

# Selecting for Hill Climbers

Researchers and ranchers work together to identify genetic markers to help select cattle that will move off riparian areas.

by **Paige Nelson**, field editor

**M**any ranchers just like to ranch. A few, those like registered-Angus breeders Dick and Erin Evans, owners of Heartstone Angus, find satisfaction in incorporating research into ranching.

Since they moved from an irrigated hay farm in Pueblo, Colo., to New Mexico just south of Silver City 10 years ago, the Evanses have been selecting Angus cattle that thrive in the desert.

Recognizing the critical need for feed efficiency and traveling ability under harsh, dry conditions, the Evanses began observing and identifying those cattle that consistently spent three to five days away from water.

They hypothesized that those cattle were traveling farther from water and using more remote areas. They began retaining their daughters, as long as the heifers met other stringent requirements. Their idea was to

identify, develop and improve genetic lines better adapted to distribute across the entire range.

Yet with no actual distance-tracking ability, could they be sure?

Whether they were sure or not, the Evanses knew, from personal experience, work in this area was important. They weren't alone in their thinking.

"Distribution is a big issue in the western United States, especially on public lands because most stocking-rate issues have been addressed on public lands, but concentrated grazing in localized areas continues to cause problems," agrees Derek Bailey, professor in the Department of Animal and Range Sciences at New Mexico State University (NMSU) and director of the Chihuahuan Desert Rangeland Research Center.

"Distribution is an issue because usually we don't like where livestock graze. They tend to overgraze riparian areas and bottoms and

not utilize the slopes and the high elevations and ridges like we'd like them to," he explains.

It would only be a matter of time before the two progressives would cross paths.

## Research designed for ranchers

The Evanses already had a developed relationship with NMSU, so when they got wind of the university's new grazing study using genetic markers to predict distribution, it pricked their interest.

The research was headed by Bailey, who had done grazing observation work similar to that of the Evans couple. Now, Bailey was taking range utilization a step further by using global positioning system (GPS) tracking collars combined with genetic testing.

## The power of observation

Like the Evanses, Bailey had been interested in grazing distribution and range usage for years. In 2001-2003, Bailey, then at Montana State University, used observation

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► **Above:** Derek Bailey, professor in the Department of Animal and Range Sciences at NMSU and director of the Chihuahuan Desert Rangeland Research Center, likens hill-climbing cattle to marathon-running people.

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to designate cattle as hill climbers or bottom dwellers. For two years, Bailey documented which cows grazed where most often. By the third year, he split the herd by designating bottom dwellers and hill climbers and put them in separate pastures.

“Then we watched what happened,” recalls Bailey, “and like we had hoped, and like we had predicted, the hill climbers did more grazing on the slopes and less grazing in the bottoms.”

Bailey verified his data by measuring stubble height in the riparian areas of both pastures. The hill climbers’ pasture had riparian stubble heights of 5 inches (in.). Bottom dwellers grazed their riparian zones down to 3 in.

“That’s important because 4 to 5 inches is generally the standard and the minimum level the Forest Service and BLM (Bureau of Land Management) will usually accept in riparian areas,” says Bailey.

The results were meaningful, but even if they were incorporated on ranches, progress would be slow. If someone wanted to turn a herd into hill climbers, they’d have to track the entire herd and cull out the ones they didn’t like, he says, calling it an expensive, time-consuming, not-so-attractive option.

### Making genetic progress

Knowing he would have better selection pressure if he approached grazing



PHOTO BY ADRIAN LIPKA

► Mitch Stephenson, doctoral student at New Mexico State University, obtains a blood sample from a Heartstone Angus Ranch cow for DNA analysis.

distribution from the bull side, Bailey decided to conduct another study.

The “Genetic Influences on Cattle Grazing Distribution: Association of Genetic Markers with Terrain Use in Cattle” study began in 2010 with full funding from Western Sustainable Agriculture Research and Education (SARE).

This time, Bailey and cooperators Milt Thomas, Colorado State University (CSU), genomics, genetics and physiology; Scott Speidel, CSU, animal breeding and genetics; Mark Enns, CSU, animal breeding and genetics; and Juan Medrano, University of California–Davis, genomics, studied cattle from seven ranches across three states.

GPS collars tracked 160 cows during two 2-year periods. Researchers took blood samples from each cow and then fitted her with a collar. The collars recorded location data every 10 minutes for at least two months.

Twenty Heartstone Angus cows were tracked.

“We anticipated when we started doing the research with Dr. Bailey that there would be kind of a dove tail between the range utilization and the cows that didn’t need water as frequent,” Dick says, basing his assumption on his previous observations. “What we found was there were some cows that didn’t go half a mile from water, and they still didn’t come in for four or five days.”

The Evanses’ situation further proved the need for the GPS-tracking component to truly understand the genetic component responsible for cows willing to travel the farthest for grass.

Researchers ran high-density genomic tests on each blood sample. They looked at 770,000 locations along the 29 chromosomes.

Certain single nucleotide polymorphisms (SNPs) along chromosomes 4, 17 and 29



PHOTO BY MITCH STEPHENSON

► Heartstone Angus Ranch cows with newly fitted global positioning system collars.

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accounted for grazing variation among the cattle tested. Some SNPs accounted for up to 25% of the variation, and in total, researchers were able to account for up to 30% of the variation.

“That’s significant,” says Bailey. “Milt Thomas and I almost fell over backward when we heard that because most SNPs only account for 1%-2% of variation. That means that the heritability of grazing distribution of terrain use is likely similar to something like weaning weight.”

### Verifying the results

“The downside of this is that we only looked at 160 animals,” admits Bailey. “Most genetic studies use at least 500.”

The data the researchers were able to gain from those 160 cows is valuable, but Bailey isn’t shy about it being a massive effort.

“This is a very ugly, hard-to-process trait. It’s not simple. This is the result of months of different behaviors you’ve got to try to sum up,” he states.

Collecting locations every 10 minutes means 144 positions every day for at least two months. That is a lot of data to crunch, he says.

Yet without verification, the results mean nothing, so Bailey and his collaborative team are currently in Round 2, which began in July of 2015. The team added Larry Howery from the University of Arizona and Jon Wilker from the University of Nevada, Reno’s Gund Ranch. Heartstone Angus is the only registered cooperator herd in this Western SARE study, and Dick and Erin are also members of the planning team.

This time, however, is a little different.

“All the cows are expected to be at least half Angus,” explains Bailey. “Some will be full Angus. Last time we had all sorts of breeds. We’re trying to keep them Angus in this study because they are the predominant breed, and the markers may vary some among breeds. This way we can try to keep it more consistent to make it a tighter study.”

Thanks to the use of the Evanses’ registered cattle, genetic information on certain cows can be traced as far back as eight generations.

“We’re hoping it is going to help connect the dots,” says Dick.

When the tracking data are crunched, Bailey hopes by using the same SNPs identified previously, he will be able to predict whether the cow was a hill climber or bottom dweller.

“If they do, then we validate that research,



PHOTO BY DEREK BAILEY

► Researchers are monitoring the grazing patterns of this GPS-collared cow at the NMSU Chihuahuan Desert Rangeland Research Center near Las Cruces, N.M.

and we’re really onto something!” he emphasizes.

### From prediction to practice

The Evanses see the results of this verification study as having a huge impact on ranching in the western United States.

“I read a lot of technical articles and research projects,” Dick says. “Sometimes I read research projects and when I get done reading it I think, ‘Why did they spend the money on this?’ Some things are real practical and some things are real academic.”

“That’s one of the reasons I really was excited to participate in this project, because if it can be identified as a transferable genetic trait, then the western United States has one more selection process they can use to improve their herds.”

That is just what Bailey is hoping for. He envisions an EPD for grazing distribution.

“So, you’d have a way to rank bulls based on their chances of siring daughters that are hill climbers,” he explains.

To make sure he was on the right track with commercial ranchers, Bailey asked a group of Arizona ranchers, “Would you be willing to spend extra money if you knew that the bull would have a better likelihood to sire daughters that were hill climbers?”

“Eighty percent of our respondents said, ‘Yes.’ That just tells me that ranchers recognize the value of distribution,” he says.

However, how does all of this distribution affect weaning weight?

During his time at Montana State, Bailey proved through two different studies there is no correlation between where the cow grazed and calf weaning weight, calving date, calf birth weight, cow rebreeding date, cow body condition score in the fall, cow weight or cow height.

This fact came as no surprise to the Evanses, who were selecting heifers based on the calf’s mother’s ability to wean a calf that weighs at least 50% of her own body weight, without extra supplement besides protein in the fall, as well as her ability to travel. The Evanses had already discovered that their

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**—Dick Evans**

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hardy Angus cows were capable of doing that in harsh desert conditions.

“It’s because they are adapted to this environment,” offers Bailey. “To hill climbers, it’s not as big of a deal to climb. They may not know that they aren’t elk,” he laughs.

### Why marathons, why steep slopes?

While Bailey recognizes the role behavior plays in distribution, he says, maybe the simplest way to think about the variation is to compare cattle to humans.

“Look at the variation of people,” he poses. “I really appreciate people that can run a marathon. I can’t even get my head around it. There are people that do that for fun — they choose to do that.”

By identifying and selecting those cattle willing to walk long distances from water or up steep slopes for grass, Bailey and the Evanses believe all of the West can benefit, but fate waits on the results from two more years of grazing data to be collected.

While he waits, the Evanses say they will

continue to select for cattle that can thrive in New Mexico conditions. For Bailey, there will always be more pieces of the puzzle to fit.

“Everything we’ve done so far has worked out really well, better than we could have ever expected. If it is this promising, I’m not going to stop and worry that it might not work. That’s not my style,” he states.



**Editor’s Note:** *Paige Nelson is a freelance writer and cattlewoman from Rigby, Idaho.*