “most populated U.S. city founded in the 20th century.” It began in 1920 as just over 2,000 souls nestled at “the Meadows,” an artesian-fed oasis. That increased to 552,539 by 2006, with its greater metropolitan population at just under two million.
- Salt Lake City was large by the standards of the time, with 53,531 residents in 1900. By 2006 it was estimated at 178,858, and the greater metropolitan area was estimated at over one million.
- Albuquerque — on the banks of the Rio Grande on the Atlantic watershed, but now dependent on the Pacific-bound Colorado for much of its water — was founded in 1706, making it one of the oldest cities in the nation. By 1900, it had grown to a mere 8,000 people, but today it hovers at 841,133 with the metro area at close to one million.
- El Paso, Texas, and Juarez, Mexico, trans-border towns on the north and south sides of the Rio Grande, have a combined population of 2.3 million. The El Paso metropolitan area was 736,330 residents as of 2000; Juarez, in 2005, it was 1,301,452.

## Waves and Tsunamis

In the 1960s and 1970s, population was a hot-button issue in the United States. But it slipped from the political and even environmental radar in the 1990s. Today, as the immigration debate rages and as we struggle with a multitude of problems — most caused by or exacerbated by rapid growth — population is the ignored elephant in the room, receiving little or no media coverage or acknowledgement by leaders. Yet it is at the core the water problems of the Southwest.

Our nation grows at an astounding rate and now numbers among the planet’s population heavy hitters, having gained a whopping 100 million citizens just between the early 1970s and 2006.

**Table 1. State Population Growth as Dramatic as Municipal Growth**

State	1900	1950	1990	2000	2007
Colorado	539,700	1,325,089	3,294,394	4,301,261	4,861,515
Arizona	122,931	749,587	3,665,228	5,130,632	6,338,755
California	1,485,053	10,586,223	29,760,021	33,871,648	36,553,217
Utah	276,749	688,862	1,722,850	2,233,169	2,645,330
Nevada	42,335	160,083	1,201,833	1,998,257	2,565,382
New Mexico	195,310	681,187	1,515,069	1,819,046	2,499,481
Wyoming	92,531	290,529	453,588	493,782	532,668

**Source:** U.S. Census Bureau.

In the 1960s, Paul Ehrlich's *The Population Bomb* was a best seller, incidentally predicting a day when the southern border would be fortified against illegal border crossers. Earth Day founder Gaylord Nelson was outspoken that both United States and world population must be stabilized, as were former Sierra Club executive director and Friends of the Earth founder David Brower and Kennedy and Johnson administration Interior Secretary Stewart Udall.

Echoes of such thinking carried through the 1980s. Then-Sierra Club President Carl Pope — in sharp contrast to the club's stand on domestic growth today — called the United States “the world's most overpopulated nation,” with the club seeing unfettered immigration as a problem due to the nation's high population, its high growth rate, high standard of living, and the resulting huge environmental footprint of each resident.<sup>17</sup> (The club reversed its stand, critics charged, to meet stipulations placed on a \$101 million donation in the 1990s; the club responded that the reversal had nothing to do with the donation.)<sup>18</sup>

Pope's “most overpopulated nation” statement was based on an equation advanced by Ehrlich and other biologists called  $I = PAT$ , or Impact (on the environment) equals Population plus Affluence (which drives rates of resource consumption) plus Technology used.

A highly populated nation with little technology could have less of an  $I = PAT$ , or environmental footprint, than a sparsely populated nation with lots of machines. The United States, with a high population (today the third highest in total population in the world), much technology, and high consumption levels has a huge  $I = PAT$ . So too do China and India because of their even higher populations and rapid conversion to technology.

Out of the population awareness of the 1970s came a study that — had its recommendations been heeded — might have meant a vastly different demographic picture and an American Southwest far less troubled by water problems today. Two other important subsequent studies — one on population and one on social and economic consequences — also were ignored.

In July 1969, President Richard Nixon presented “A Special Message to Congress on Problems of Population Growth,” a telling title in that it acknowledged that there could be problems associated with population growth. In March 1970, Nixon appointed the Presidential Commission on Population and Growth and the American Future, more commonly known as the Rockefeller Commission because it was headed by John D. Rockefeller III. The bipartisan commission included Sens. Bob Packwood (R-Ore.), Alan Cranston (D-Calif.),

and representatives from business, environmental and conservation groups, clergy, banking, education, medicine, industry, unions, and government.

After a two-year study, the commission issued its conclusions on March 27, 1972. The cover letter to Nixon and Congress stated, “[W]e have concluded that, in the long run, no substantial benefits will result from further growth of the nation's population, rather that a gradual stabilization of our population *through voluntary means* [emphasis added] would contribute significantly to the nation's ability to solve its problems. We have looked for, and have not found, any convincing economic argument for continued population growth. The health of our country does not depend on it, nor does the vitality of business nor the welfare of the average person.”<sup>19</sup>

The commission was cautious and diplomatic as it discussed the nation's still-high post-war birth rate of about three children per woman, down from a post-war high of 3.8 children per woman. They likely thought the greatest obstacle to stabilizing population would be that high birth rate. They also likely thought that the other growth source — immigration, then at 500,000 a year — would be maintained at similar or even more prudent levels. Little could they realize that even as the report was issued, the birth rate was beginning to plummet toward replacement level, or 2.0 or fewer children per woman, a rate that only in 2008 increased to above replacement level. Had Congress kept legal immigration low and our borders under control, the United States today — like most of the rest of the developed world — would be nearing population stabilization.

But immigration law revisions made in 1965 were already significantly changing the face of immigration policy in 1972. Nor could the Rockefeller Commission know that Congress would not act on another recommendation: “[T]hat Congress immediately consider the serious situation of illegal immigration and pass legislation which will impose civil and criminal sanctions on employers of illegal border-crossers or aliens in an immigration status in which employment is not authorized.” The commission clearly recognized that jobs are the root draw for illegal border crossers.

They could not anticipate that the nation was headed into three decades of slack border enforcement and an assumption by many in Congress, on Wall Street, and by some on Main Street that illegal border crossers are a valid source of cheap and plentiful labor. Nor could they foresee a resulting wave of population growth in the 1990s and after that would sweep the nation.

Two subsequent commissions also made recommendations that were ignored:

- In 1993, President Clinton's Council on Sustainable Development recommended that immigrant admissions be slashed sufficiently to allow population stabilization.<sup>20</sup>
- In 1998 the bi-partisan Commission on Immigration Reform, chaired by Barbara Jordan, recommended cuts to immigration to protect resident poor and minorities from unfair economic competition.<sup>21</sup>

Today's mostly immigration-driven population growth necessitates a look at the Great Wave of Immigration from 1880 to the mid-1920s. While the United States is a nation of immigrants, it is also a nation that has, generally speaking, tightly controlled its borders. Founders Washington, Jefferson, and Franklin, for reasons *apropos* to their times and the challenges facing a fledgling nation, urged caution on immigration. It is noteworthy that between 1776 and 1826 only 710,000 immigrants entered the new nation, far less in 50 years than during just two years of the Great Wave, which averaged 600,000 immigrants a year,<sup>22</sup> and certainly far less than immigration in just one year today. The Great Wave consisted of mostly legal immigration, even if the rates allowed might have been called excessive, a point borne out by the American peoples' demands early in the 20th century that immigration be reduced.

The high immigration of the Great Wave inspires flowery prose predicated on the "give me your huddled masses" sentiment affixed to the Statue of Liberty, incidentally added long after Lady Liberty's original construction. Unanswered is how many huddled masses — in a world adding 78 million people a year — any nation can realistically welcome. More, there was a stark aspect to the high immigration of the Great Wave that is overlooked: that it came about in large measure because, as Voltaire once aptly if cynically pointed out, "The rich will always require a plentiful supply of the poor."

During the Great Wave, a huge supply of cheap immigrant labor was sought for mines, factories, railroads, and the Western expansion. But even then, issues about immigration's impacts on the resident poor were raised. Black author and educator Booker T. Washington, during a speech at the Atlanta Exposition of 1895, begged in vain that business and industry "cast down your bucket where you are" and hire slaves freed by the Civil War and other blacks desperate for employment.<sup>23</sup>

And then, as today, it came down to numbers. The historically unprecedented number of Great Wave immigrants flooded labor markets and frustrated labor's

efforts to improve dangerous working conditions, putting labor — in some measure in contrast with labor's stand today — firmly on the side of limiting immigration even as cities and towns were having difficulty housing and assimilating the sheer numbers of new arrivals.

Immigration became as much a hot-button issue 100 years ago as it is today. Finally, the will of the American people could no longer be ignored and legal immigration was slashed by Congress to a mere 250,000 a year beginning in 1920, a ceiling that held until 1965. During the Great Depression, it was often below 10,000 a year. Not coincidentally, it was between 1920 and 1965 that the labor movement overall made great strides and the lower and middle classes saw unparalleled advancement.

The Rockefeller Commission made another key recommendation: that the nation draft and pass a national population policy to guide decisions that would affect population. Such a policy, had it been drafted and passed, might have guided Congress to keep better reins on immigration if population, not just demand for immigrant labor, was considered.

The Rockefeller Commission also expressed grave concerns about the nation's ability to educate its citizens, provide adequate health care, protect the environment, and adequately maintain and build infrastructure if the population was allowed to rise from just over 200 million in 1972 to 300 million, exactly the hallmark reached in October 2006 despite warnings by the commission that that plateau should be avoided.<sup>24</sup>

It took 139 years from the nation's founding to reach 100 million in about 1915, up from a mere four million at the first census in 1790. But in 1967 — just 52 years after the 1915 hallmark — the United States reached 200 million people. Just 39 years later, in 2006, the nation reached 300 million, meaning we are one of only three nations (along with China and India) with over 300 million residents.<sup>25</sup>

That brings us to what this writer calls the Great Tsunami of Immigration.

Census Bureau data show that each year 1.6 million legal and illegal immigrants (combined) settle in the United States and 350,000 leave, for a net gain of 1.25 million people, up from about 600,000 during the Great Wave.<sup>26</sup> Recent evidence indicates a decrease in border crossings due to better border enforcement and a slowing economy,<sup>27</sup> but the 1.25 million is particularly troubling from the standpoint of the Rockefeller Commission's hope that Congress would keep legal immigration alone at no more than 500,000 a year.

# Center for Immigration Studies

The Center for Immigration Studies estimates that if we legally admitted just 300,000 a year, by 2060 the population would be 80 million less than it otherwise would be.<sup>28</sup>

If recent immigration levels continue:

- The nation's population will increase from 300 million in 2006 to 468 million by 2060, an increase of over 167 million. Immigrants plus their descendants will account for 105 million of those, or 63 percent.<sup>29</sup> Although high-range U.S. Census Bureau projections put that number as high as 498 million by 2050.
- In the 60 years between 1860 and 1920 only 25 million immigrants arrived. That is less than one-quarter of the 105 million projected to 2060, meaning over four times as many people will arrive in fewer years.<sup>30</sup>
- In just *six years* between 2000 and 2006 nearly as many people — 20 million — were added to the population as were added in that earlier 60-year period.
- For perspective on that growth, developing nations — the nations most people think of as having alarming growth rates — grew by 16.3 percent between 1995 and 2000. During the same period, the United States grew by 10.6 percent, adding 29 million people.<sup>31</sup>

- We could easily add another 100 million people and pass the 400 million milestone by 2030, if not before.

Although the U.S. fertility rate remains close to the replacement level of roughly 2.1 children per woman (up from a 1970s low of 1.7 per woman), more women than ever are having babies so the population also grows through the birth rate. The 4,317,000 births in 2007 edged out the 1957 height of the baby boom. Of those, roughly one million were to legal and illegal immigrants. However, likely due to a slowing economy, the high 2007 birth rate slowed somewhat in 2008 to 4,247,000 births — a drop of about 2 percent. While the birth rate “contracting” or falling was much ballyhooed in the media, it should be noted that births still remain at the highest levels in decades, again due to the fact that while their families are smaller, more women are having babies.<sup>32</sup>

And the United States into which the Great Tsunami of Immigration flows is a vastly different nation than that into which the frontier-era Great Wave flowed. The nation was then a still largely unsettled frontier with only 25.6 Americans per square mile in 1900. Today there are 83 per square mile, a 300 percent increase. We are a much more urban nation and one confronting major economic, environmental, resource, energy, education, social, healthcare, and infrastructure issues. As the Rockefeller Commission warned, increased population will make all such issues more challenging.

## Immigration and Population Growth in the Southwest

Table 3 reports the impact of immigration on population growth in the Southwest between 2000 and 2007.<sup>33</sup> The first column shows the number of immigrants in 2007 who arrived in the United States between 2000 and 2007 plus the number of children these immigrants had in the United States after they arrived. The second column takes this increase in the size of each state's population caused by immigration (new arrivals plus births) and divides it by the total increase in each state's population. In 2007, for example, 337,965 immigrants said they arrived in Arizona between 2000 and 2007. These same immigrants had 41,975 children after they arrived in the United States. Overall Arizona's population grew by 1.208 million. Thus, immigration accounted for 31 percent of population growth in the state over this time period.

**Table 2. Most Populous Countries, 2009 and 2050 (millions)**

2009		2050	
Country	Population	Country	Population
China	1,331	India	1,748
India	1,171	China	1,437
United States	307	United States	439
Indonesia	243	Indonesia	343
Brazil	191	Pakistan	335
Pakistan	181	Nigeria	285
Bangladesh	162	Bangladesh	222
Nigeria	153	Brazil	215
Russia	142	Congo, Dem. Rep.	189
Japan	128	Philippines	150

**Source:** U.S. Census Bureau International Database.

There is another way to think about the impact of immigration over this time period. The third column in the table reports the number of immigrants who arrived from 2000 to 2007 plus births to all immigrants living in the state over this time period, not just immigrants who arrived in the 2000-2007 period. Calculating the impact in this way has the advantage of showing the full effect of immigration and it is a reminder that immigrants who arrived before 2000 can still have a sizable impact on population growth long after they first arrived. When calculated using this approach the effect of immigration is larger in every state.

Overall Table 3 shows that immigration has had a substantial impact on population growth in the Southwest. Depending on how the effect of immigration is calculated, Table 3 shows that between roughly one-quarter and one-half of the Southwest states' population increases were due to immigration in every state, with the exception of California, where the effect of immigration was much larger. Because California represents such a large share of the total population in this region and because immigration was such a large factor in that state's population growth, immigration accounts for more than half of the increase in population in the entire region.

That brings us back to the 468 million U.S. population we might have by 2060.

If illegal immigration is stopped and legal immigration reduced to about 300,000, or roughly the number of people who leave the United States in any year, immigration would no longer be a growth contributor. However, due to a factor called momentum — population growth is like a speeding locomotive, it takes time to stop once the brakes are applied — the United States will still reach 350 million people in about 30 years, after which, based on births alone, population might slowly decline. That is a huge increase, but a far cry from the 167 million additional people that could be added at the immigration levels of recent years.<sup>34</sup>

But if our standing alone with China and India as having over 300 million citizens does not send a population warning shot across the bow, consider this: Through 2050 just eight nations will contribute half of all growth on the planet. They are India, Pakistan, Nigeria, China, *the United States*,

Bangladesh, Ethiopia, and the Democratic Republic of the Congo — in that order.<sup>35</sup>

In contrast, most other industrialized nations have stopped growing, or nearly so.

A nation not long ago known for its relatively modest population size, open spaces, plentiful resources, and bright future — based in part on a high resource-to-population ratio — is now a population super-giant. With that will likely come all the implications to our nation's and the planet's environment, our economy, and our social future, to include writer Isaac Asimov's cautionary "democracy cannot survive overpopulation," as regulations are put into place to ameliorate crowding.

For those who point to the region's wide-open spaces as evidence of "plenty of room for more," this fifth-generation native of the region replies that those wide-open spaces are rapidly disappearing. Mountain valleys are filling with sprawl. Wildlife are in crisis, often displaced from critical habitats to live almost as refugees on urban fringes or, particularly in the case of

**Table 3. Impact of Immigration on Population Growth in the Southwest between 2000 and 2007**

State	Impact of Immigrants Arriving 2000 to 2007, Plus Births to Only These Immigrants		Impact of Immigrants Arriving 2000 to 2007, Plus Births to All Immigrants	
	Numerical Increase	Share of Population Growth <sup>1</sup>	Numerical Increase	Share of Population Growth <sup>2</sup>
Arizona	379,940	31 %	536,622	44 %
California	2,429,421	91 %	3,971,084	100 %
Colorado	186,211	33 %	261,002	47 %
Nevada	157,868	28 %	231,436	41 %
New Mexico	57,490	38 %	87,151	58 %
Utah	95,484	23 %	128,006	31 %
Total	3,306,414	59 %	5,215,301	93 %

**Source:** Figures for population growth are from the 2000 Census and the Census Bureau's 2007 state population estimates. Figures for immigrant arrivals and births are from the public use file of the 2007 American Community Survey.

<sup>1</sup> Number of immigrants (legal and illegal) who arrived 2000 to 2007, plus births in the United States to these same immigrants, divided by total state population growth, 2000 to 2007.

<sup>2</sup> Number of immigrants (legal and illegal) who arrived 2000 to 2007, plus births in the United States to all immigrants, divided by total state population growth 2000 to 2007.

many aquatic species, perishing despite environmental laws meant to protect them. And those admittedly large regions that are still sparsely populated are usually not where most people would chose to live due to climate, isolation, or lack of water. And it is not space — people often live in high densities and survive, even thrive — but resources, especially water, that limit population. And that is the issue that looms in the Southwest.

## Water We Gonna Do?

The ongoing drought has delivered below average snowfall in the Rocky Mountains and below average snowmelt on the Colorado River drainage for eight of the last 10 years. During four of those years, the Colorado had less than half normal runoff. In 2004, the runoff was 45 percent of normal and during the severe drought of 2002, 30 percent of normal. The winter of 2009-2010 brought heavy snowfall but multiple such winters would be needed to replenish reservoirs.<sup>36</sup>

With drought, Lake Mead shrank to 1,103 feet above sea level in April 2009, rapidly approaching the record-setting low of 1,092 feet set in May 1965 as the flow was slowed to a trickle to free up water to fill the new Lake Powell upstream. It took Lake Mead 19 years to recover even though the region was not then in drought and the population was only about 30 percent of what it is today.<sup>37</sup>

By spring 2009, Lake Mead was down to 43 percent of capacity and startlingly close to the 1,075-

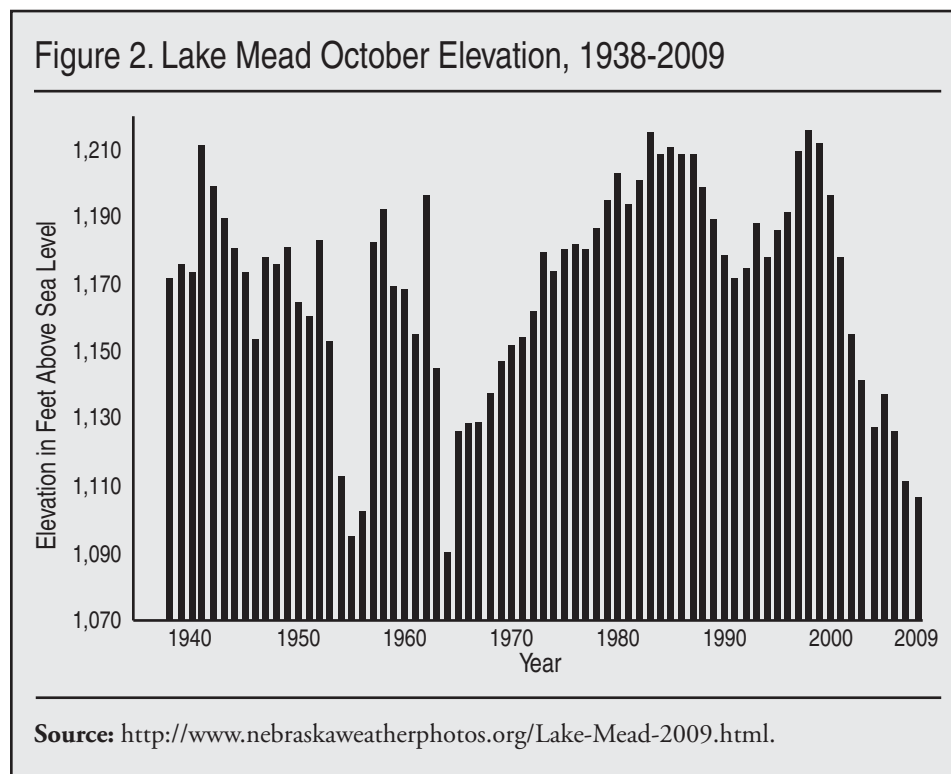
foot elevation that is the trigger for a federal shortage declaration that would force Nevada, Arizona, and New Mexico to sharply curtail water use. (By mid-summer, it was at about roughly 1,095 feet above sea level.) Critical in this picture is that in an average year with more-or-less normal snowfall in the Rockies, more water is released from Lake Mead than flows into it; in other words, “banked” water is drawn down even in average years. It takes several years with above average runoff to build up the lake’s reserves.

Lake Powell, the second largest reservoir in the nation, has taken a similar hit. A long, slender reservoir spanning the Arizona-Utah border following the rugged canyons of the Colorado River (to the north) and San Juan River (to the east), Lake Powell, after the completion of Glen Canyon Dam, took 17 years to fill with the combined waters of the Colorado, Green, and San Juan rivers.

Characterized by water surrounding archetypical desert buttes, Lake Powell reached a record low of 3,555 feet above sea level in April 2002. That was only 33 percent of the reservoir’s capacity, down from the full mark at 3,700 feet, meaning that the reservoir was within two years or less of running dry. The water flow on the Colorado in drought-parched 2002 was only 30 percent of average. Hydrologists in 2002 reported that precipitation in the Colorado River Basin was the lowest since records were begun in 1906.

In 2002, some warned that with ongoing drought and today’s far higher population in the Southwest, Lake Powell could never be refilled. In a region where many people revere water projects as infallible wonders of engineering, the warning was scoffed at. Yet in 2006 the U. S. Bureau of Reclamation announced that, indeed, the reservoir would likely never again reach its full mark due partly to drought, partly to increased population, and partly to a new agreement (to be discussed later) forged to try to cope with shortfalls on the Colorado.<sup>38</sup>

Meanwhile, on the Rio Grande — the Southwest’s other “big” river — the *Los Angeles Times* report-



ed in 2002 that “The reservoir at Elephant Butte Dam, a lifeline for large portions of New Mexico and Texas, has dropped 75 feet below the brown sandstone cliffs of its abutments. The river is so emaciated it has even lost its way to the dam, forcing federal workers to dig a \$9 million trench through the muck in the hopes of capturing whatever water does flow,” a repetition of the 1950s drought.<sup>39</sup>

“Conditions along the Rio Grande mirror the chaos and upheaval in virtually every major Western watershed, where key reservoirs are well below capacity and in some cases bone-dry,” the article said.

While Elephant Butte has recovered somewhat, the article also alluded to global warming, referring to reports issued through the Scripps Institute of Oceanography predicting precipitation levels decreasing by 10 percent, eventually bringing a one-third drop in already inadequate reservoir reserves. That report, issued in November 2002, warned of a global warming “train wreck” and cautioned that water supplies would fall far short of projected demands.<sup>40</sup>

A NASA scientist not affiliated with the studies told the Associated Press that continued population growth will exacerbate the problem.

“The problem in the West is not climate change, it’s too many people using too much water,” said research oceanographer Bill Patzert. “If nothing happens, we’re in trouble. If something happens, it’s worse.”

Added an engineer at the California Department of Water Resources, Doug Osugi, “Climate change just adds to the complexity of the already complex job of responding to changes in demand.”<sup>41</sup>

That was in 2002. In a 2007 report published in *Science*, the Intergovernmental Panel on Climate Change related how all but one of 19 climate models showed increasing aridity in the Southwest.

“If these models are correct, the levels of aridity of the recent multiyear drought ... [will] become the new climatology of the American Southwest,” with 1930s Dust Bowl-like conditions becoming a norm, wrote lead scientist Richard Seager.<sup>42</sup>

In March 2008, the Scripps Institute issued even more dire warnings that captured headlines around the nation. The report — bleakly named “When Will Lake Mead Go Dry?” — did not mince words, “There is a 50 percent chance Lake Mead, a key source of water for millions of people in the southwestern United States, will be dry by 2021 if climate changes as expected and future water usage is not curtailed.”<sup>43</sup>

A Scripps Institute press release stated that marine physicist Tom Barnett and climate scientist David Pierce “concluded that human demand and natural

forces like evaporation of water are creating a net deficit of nearly one million acre-feet of water per year from the Colorado River system that includes Lake Mead and Lake Powell” (emphasis added).<sup>44</sup> In other words, the elaborate plumbing and water-banking system that sustains the American Southwest is rapidly drawing down principal from its hard-won water savings account and risks an overdraft or total collapse of the “banking” system.

It continued, “Their analysis of Federal Bureau of Reclamation records of past water demand and calculations of scheduled water allocations and climate conditions indicate that the system could run dry even if mitigation measures now being proposed are implemented.”

Key was that the dire projections were based on non-drought conditions. The scientists opted to err on the side of caution, although “the water shortage is likely to be more dire in reality;” in other words:

- The study was based on average Colorado River flows of the unusually wet past 100 years, when flows were far higher than the 500-year norm.
- The predictions were not based on past severe droughts, such as those in the 1500s.
- The scientists used an estimated river flow of 15 million acre-feet a year, the average flow on the Colorado over the last 500 years.

In short, their assessment was based on conditions typical of 1960-to-1995 — one of the wettest periods in 1,000 years. Yet even with the information stacked for a favorable outcome the report concluded that “Today, we are at or beyond the sustainable limit of the Colorado system. The alternative to reasoned solutions to this coming water crisis is a major societal and economic disruption in the desert Southwest; something that will affect each of us living in the region.”

Barnett told the *Las Vegas Review Journal*, “We were stunned at the magnitude of the problem and how fast it was coming at us. Make no mistake, this water problem is not a scientific abstraction, but rather one that will impact each and every one of us that live in the Southwest.”<sup>45</sup>

That brings us to fact that the bottom half of reservoirs are smaller than the top half. The researchers predict that by 2017 there is a 50 percent chance that reservoir levels will be insufficient for power generation at Lake Mead — that’s the Lake Mead of Hoover Dam fame with a hydroelectric facility that spawned assumptions of an endless, resource-rich future for the Ameri-

can Southwest. Should Lake Mead drop to an elevation of 1,050 feet — only 55 feet below May 2009 levels — Hoover Dam’s famous turbines would not be able to generate electricity.

At an elevation of 895 feet, the reservoir would be at “dead pool” with its water too low to be used unless pumped out. That “dead pool” — and the fact that the primary of two intakes could be unable to draw water perhaps as early as 2012 — represent a grim possibility that Las Vegas’ Southern Nevada Water Authority is trying to prepare for via the construction of a new \$837 million intake to draw water from the Colorado River’s original channel in the deepest part of the reservoir. But this intake is not slated for completion until 2013.<sup>46</sup>

And in a repetition of history, Las Vegas now seeks to tap ground water in eastern Nevada to pipe into the city at a cost estimated at \$3.5 billion, although crit-

ics charge it will cost upwards of \$10 billion. Residents in Clark, Lincoln, and White Pine counties wonder if they will be the next Owens Valley.

But a spokesman for the Southern Nevada Water Authority called the need for the pipeline indisputable, precisely because of the Scripps Institute’s projections: “If Lake Mead craters, we lose 90 percent of our water supply,” J. C. Davis told the *Las Vegas Sun* in February 2009.<sup>47</sup>

But the U. S. Bureau of Reclamation and some other water officials disagreed with the Scripps study’s conclusions. The Southwest’s critical reservoirs are so important that the Bureau of Reclamation and the Upper and Lower Basin states will not allow them to run dry, the Bureau stressed. Speaking to the *Las Vegas Journal* in February 2008, Terry Fulp, area manager of the Bureau’s Boulder Canyon Operations, dismissed





the Scripps report as “doom and gloom,” in part because entities using Colorado River water have forged new agreements, including triggers that would kick in at various dropping water levels to force mandatory conservation.<sup>48</sup>

The Bureau of Reclamation also directly disputed the Scripps study. The Bureau itself studied the river and ran computer models of the river. Robert Walsh was quoted in the online *IEEE Spectrum* as saying none of those models showed Lake Mead going dry. But Barnett, also in *IEEE Spectrum*, disputed the Bureau’s findings because the agency modeled river flows without factoring in climate change.<sup>49</sup>

Barnett and others also have cautioned that if drought- or global-warming-decreased water flows happen, the entire Colorado River system will lose “resiliency” and respond far more quickly and far more negatively to drought.

Pierce and Barnett have since given further warnings about the inability of the Colorado to continue to be the water lifeblood of the Southwest. In April 2009 the results of another study were issued in the journal *Proceedings of the National Academy of Sciences*.<sup>50</sup>

With climate change, it is possible the Colorado will not be able to meet allocated obligations for water delivery 60 percent to 90 percent of the time by 2050 and could face a 10 percent to 30 percent reduction in runoffs, the Scripps Institute authors warned. They also showed that by 2025 the Colorado could come up short by about 400,000 acre feet of water 40 percent of the time, or the amount of water needed to supply between 400,000 and 800,000 homes.

Tellingly, the Bureau of Reclamation, using a somewhat different approach than Barnett and Pierce, came up with less dire but still troubling numbers, finding that the Colorado would run short of water between 58 percent and 73 percent of the time by 2050.

The Bureau’s Fulp, as quoted by Associated Press, was more subdued this time, “We’ve got some serious issues to grapple with.”<sup>51</sup>

And again, population was mentioned as Brad Udall, director of the University of Colorado’s Western Water Assessment told Associated Press, “We’re on a collision course between supply and demand,” with growing populations demanding more water.<sup>52</sup>

But it is where some seek to find “more” water that may be problematic.

## An Over-Allocated Colorado As a “Solution” to Drought

How many people the arid Southwest can accommodate remains a mostly unasked question, a point made in the preface to a 2007 report by the National Academies of Science on Colorado River management: “It became clear that a broad understanding of Colorado River management issues is not possible unless both water supply and demand issues are adequately considered.”

The Academies continued, “Our report presents population growth data for much of the western United States that is served by Colorado River water. The cities in the region are collectively the fastest growing in the nation. *Of further concern is that this growth seems to be occurring with little regard to long-term availability of future water supplies.*” (Emphasis added.)<sup>53</sup>

Others also have recognized the problem. An in-depth commentary on growth and immigration by Lee Green in the *Los Angeles Times* said, “[T]he discussion is always about accommodating growth, never about slowing, limiting, or stabilizing it. Mention the idea of somehow trying to limit the population and politicians react as though you have suggested that our society eats cats and dogs.”<sup>54</sup>

Leaders have a worried eye cast toward long-term bonded indebtedness undertaken, sometimes years ago, predicated on growth projections decades into the future. That growth — based on a hope for more people to “spread the pain” — can not be covered without undue hardship on current residents or the risk of governments running into financial problems if growth projections are not met, although California’s current financial woes are, in part, linked to its high growth.

Growth in the Southwest seems to be occurring based on assumptions that there always will be one or more technical solutions to “create” new water. Various ideas include: deep-well injection to store water underground, rather than in evaporation-plagued reservoirs; desalination, requiring 10 times as much energy to process as conventional water; desalination of brackish aquifers, requiring five times as much energy to process as conventional water; sewage reuse — or as some bluntly call it, “toilet to tap” — returning processed sewage to municipal systems, assuming it can be sold politically; and storm-water-runoff capture, which is like sewage reuse, with environmental implications since it keeps water that would normal flow back into rivers from doing so.

Strangely the “answer” many offer to the Southwest’s current water shortages is more diversions from the already over-allocated Colorado River system.

For example, New Mexico towns and cities eye use of Colorado River water via the huge Navajo-Gallup pipeline, recently funded by Congress, while Utah wants to divert, via the Lake Powell pipeline, 100,000 acre-feet of the Colorado River water to supply yet more growth around St. George, while a developer proposes the diversion of 225,000 acre-feet per year from the Colorado River's headwaters in Wyoming over the Continental Divide into the Denver metro area.<sup>55</sup>

California has long used more water — about 800,000 acre-feet a year — from the Colorado River than the 4.4 million acre-feet to which it is legally entitled under the Colorado River Compact. But that happened when the population of the Upper Basin states was sufficiently small that those states did not use their full allotments on the Colorado, leaving plenty of water for California. But severe drought and the region's — especially California's — booming population forced the issue and led, in 2003 and 2007, to new water-management plans.

When water was apportioned under the Colorado River Compact, Nevada had almost no population and even less clout. No one foresaw the day when 40 million people a year would visit Las Vegas or when the state's population would explode. But with the latter-day population boom — at one time in the 1990s a 4 to 5 percent per-year growth rate made Nevada one of the fastest growing regions in the world — Nevada needed more water and had the clout to go after it.

That brought threats to do the unthinkable: to try to break the very spine of water management in the Southwest by contesting in court the defining document governing water, the Colorado River Compact.

“If there is no way that the [Colorado River] compact can accommodate Nevada, then Nevada has no choice but to consider the compact broken,” Patricia Mulroy, head of the Southern Nevada Water Authority, told a reporter from *High Country News*, a Western environmental publication.<sup>56</sup>

But to meet Nevada's water needs California must stop routinely using more than its legal allotment on the Colorado.

This resulted in the Quantification Settlement Agreement (QSA) in October 2003. Critics charge a modern-day repetition, *a la* Owens valley, of turning fertile farmland to dust to grow cities.<sup>57</sup>

States in the Southwest often view agriculture as a water savings account, putting water to the “beneficial use” required under Western water law until it is needed for urban growth.

Southern California's Imperial Valley, with a 300-day growing season, is one of the most fertile

agricultural areas in the world. Its 400-plus farms and 450,000 irrigated acres support a \$1.2 billion-a-year industry that feeds much of the nation and provides 40 percent of the nation's winter vegetables.

The QSA forces farmers in the Imperial Valley and nearby Palo Verde Valley into signing a 75-year contract to sell enough water to send San Diego 200,000 acre-feet of water — about one-third the city's current needs — or face harsh sanctions and the brunt of the blame if California faces punitive water cutbacks for failing to meet the 2016 goals for reduced use of Colorado River water.

Agriculture is already giving way to urban development across vast swaths of the West as farmers sell their water and land — sometimes prime agricultural land — for urban development. (In general, each person added to the population results in the loss of one acre to urbanization and highways.) Large areas of prime Colorado farmland, for example, now rest under houses. In California, about 122,000 agricultural acres are lost to development each year. If California's population doubles from 32 million to 65 million, 100 million acres of land would be required for housing, industry, and highways. Nationally, only 450 million of the nation's 2.3 billion acres (about 20 percent) are suitable for agriculture.<sup>58</sup>

Critical is the apparent lack of discussion — in a nation drawing close to being a net importer of food rather than a major food exporter — of just how much land can be carpeted with development and how much water can be taken from agriculture to grow cities. Is it in the nation's best economic and national security interests to import food — as we do now oil — particularly considering an already troubling trade balance? If we are to embrace environmental sustainability, are such approaches to grow larger cities sustainable in a multitude of ways?

That brings us to the 2007 agreement, hailed by its authors as the most important since the drafting of the 1922 Colorado River Compact: a management plan for the river in drought; in other words, a crisis-management plan. But it failed to address the issue of how climate change will affect the Colorado River and triggered the Scripps Institute of Oceanography publication, “When Will Lake Mead Go Dry?”

The agreement grabbed headlines nationally and regionally.

“Facing the worst drought in a century and the prospect that climate change could yield long-term changes on the Colorado River, the lifeline for several Western states, federal officials have reached a new pact with the states on how to allocate water if the river runs

short,” was the variation of the lead on a wire service story run on the front pages of newspapers from San Diego to Denver and from Salt Lake to Tucson.<sup>59</sup>

The *Los Angeles Times* stated things more bleakly: “The federal government Thursday ushered in a new era of shortages on the Colorado River, adopting a blueprint for how it will tighten the spigot on the West’s most important water resources.”<sup>60</sup>

Again, the Colorado River Compact was drawn up on the assumption that about 16.4 million acre-feet of water (for United States use) flows in the river annually. But between 2000 and 2005, the average flow was a paltry 9.62 million acre-feet, although that was up from the even worse 5.4 million acre-foot average during 2001-2003. Those deficient flows — combined with the region’s booming population — mean that water supplies are pinched two ways, between drought and growth.

“We have had good news and bad news,” then-Interior Secretary Kirk Kempthorne said at the signing of the management plan at the Colorado River Water Users Association meeting at Las Vegas’ Caesars Palace in December 2007. He called the water-management agreement the “good news” and a drought with no sign of ending the “bad news,” as he warned that global warming will likely further decrease water runoff in five of the river’s seven basin states.<sup>61</sup>

The new agreement sets guidelines for how the Interior Department will declare a shortage on the river. Such guidelines were never before legally defined. A shortage will be declared when the system is unable to produce the 7.5 million acre-feet required for use by California, Arizona, and Nevada and will be determined by monitoring water levels at Lake Mead. The guidelines define how each Colorado River Basin state must share the shortage as Lake Mead’s surface elevation approaches the critical 1,075 feet above sea level.

But there were those of scientific influence who raised concerns about a key aspect — or lack thereof — of the agreement from a population standpoint.

One such voice was Michael Cohen, a senior research associate at the Pacific Institute, who bluntly told the *Los Angeles Times*, “None of the municipal agencies are saying, ‘We need to reevaluate our urban plans, our growth plans, because there’s only so much water.’ It’s not clear that the states are saying, ‘OK, we’re going to now live in this era of limits.’”<sup>62</sup>

## Conclusion

As the population clock ticks<sup>63</sup> on United States growth, we should remember congresswoman and civil rights leader Barbara Jordan’s admonition, “It is both a right and a responsibility of a democratic society to manage immigration so that it serves the national interest.”

Whether current immigration levels benefit the national interest seems not to be considered by policy-makers, even as some immigration “reform” proposals would dramatically increase immigration absent discussion about the population implications. Yet every step forward we take technologically, through conservation or in other ways, especially as pertains to environmental and critical carrying capacity issues like water, risks being negated by population increases.

The story of the frog sitting in water heated slowly enough that it does not recognize what is happening and boils to death is often used to describe population growth. Indeed, most Americans today have lived in times of such high population growth that we lack perspective on it or never really consider its possible negative implications to the nation’s well being in a likely far more resource-strapped future. For example, when Lyndon Johnson was president, the United States had only five cities with populations of a million or more; today, there are 44 of that size or greater.

The Southwest’s water situation must be considered in the context of policies fueling the nation’s high growth rate. For that to happen:

- Population must be brought back into the national conversation.
- The Rockefeller Commission’s recommendations should be revisited and a new commission engaged to update the earlier commissions’ recommendations based on current scientific research, including on critical resource issues such as water.
- The Rockefeller Commission’s recommendation that the nation draft and implement a population policy should be re-visited to rationally guide decisions on topics like immigration.
- The immigration recommendations of President Clinton’s Council on Sustainable Development should be revisited by policymakers and embraced by environmentalists and others who espouse the necessity for sustainable approaches.

- We need public acknowledgement of the nation's high growth rate, a jaundiced perusal of the assumption that all growth is good, and a national discussion of just how populated a nation and what quality of life we want to bequeath to our descendants — the main recipients of the effects of today's policies — as decisions are made relevant to key growth drivers like immigration.

Since the preponderance of evidence indicates there isn't enough water in the Southwest for the current population, Lake Mead will likely drop to the 1,075-foot

elevation, triggering a basin-wide shortage declaration, in early 2011, it is imprudent to assume that somehow water will be “created” technologically in sufficient quantities and at affordable prices for much higher projected populations by 2050 and 2060, especially considering global warming's likely influence on precipitation.

Nothing is more elemental to life, quality of life, or the well being of the environment or the economy than water. To continue high immigration or to increase immigration is incompatible with the nation's, and certainly the Southwest's, future well being.

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## Population, Immigration, and the Drying of the American Southwest

By Kathleene Parker

This *Backgrounder* offers an historical overview of the critical issue of water in the American Southwest, where the water situation is becoming increasingly critical during a prolonged — but not uncharacteristic — drought in the arid region. We also examine the demographic trends that drive high rates of U.S. and, as a result Southwest, population growth. We present evidence that indicates there is insufficient water for the region's current population, much less the larger future populations that will result if immigration continues at its present high rate.

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