Designing Water's Future

CASE STUDY:

Mexico

TEHUACÁN VALLEY MEXICO:
WATER SHORTAGES WITHER ECONOMIC RUIN
AND SPUR IMMIGRATION TO U.S.

THE ASPEN
DESIGN CHALLENGE
TO STUDENTS

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By the standards of rural Mexico, Francisca Rosas Valencia cuts an unlikely figure as community leaders go. The 46-year-old farmer and mother of nine has spent her entire life in San Marcos Tlacoyalco, a dusty town of 10,000 people located in the heart of the Tehuacán Valley southeast of Mexico City.

Rosas has defied social convention by encouraging her neighbors to replace their traditional corn crops in the parched fields around San Marcos with amaranth, a high-protein grain that requires less water to cultivate. Though her pioneering work earned a national award, it was motivated by much more basic values: deepening drought, economic ruin caused by water shortages, and migration north to the United States by many of the valley's most capable young men, including one of Rosas' sons.

The disturbing irony: the Tehuacán Valley and the city of 250,000 that bears its name is best known for the mineral water drawn from local springs. The 775-square mile valley also is the site where indigenous peoples domesticated corn as an agricultural crop for the first time in the history of mankind between the years 5000 and 3400 B.C. Today, as in so many other villages in Mexico and across Latin America, Rosas and the other villagers in San Marcos trudge down through cactus to a tiny reservoir each morning and fill up 20-liter plastic containers that are hauled back up to the village by mule. There is no water left over to irrigate the fields.

Demand for Mexico's finite supply of water will rise steadily for the foreseeable future. Demographers predict that the country's population will surpass 120 million by the year 2025, yet as of 2001 the nation's Environment Minister reported that 12 million Mexicans had no access to safe drinking water. As in many other nations, Mexico's existing supplies of water are unevenly distributed. The arid northern third of the country is home to only nine percent of Mexico's total volume of river water, whereas the southern states that account for about 20 percent of the national territory boast the best aquifers, have fully half of the river water supply and receive most of the rainfall nationwide.

The traditional admonishment to foreigners freshly arrived in Mexico against drinking the water is no glib cliché. Only two percent of the nation's surface water is classified as being of high quality, and a United Nations survey that evaluated water quality in 122 countries placed Mexico near the bottom of the list at number 106, behind the likes of Guatemala, Egypt and China. Contaminated water ranks second among causes of infant mortality nationwide, and untreated wastewater from homes and industries ranks as the main culprit.

Polluted water is a grim fact of life for both city dwellers and rural villagers. In 1996 the government-run National Water Commission reported high concentrations of toxic chemicals in wells used by the industrial city of León for drinking water. An estimated 150,000 residents of Mexico City imbibe water with dangerously high levels of arsenic. The public health hazards associated with contaminated water supplies aren't confined to any single region of the country: so-called "black waters" have been used to grow vegetables near the southern city of San Cristóbal de las Casas and alfalfa and other forage crops in the central Mexican state of Querétaro.

The country's agribusiness sector is a leading source of water pollution. About 6,000 residents of the Mexican capital consume water containing harmful amounts of pesticide. According to the National Water Commission, wastewater from 61 sugar mills generated 6.2 tons of biochemical oxygen demand in 2000, a reliable yardstick of the amount of fecal and other organic material in water. Pig farms in particular generate massive quantities of excrement that foul rural water supplies. The risks arising from polluted water in the countryside threaten wildlife as well as human beings: over 8,000 migratory birds died near the town of Tequisquiapan after drinking from contaminated ponds and streams.

Aging infrastructure is aggravating the country's shortage of safe water. The amount of water lost daily from ruptured pipes in Mexico City is large enough to supply a metropolis the size of Rome. The rapid pace of urbanization throughout the country further taxes the nation's water supply. Over 20 million people live in the Mexican capital and its outlying suburbs, and the prohibitively high cost of building new water treatment plants has led municipal officials to draw an ever-growing percentage of the capital's water supply from surrounding rural areas.

FUN AND NOT-SO-FUN FACTS:

- Over the last four decades, the number of large and sophisticated agribusinesses specializing in raising vast numbers of chickens, pigs, cattle and other produce, has increased substantially. These businesses, not surprisingly, have put enormous stress on underground water reserves.

- In the 1990s, hundreds of Maquiladoras, or textile factories, were created principally for the manufacture of blue jeans for the world market. At its height the area supported 700 plants. Each factory required huge amounts of underground water. Combined with deforestation and overgrazing, today Tehuacán is one of the driest regions of Mexico.

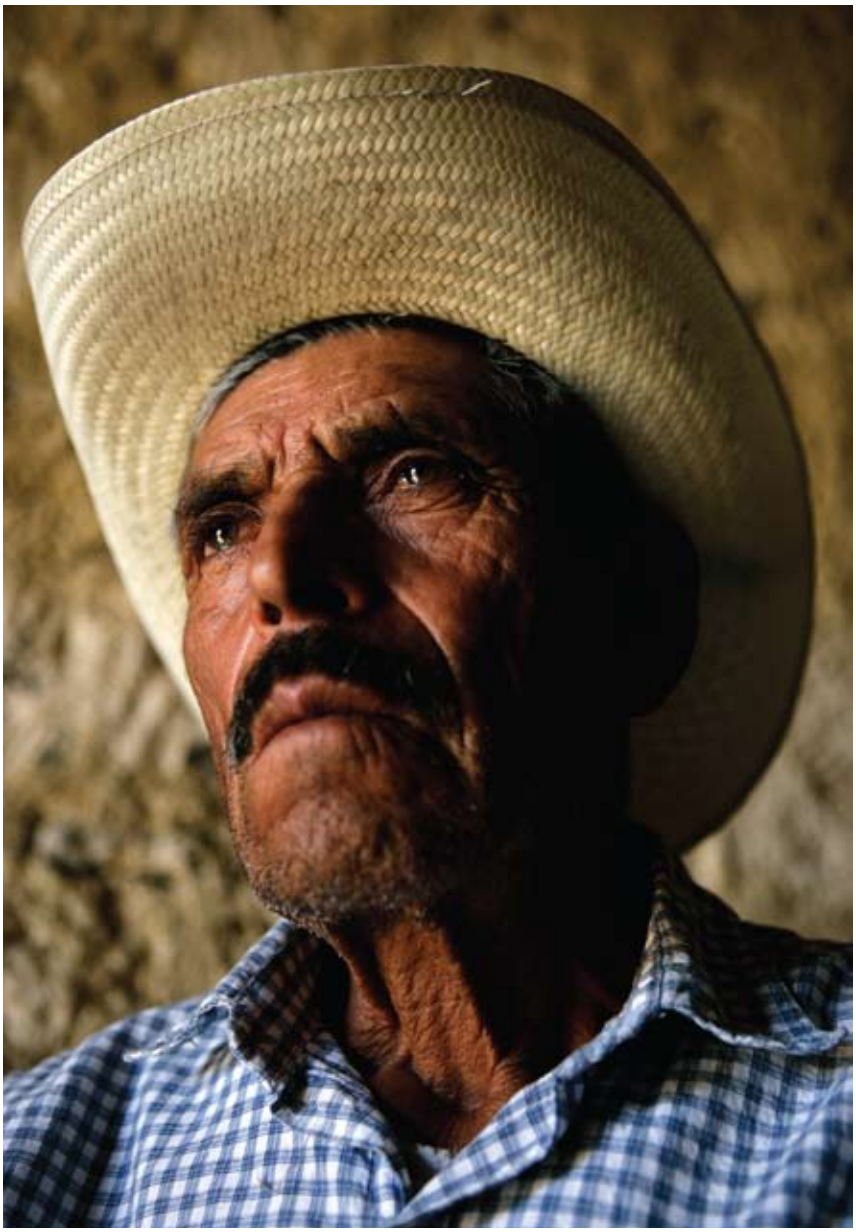
REPORTING: *Joe Contreras, Newsweek for Circle of Blue*
PHOTOGRAPHY: *Brent Stirton, Getty Images for Circle of Blue and J. Carl Ganter, Circle of Blue*

PHOTOGRAPHY BY BRENT STIRTON / GETTY IMAGES

A lone Mexican woman skirts a jaguey near San Marcos Tlacoyalco. These man-made, earth-bermed basins collect rainwater for livestock and also supply water for domestic needs.

PHOTOGRAPHY BY BRENT STIRTON / GETTY IMAGES

It's a one-mile walk to the stream where this mother bathes her children twice a week.



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Valentin Carrillo Hernández, 74, is an elder in the town of Santa Ana Teloxtoc, where he and other farmers experiment with drip irrigation techniques. "This little water maintains the plants," he observes, "so they should produce."

PHOTOGRAPHY BY BRENT STIRTON / GETTY IMAGES

Drinking water is the second-largest expense after food for Guadalupe Dávila López and his family. He only gets two hours of water a week piped to his home and must supplement that with water bought from a private supplier. His farming income cannot cover this cost, so he also works as a laborer.

PHOTOGRAPHY BY BRENT STIRTON / GETTY IMAGES

Francisca Rosas Valencia dabs away tears while praying for her son, Florentine, who left home to work in Los Angeles. "It is not easy to be outside of one's homeland," she says, "That is what makes me sad. I fear that in the future my children and grandchildren and the families of my neighbors will be forced to leave."

PHOTOGRAPHY BY BRENT STIRTON / GETTY IMAGES

A young girl scoops a murky bucketful from a watering hole in San Marcos Tlacoyalco. Surrounded by barren land, this pool is intended for livestock, but families come to collect water for bathing and laundering as well.

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In the damp and narrow tunnels of the galeries filtrantes, Pedro Hernández Martinez and Armando Castillo Osorio tend the work begun by their grandfathers, who hewed a path to water underground.

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Rosalino Carrasco Luna, 74, of Atecoxco is a corn farmer who says he has developed a water divining method using nothing but a rock dangling from a thin rope. He attributes the faltering rains of recent years to the alignment of certain planets.

PHOTOGRAPHY BY J. CARL GANTER / CIRCLE OF BLUE

Subsistence farmers must increasingly compete with the thirst of industrialized farms and factories concentrating in rural areas, taxing an already-strained groundwater resource.

PHOTOGRAPHY BY BRENT STIRTON / GETTY IMAGES

The Carrillo family constructed this water collection reservoir with the help of Alternativas, a regional nonprofit organization. Using a system of pipes and terraces, they are able to deliver precious water to their fields in the valley.

PHOTOGRAPHY BY BRENT STIRTON / GETTY IMAGES

Symbols of faith blossom throughout the Tehuacán Valley. Atop a barren post, these crosses overlook a jaguey in San Marcos Tlacoyalco where a mother and daughter collect water.

PHOTOGRAPHY BY BRENT STIRTON / GETTY IMAGES

To this day, a Mexican diner who wants to order a bottle of effervescent mineral water with his meal will ask for "un Tehuacán." Residents of this valley, legendary for its vibrant springs, must now buy some of the water they drink and gather the water for laundry and livestock.

PHOTOGRAPHY BY J. CARL GANTER / CIRCLE OF BLUE

Water pipes run downhill to industrialized chicken farms. Low rainfall in recent years has failed to compensate for plunging groundwater levels, threatening the security of the community.

PHOTOGRAPHY BY J. CARL GANTER / CIRCLE OF BLUE

Stocking up on her family's needs, this woman lives in a village where the water may run for only a few hours a day, pumped in from wells at the edge of town. But sometimes the pipes run dry due to ruptures in the system and it's not uncommon for water to be shut off because enough people couldn't pay their electric bills.

PHOTOGRAPHY BY J. CARL GANTER / CIRCLE OF BLUE

A partially constructed well lies idle in the Tehuacán Vally because limited financial resources have prevented local residents from completing the project. Meanwhile, a wire fence keeps village goats from destroying this precious asset.

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Guadalupe Dávilla López (CENTER), Moisés Carrillo Carlos (LEFT) and José Luis Varrilas Juárez (RIGHT). These three hard-working campesinos and their families have drinking water delivered to their homes at great expense. They all have children who have migrated from home in search of jobs.

PHOTOGRAPHY BY J. CARL GANTER / CIRCLE OF BLUE

A young boy pauses on a makeshift garbage bridge as he crosses a stream of raw sewage near San Marcos. The townspeople fear that these unregulated discharges will eventually seep into and contaminate their wells, which are a couple of miles away.

PHOTOGRAPHY BY J. CARL GANTER / CIRCLE OF BLUE

Christ upon the water in this religious iconography reflects the abiding faith which sustains the people of Tehuacán as they struggle to surmount the challenges to their water, their culture and their future.

PHOTOGRAPHY BY J. CARL GANTER / CIRCLE OF BLUE

The sun glints upon a cross in San Marcos at what once was a local jaguey. Lightning struck this fragile man-made reservoir, and the water fled. It is now a place to graze livestock and gather for soccer games.