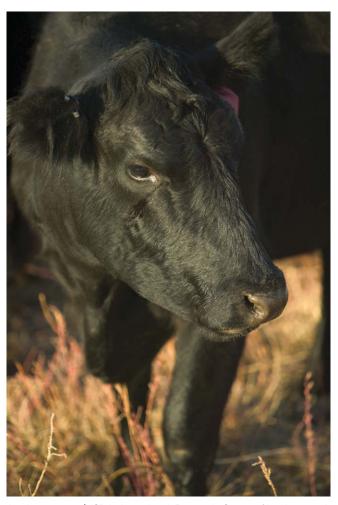


Speaking With Species in Our Profession

An interview with a cow

he Bos genus includes two species that comprise domesticated cattle populations around the world. These are Bos taurus, domestic European cattle, and B. taurus indicus, domestic Brahman or humped cattle. (Other species of the Bos genus include B. grunniens, the yak of Asia). Though rangelands, of course, are a type of land not specifically categorized by a single use, and rangelands provide a wide array of important ecological services, about two-thirds of the world's agricultural land is



An Angus cow (USDA Agricultural Research Service file photograph image number 368-1).

uncultivated and used for grazing by domesticated livestock. Globally, there are about 1.5 billion head of cattle and over 800 breeds. In the United States, the beef cattle cow and/or breeding heifer numbers have varied from about 32-34 million over the past 30 years. About 60% of these cattle are located in the 17 western states, and the bulk of those cattle are in the four states of Texas, Oklahoma, Nebraska, and Kansas. About 19% (6.3 million) are within the 11 western states that contain significant amounts of public rangeland. Much of the information that forms the basis of this "interview" was drawn from Betty Fussell's 2008 book Raising Steaks: The Life and Times of American Beef, several textbooks on ruminant nutrition, Jay Gottfried's research on sensory perceptions in mammals related to dietary choices, and several articles in the 24 April 2009 issue of Science (vol 324). Regarding this last source, the article entitled "The genome sequence of taurine cattle: a window to ruminant biology and evolution" by the Bovine Genome Sequencing and Analysis Consortium et al. (324:522-528 plus supplement) was quite instrumental (though the genome sequenced was from Herefords, not the Angus pictured for this "interview").

Better Than a Horse

Question: Of the thousands of mammalian species in the world, only a few have been domesticated. Do you wish we could disconnect this servitude and return your species to the wild?

Answer: Yes, but please tell me you are going to ask more pertinent questions. Your demand for beef protein precludes any thoughts, even fantasies, of our return to the wild ancestral origins of the now extinct aurochs, *B. primigenus*. A small portion of the world's human population may be vegetarian, but globally the millions of people rising up into the middle classes will do nothing but further enclose us in your food chains.

My apologies for seeming to underestimate both your intellect and your awareness of your ancestry. My question stems from the fact that bovines trace their evolutionary history to about 20+ million years ago during the Miocene epoch,

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but your domestication was relatively recent, about 8,000-10,000 years ago.

Our domestication occurred in conjunction with the beginnings of agriculture about 10,000 years ago. It is interesting to note that livestock domestication developed under a wide variety of settings. Your history shows that we were domesticated in both sedentary and nomadic cultures, in agrarian and hunter-gatherer societies, and prior to and subsequent to domestication of plants. Obviously, we were central to your advancement from a fairly insignificant species of mammal to the most dominant species across the planet. You were able to exploit the wonders of our digestive system and its ability to convert cellulose into protein, something you are unable to accomplish yourselves. That digestive value is still extremely important to you. In the process, you also domesticated the horse for transportation and work, but now those values are greatly reduced. Horses are an antiquated species without the advanced evolutionary benefits of the ruminant system. There is a reason you chose to sequence our DNA before that of the horse. They are good for parades, Hollywood westerns, and race tracks, but little else of substance and value. Why you don't eat them with more relish is beyond me.

I detect considerable animosity toward horses.

People don't seem to recognize how evolutionarily archaic is the horse's digestive system. The equids are hind-gut fermenters, those with microbial digestion at the end of their digestive tract, developed hundreds of millions of years ago, before grasslands were prevalent. They are animals built for coarse forages and for high intake rates. You waste a lot of good-quality forages feeding your horses. They are not the modern digestive systems that have evolved with grasslands that include many rather elegant and efficient forms of herbivory. There are over 150 species of ruminants that occur across most terrestrial environments today, and even newer species with similar digestive systems, like the hippopotamus, that are much more advanced than the horse.

You take some solace in the fact that the cattle genome was seen as more important to sequence than that of a horse?

Absolutely. You sequenced the rat and the sea urchin before us, but that was to get the process down so you could then focus on a species of importance. Our cattle genome contains 22,000+ genes, and at least 14,345 are orthologs, that is, genes shared, in this case, by cattle, dog, human, rat, mouse, opossum, and platypus. We have an amazing common history, but we also have very specific genes unique to ruminants that provide us with metabolic, physiologic, and immune adaptations unique to our order. You have certainly gained tremendous insights into a key food species, but you have also gained insights into mammals more generally, and your own development as a species.

How do you counter the rap you have as a driver of desertification and biodiversity loss through over-grazing?

The basic principles for managing livestock on rangelands and pastures have been around for centuries. There are no secrets and no singular formulas. On occasion, on each continent, at some point in time in the past, you have misused us, ignored those principles, and created widespread havoc. Many of these past disasters persist even today. Yet, there are many, many examples of land properly managed under grazing use by livestock. And these examples defy any simple characterization except that humans are engaged in management in some learned, principled fashion. In this manner, we are just a tool, and reflect the abilities of a manager. We are an evolved system that provides you with a very sustainable process to convert cellulose to protein with minimal environmental impacts, if managed well. With 6+ billion people, and headed toward 9+ billion, you need

And then, of course, there is the issue of methane.

Talk about a non-issue! Methanogenesis is a natural process resulting from carbon metabolism through rumen fermentation, and has occurred for millions of years by billions of ruminants. Yes, methane is a greenhouse gas, and greenhouse gases are one of the main factors that contribute to climate conditions on this planet. However, any discussion of methane avoids the real concern, and that is CO₂ production as a result of your methods of combusting coal for energy. Until you effectively wrestle with that issue a discussion of effects of methane production from ruminants is nearly irrelevant.

How do you respond to the fact that people scoff at the idea that the study of livestock and their management can be considered a science?

Well, those physicists and astronomists can just come down off of their high horses. They are not paying attention to their own scientific literature. There have been wonderful articles written of late that describe mammalian brain functions, how we perceive our environments, and how we as organisms choose what to eat and what to avoid. Many of these scientific observations originated from animal studies. For example, recent research using ruminants (humanely, I might add) has illustrated how we balance ingestion of nutrients and even toxins in our diets in order to provide internal benefits. These studies have application to other mammals, and provide you with insight about your own dietary behaviors. Again, even in the study of the management of grazing behaviors, you have used us, in a reductionist manner, to learn about yourselves.

You are resigned to the fact that beef is "what's for dinner"?

Look, this aspect of food production can be quite sustainable if it gets to the kitchen more directly from grazing

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lands and with less of a carbon footprint. In actuality, this happens in most places around the world. Yet, there is an increasing reliance on concentrated, confined, factory methods of meat production with many undesirable effects, especially in terms of energy use and resulting product quality. This requires an obese reliance on fossil fuels and a dangerously cascading, ubiquitous use of antibiotics. You shouldn't do that. Fortunately, even in the United States the potential for diffuse, local production systems that exploit renewable forage resources is quite real. For example, about 40% of US beef production originates from small farms and ranches. About 20% of your farmers and ranchers are new to the business (<10 years experience), meaning you have a system that, though aging, is being replaced. Though these small farms and ranches are quite reliant on off-ranch income, they are literally everywhere. You just have to invest in the infrastructure that these local production systems require. There are many current instances where metropolitan populations will pay for this beef protein if it can be supplied. You and your land will be healthier for it.

You have to admit, though, horses have a much more regal and athletic appearance than cows.

Why don't you go jump over the moon.

Interview conducted, edited, and condensed by Susan R. McGuire, a pen name used by the author of this article. Her "interviews" with members of our profession, inanimate objects, biological specimens, and other subjects of passing interest are an irregular contribution to Rangelands. All costs of publishing these interviews are sponsored by a research unit of the Agricultural Research Service, the in-house research agency of the United States Department of Agriculture, whose rangeland scientists are a segment of our Society.

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