

## RESEARCH

My family's extensive history in livestock production, along with my education and work experiences, drive my passion to assist ranchers, feed manufacturers, feeders, landowners, wildlife managers, and natural resource managers. This passion has shaped and guided my applied Ruminant Livestock Nutrition Research Program, which is part of a holistic approach to "Ranching Solutions," a core objective of the Texas A&M AgriLife Research Center in San Angelo.

Through personal experiences, consultation with clientele, and performing an extensive literature review, I determined that the main issues regarding efficient and economically sustainable production of sheep and goats in the Edwards Plateau region of Texas were: (1) reoccurring drought conditions; (2) volatile price structure and availability of livestock feed ingredients; (3) predators of all kinds [e.g., dogs, coyotes, wolves, birds, and external and internal parasites]; (4) animal end-product cost, quantity, and quality; and (5) woody plant encroachment, which has led to rangeland degradation and a reduction in forage and livestock production potential and water availability. From day 1, my goal has always been to design a livestock nutrition program that concurrently addresses as many of these issues as possible. To achieve this goal, I developed multidisciplinary collaborations across Texas and the U.S. and have completed numerous research projects that have focused on the following objectives: (1) designing innovative, cost-competitive, non-human edible livestock feed ingredients (e.g., ground woody products from *Juniperus* and *Prosopis* spp.) and feeding strategies to reduce livestock production costs and enhance sustainability, growth efficiency, health, and end product quality; (2) exploiting the beneficial attributes of plant secondary compounds (terpenes and condensed tannins [CT]) and physical and nutritional feed characteristics of ground woody products, hay varieties, cottonseed hulls (CSH), sorghum grain, and dried distillers grains with solubles (DDGS) to enhance animal growth efficiency, health, and end product quality; and (3) enhancing rangeland health, productivity, and water availability by providing an economic incentive to increase the removal of encroaching woody plants by converting them into valued livestock feed ingredients.

Because DDGS are a highly cost-competitive source of protein and energy and that *Juniperus* spp. and *Prosopis* spp. are the most abundant and problematic woody species in Texas, my *in vitro* and feeding studies have focused on increasing the feeding value of these ingredients. These studies, along with a 100-year history of using ground woody products in livestock diets, led to the development of the Texas A&M AgriLife "[Wood to Feed](#)" program. The impacts of the "Wood to Feed" program are numerous and include creating four new, unique, and cost-competitive livestock feed ingredients (ground *Juniperus ashei*, *J. pinchotii*, *J. monosperma*, and *J. virginiana*); enhancing our knowledge related to feeding ground *Prosopis glandulosa*; reducing livestock feed costs and the cost/kg of gain; enhancing end-product quality (e.g., greater meat "healthy" fatty acids and less saturated fatty acids, and greater sensory characteristics) and animal health (e.g., reducing internal parasite motility by 44% and fecal egg shedding by 69% and increasing synthetic anthelmintic efficacy by 66%).

These new woody plant ingredients are unlike any other ingredients currently on the market: they require no inputs by man to grow (including land cultivation, planting, irrigated water, fertilizer, pesticides, or herbicides); can concurrently enhance natural resources when harvested; and are available year-round, thus not subjected to seasonal pricing or availability. Current and potential impacts of the Wood to Feed Program are exciting to colleagues, livestock and commercial wood processing industries, land owners, and natural resource specialists and programs, and have been an important factor in increasing the demand of my livestock nutrition program. For example, the Wood

to Feed program was listed as a “Highest Research Priority” in a 2016 survey of Texas beef cattle producers, conducted by The Texas A&M AgriLife Vice Chancellor’s Office.

Objectives of my applied ruminant livestock nutrition program are diverse, and thus I have developed numerous multidisciplinary collaborations across Texas and the U.S., which includes livestock, meat, wool and mohair, dairy, rangeland, and crop scientists; plant physiologists; economists; geneticist; parasitologists; toxicologists; microbiologists; engineers; extension specialists and agents; ranchers; livestock industry groups; and personnel from Texas and U.S. Forest Services and Natural Resource Conservation Service (NRCS). With these collaborations, along with my program being sufficiently funded, the goal of creating a novel, cost-competitive roughage feed ingredient from undesirable encroaching plants has come to fruition. An additional benefit is that my efforts and accomplishments directly align and support the Texas A&M AgriLife Research Mission of “Scientific discovery that benefits consumers and expands agricultural sustainability, profitability, and environmental stewardship.” My Wood to Feed program also supports Texas A&M AgriLife Research strategic priorities of enhancing “economic viability,” “environmental and natural resource stewardship,” “social acceptability,” and “resilience to shock.” My program has been personally and professionally fulfilling, because it has not only allowed me to pursue my passion of enhancing the economic viability of ranching families and the livestock feed industry, but also to pursue diverse research interests.

My Texas A&M AgriLife Research Livestock Nutrition Program has an exciting and productive future. The knowledge gained over the past 12 years, along with adaptability of my program, places it on the forefront of applied sheep and goat nutrition research. I am now in a position to lead new efforts to: (1) revive and enhance the marketability and use of ground aspen wood in animal diets, which has been a commercially approved feed ingredient since 1980; (2) evaluate specific biological effects of plant secondary compounds on animal production, metabolism, health, end product quality, grazing behavior, and rumen physiology and microbial diversity; and (3) train graduate students, post-docs, and visiting scientists in order to fill the critical deficiency of U.S. sheep and goat specialists.

Due to having excellent drylot feeding facilities and an efficient feedmill at the San Angelo Center, the majority of my research has been done in a feedlot setting. Additional feedlot trials are planned, but greater emphasis will be placed on the use of plant secondary compounds to enhance livestock production. In addition, a greater percentage of my research efforts will be directed towards enhancing production efficiency of grazing livestock by studying animal behavior and strategic rangeland supplementation and grazing strategies. Evidence suggests that woody products contain unique fiber and digestive characteristics that can enhance rumen function, reduce acidosis, and improve feed pellet durability. Evidence also suggests that terpenes and CT can: (1) enhance bypass protein; (2) increase rumen microbial efficiency, thus possibly become a substitute for ionophores; (3) reduce urinary calculi and ruminal acidosis and bloat; (4) reduce fly larvae development, ammonia emissions, and concentrations of skatole and indole in manure; (5) alter N metabolism so that urinary N excretion is reduced; (6) enhance colostrum and milk fatty acid composition, which could possibly increase lamb or kid goat survivability; (7) reduce external and internal parasites and enhance synthetic anthelmintic efficacy; (8) be used as a feed supplement intake limiter; and (9) reduce non-target species consumption of white-tailed deer supplements. The efficient, productive, and extensive collaborations that I have developed will allow my research program to effectively pursue all of these concepts.

## **TEACHING**

7887 U.S. Highway 87 North  
San Angelo, Texas 76901-9714

Tel. 325.653.4576 • Fax. 325.658.4364  
<http://sanangelo.tamu.edu>

Although I do not have a formal teaching appointment, I firmly believe that teaching activities are important for all faculty. Interacting with undergraduate and graduate students can provide new perspectives on pertinent issues and sharing knowledge and expertise is critical if we are to fully impact future generations of animal scientists. My goal for students is to not only provide summarized information, but to help them become effective problem solvers. To achieve this, I ensure that students understand the entire research process, which includes defining the problem, designing and conducting the study, analyzing samples in the laboratory, and managing and presenting the data. I have found that discussing intricacies of the trial, along with quizzing students on why they are doing certain activities, impacts their ability for taking “ownership” of the trial and allows them to effectively communicate the objectives to others. In addition, I strive to teach students positive work ethics, effective communication skills, and the importance of maintaining research integrity. I also strive to incorporate current literature and “real-world” ranching scenarios into our discussions, especially when guest lecturing on campus.

## **SERVICE**

Service activities are critical to maximizing the impact of a research program, especially an applied program such as mine. The impacts of my service activities include promoting the Texas A&M AgriLife outreach mission, enhancing my local, state, national, and international recognition, and increasing opportunities for collaboration, funding, and invited presentations. My research objectives and results not only have to be meaningful to the scientific community, but also effectively translated into practical livestock production practices. Thus, I devote an extensive amount of time developing conferences, delivering presentations at livestock producer-oriented field days, consulting colleagues and clientele across Texas and the U.S.A., traveling internationally, training students, lecturing in the classroom, and summarizing and delivering information through various on-line media outlets such as the Texas A&M AgriLife Nutrition Program’s website, YouTube videos, and Facebook.

I have also been working towards getting various ground woody plant products approved as a commercial feed ingredients; [click here for more information](#). Tremendous benefits to natural resources (forages, water, soils, etc...), livestock, and net profits will be realized as ground wood products begin to be incorporated into livestock feeds.

I have been elected to serve on numerous local, state, and national research and planning committees, which allows me to provide constructive leadership and develop new collaborative relationships. I have also served on an editorial review board and currently provide *ad-hoc* reviews for seven journals, the impacts of which, have been to increase the visibility of my program and enhance my technical writing skills. In addition, I provide Extension personnel (across the U.S.) with consulting support; have chaired various committees for the American Society of Animal Science; developed and hosted livestock producer conferences; participated in Texas A&M AgriLife Extension Youth Veterinary Science Workshops; and assisted with youth livestock shows.