

# Cattle and climate: Ranching in the arid Southwest

By Zack Guido

Knee-high Lehman lovegrasses and blue gramma grasses, cured brown by the dry weather, bowed in the wind on flanks of the Chiricahua Mountains in southeast Arizona. Cows grazed near a windmill, the ears and back of a loping coyote bobbed in and out of view in the distance, and a wind vane pointed west. Welcome to Jim Riggs' Crossed J ranch, 10,000 acres of shrub-covered hills and grassy plains that have fattened herds in wet years and thinned them during droughts since the ranching boom of the late 1800s.

"When we have good grass cover like we do this year, it really protects the pastures and cows," Riggs said, spreading his hand over the tops of grasses. "When the grasses are stripped, the soils don't hold the moisture well, and the grasses don't grow well."

Riggs' knowledge about his ranch is time tested. He draws his experience from a ranching history that has spanned four generations—back to 1879—and weathered hard times, including numerous droughts that bankrupted many other ranchers.

In the early ranching days in Arizona, ranchers paid little attention to the number of cows munching the grass and consequently grazed the landscape to a nub, causing widespread soil erosion. The degraded soils combined with a scarcity of ungrazed land to make the cattle industry extremely vulnerable to drought; when dry periods limited grass growth, cattle numbers plummeted.

Climate has always shaped ranching in Arizona, mostly acting as a limit on the number of livestock that the arid landscape can support. This will continue—natural variability will cause periodic drought—but the expectation that a warming world will increasingly parch



**Figure 1:** Jim Riggs (middle) walks in knee-high grasses with UA scientists Mike Crimmins (right) and Wim van Leeuwen on his ranch in the foothills of the Chiricahua Mountains in southeast Arizona.

the Southwest has caught the attention of ranchers.

Now, ranchers like Riggs and Dennis Moroney, owner of the 30,000-acre 47 Ranch near Tombstone, Arizona, are arming themselves with knowledge of past ranching obstacles and a keen eye toward future climate challenges, and are tuning their ranch operations to the environment.

"We do live in an arid region," Moroney said. "But the landscape has abundance and is extremely effective at producing food as long as we approach it on the right scale."

## A Brief History of Ranching in Arizona

Stock raising in Arizona began around 1690. Spanish ranchers first settled in the Huachuca Mountains in the headwaters of the Santa Cruz River around the same time that Jesuit missionaries bestowed livestock to O'odham Indians, who agreed to live in mission communities, according to *Arizona: A History*, a book by Thomas Sheridan, professor of

Anthropology at The University of Arizona. Ranching began in earnest in the 1730s with a revival of the Jesuit missions and a mining boom. As the Santa Cruz Valley population grew, so did the demand for beef.

For many years, the Apache Indians prevented ranchers from settling outside the Santa Cruz Valley. By the end of the American Civil War in 1865, conditions became favorable for large-scale ranching in Arizona. The Civil War had disrupted the cattle industry, leaving five million longhorns to overgraze the pastures of Texas. With grass little more than stubble, Texas ranchers moved north as well as west into Arizona. Cattle numbers in Arizona quickly grew as Texas cows populated the area. In addition, the windmill, which was used to pump groundwater into storage ponds, and two transcontinental railroads across Arizona enabled large capital investments by businessmen seeing profit in the growing beef markets.

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## Cattle, continued

By the early 1890s, Arizona cattle numbered about 1.5 million head, and more than a million sheep also roamed the landscape. Just two decades earlier, in 1871, cattle numbers hovered around only 40,000.

In a short time, the wild Arizona country was converted into a gigantic live-stock ranch. Sheridan noted in his book a rancher's reflections at the time: "We fondly imagined that these wonderful ranges would last forever and couldn't be overstocked." This perception, aided in part by favorable climate conditions that enabled healthy and bountiful forage to grow, led to a tragedy of the commons. In 20 years, ranchers allowed cattle to overgraze the open ranges, destroying the shared pasturelands.

By the mid-1880s, Sheridan wrote, a few wary stockmen concluded that ranges along the San Pedro River were "already stocked to their full capacity." A year later, the Tombstone Stock Growers Association recognized that "a crisis is fast approaching" and called for the end of importing more cattle to the area.

Although 1891 was Arizona's biggest calf crop to date, less than one-half of the average rainfall soaked the ground. When new grasses didn't grow as they had before and the cows had mowed all the old grasses, ranchers realized there was a limit to the number of cattle the land could support.

Yet very few ranchers reduced their stock. Most of them undoubtedly expected rain and grasses to return the coming year. But the summer and winter of 1892 were dry, as was the following spring. In the early summer of 1893, the bone-dry creeks and springs were evidence of the first recorded drought to have major impacts on the cattle industry in Arizona. The southern Arizona cattle population was decimated; 50 to 75 percent of all livestock perished.



**Figure 2:** UA scientist Mike Crimmins peers into a rain gauge, while colleague Wim van Leeuwen adds a larger memory card to the self-timed, digital camera.

Ranchers raced most of the cattle that did not die to market, swamping the supply and driving down prices. This, combined with a national economic depression, gave ranchers little choice but to sell cattle at rock bottom prices. Sheridan wrote that "when the dry years struck and the national market price for cattle collapsed, many of the ranchers left. Arizona's natural bounty had been exhausted. From now on, successful stock raisers had to be stewards, not scourges."

### Lessons Learned

During the cattle boom in the late 1800s, ranchers stocked their lands with as many as one cow per five acres, and environmental degradation ensued. Now, the rule of thumb for stocking rates for Moroney's ranch near Tombstone is about one full-grown cow per 65 acres. Moroney, however, stocks more conservatively at about one cow per 75 acres.

"We are in the restoration phase of a degraded landscape," he said above the bleating of two orphaned goats that he

was bottle-feeding. "Much of the Southwest landscape has a history of drought and mismanagement. Ranchers before us didn't mean to do harm, they just didn't know as much as we do now."

Riggs also stocks his ranch conservatively. The rule of thumb for his ranch near the Chiricahuas is slightly different. He allows one cow-calf combination for every 40 acres.

Both Riggs' and Moroney's livestock consume only about 60 percent of the forage, giving their ranches a large margin of error in case scant summer rains do not sprout ample grasses, or in case the price of beef plummets.

"In drought years, the landscape doesn't produce as much forage," Moroney said. "The natural reaction by managers is to pull their animals off the ranch. But when hundreds of ranches go to the market at the same time, the laws of supply and demand lower the price."

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## Cattle, continued

With a reserve of forage, Moroney and Riggs can leave their cattle on the landscape, waiting for the price to rebound.

### Learning Lessons

Riggs held up a long stalk of gramma grass, its leaf hooked at the stock end in the shape of a crescent moon. Behind him, two University of Arizona researchers repaired a weather station and added a larger memory card to an automatic camera. To the untrained eye, the thin grasses covering the landscape all look identical. But Riggs pointed out subtle differences in a few of the roughly 30 species that dominate the grass population on his ranch.

“The cows really love the blue gramma grasses. Its palatability is better than Lehman lovegrass and it doesn’t lose as much nutrition as the Lehmans when it cures,” he said. “But Lehmans are much more productive. We’ve had seasons when Lehmans have saved us.”

Grass is just as important to Riggs as his cattle. Today, as in the past, ranching is almost entirely dependent on the natural vegetation of the low and high desert ecosystems, with very few ranchers relying on irrigated pasture. When the grasses are healthy, the cattle are healthy. That is why Riggs is participating with the UA scientists in a pilot project to monitor his rangeland in an effort to collect information that will help reduce his ranch’s vulnerability to weather and climate change.

“We go to workshops all the time,” Riggs said, referring to the community of ranchers. “We read. We try to stay up to date. There is an art to range management and rangeland monitoring is extremely important.”

The UA scientists, Mike Crimmins, a climate science extension specialist and CLIMAS research affiliate, and Wim van Leeuwen of the Arizona Remote Sensing Center, collaborate with Riggs to understand how pasturelands respond

to climate. While Crimmins tinkered with the rain gauge on the weather station, van Leeuwen downloaded three months’ worth of photography from the mounted camera that shoots photographs of a swath of pastureland every hour.

The weather station, which also measures moisture in the soil, hopefully holds clues to how the timing of precipitation affects grass growth and how soils moderate climate extremes. Crimmins’ working hypothesis is that grasses grown on finer soils are more resilient to drought because those soils hold moisture longer. Van Leeuwen compares the photographs to images taken by satellites that report the “greenness” of the landscape. He hopes to calibrate the remote images with on-the-ground information and improve the accuracy and use of remote sensing for rangeland management.

The goal of these studies is to equip ranchers and others with information that improves decisions, such as how to maximize pastureland rotation and when to sell or purchase livestock.

“Every couple of months we get up at six in the morning and visit Jim,” Crimmins said. “The big picture is to take what we learn on Jim Riggs’ property and help create large-scale drought sensitivity maps.”

### Climate and Cattle

Most of the grasses on both Riggs’ and Moroney’s property sprout during the summer, making the monsoon thunderstorms vital for healthy rangelands. But winter precipitation is also important. The slow moving, widespread winter storms often saturate soils and set the stage for quick and widespread spring growth.

More than 30 species of grasses grow on both ranches. The diversity creates a buffer against short-term changes in climate. Some species are well adapted to surviving and rebounding after one dry season, and some can grow with less than a quarter-inch of rain. But none of

the species grows in sufficient quantities to support a large ranch operation during successive years of drought, like those of the late 1800s, the 1950s, and the recent dry spell that began around 2000.

“Climate change has always been a factor in the Southwest. Anybody who makes a living directly on the landscape has to pay attention to it,” Moroney said.

In 2002 and 2003, back-to-back seasons with insufficient rain forced Riggs, to reduce his stock of mother cows from about 190 to 90. As a result, his income nose-dived by 75 percent. That’s why ranchers like Riggs and Moroney are concerned about how climate may change.

“What can you do about something you can’t exactly predict?” Moroney asked rhetorically. “I think about this constantly.”

In a CLIMAS report published in 1999, researchers surveyed many ranchers and concluded that, because summer rains are vital for grass growth, having a better understanding of the monsoon would greatly aid ranching decisions (view report: <http://www.climas.arizona.edu/pubs/CL3-99.html>). Unfortunately, monsoon forecasts are not refined enough yet to be useful. In the meantime, Riggs and Moroney are making their ranches resilient to climate change by keeping stocking numbers low, leaving some land ungrazed, and, for Moroney, diversifying his business by raising goats.

“In 20 years, if we have catastrophic climate change, goats and sheep may be more appropriate in this landscape than cows,” he said. “If we experience more extreme weather, which is what many people predict, then we should prepare our ranch to deal with it.”

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