

CATSE Webpage

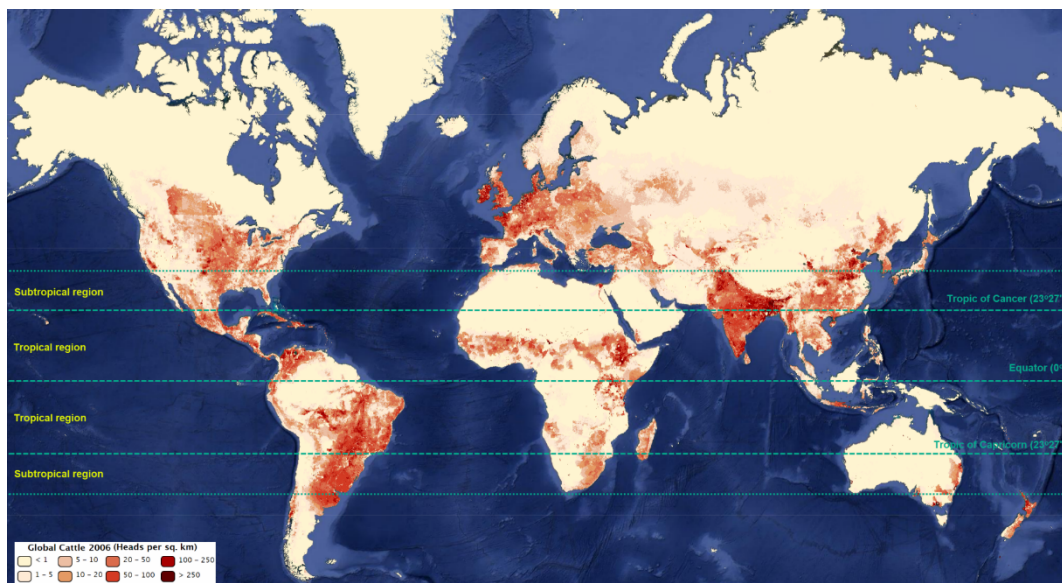
Overview

According to the United Nations, food production must more than double by 2050 to meet the demand of the world's growing population. Beef consumption is also expected to increase from 60 million to 130 million tons by 2050. Nonetheless, at least 1 billion people still experience inadequate intake of protein, and 165 million of these individuals are children. Resources for food and agriculture production will also become more limited as the planet becomes more populated and urban areas expand. Therefore, agricultural efficiency must increase dramatically during the next decades to attain global food demand while maintaining ecological stewardship and proper use of limited natural resources

At least 70% of the increase in beef production required to meet the growing demand is expected from subtropical and tropical regions of the planet, including southern US, Mexico, Central/South America, Africa, Asia, and Oceania. These regions contain > 70% of the world's cattle population (Figure 1), predominately *Bos indicus*-influenced breeds with diets based on forages and agricultural by-products. In the US, approximately 45% of beef cows are located in the southern and southeastern states, where *B. indicus*-influenced cattle are located and tropical/subtropical climates predominate. However, *B. indicus*-influenced herds reared in subtropical and tropical regions are often managed using practices developed and validated for *B. taurus* breeds in temperate environments.

To address this critical gap in knowledge, the Texas A&M – Department of Animal Science established an Area of Excellence in Cattle Adapted to Tropical and Subtropical Environments (CATSE). Our goal is to identify the biological requirements, and develop management practices tailored to cattle reared in subtropical and tropical climates. These efforts will not only optimize beef production efficiency in these regions, but also contribute toward global agricultural sustainability and food security. A multitude of research, educational, and outreach activities aligned with CATSE were developed, established, and are being planned by our faculty members, research staff, and students. These efforts encompass a variety of discipline, with activities conducted not only in Texas, but also across the US and the globe.

Figure 1



CATSE-related disciplines

Animal Behavior and Welfare

PIs: Courtney Daigle, Reinaldo Cooke

Completed Research Projects

- Environmental enrichment to feedlot cattle
- Impact of exercise on cattle behavior, productivity, and welfare
- Role of handling frequency on confined cattle welfare and production
- Effect of temperament on cattle productivity

Ongoing Projects and Future Directions

- Impact of commingling on cattle behavior, welfare and productivity
- Role of water intake on productive and welfare responses in feedlot cattle
- Use of appeasing substances to improve cattle welfare and production
- Development of environmental enrichment tools to detect sickness
- Stocking density and management considerations for beef heifers reared in drylots
- Optimizing dairy production and cattle welfare in a thermally challenging climates

Breeding and Genetics

PIs: Andy Herring, Charles Long, Joe Paschal, David Riley

Completed Research Projects

- Genome wide association of birth characteristics, weaning characteristics, multiple assessments of animal temperament, carcass characteristics, female longevity and productivity, and udder characteristics in *B. indicus*-influenced females
- Production and health responses in *B. indicus*-influenced steers to BVDV challenge
- Influence of first calving date on stayability and cow productivity in *B. indicus*-influenced cows
- Research on temperament has led to adoption of an EPD for docility in the guidelines for herd improvement by the American Brahman Association
- Regulation of temperament by different genes with divergent functions.
- Mathematical model of adaptation, or winter coat shedding and accumulation, in Angus cattle in tropical and subtropical climates
- Documentation of differentially methylation regions of genome corresponding to imposed prenatal stress in Brahman calves and across generational persistence.

Ongoing Projects and Future Directions

- Modeling of calf weigh genetic components based on Nellore and Angus parental breed differential
- Adaptive immune profile response to BVDV vaccine in reciprocal Brahman-Angus F1 cross calves
- Evaluation of calf growth and female reproductive performance of reciprocal cross F2 and advanced generation (F3 through F6) Nellore-Angus crosses
- Development of training materials for beef cattle producers in the Central America
- Post-weaning growth patterns and evaluation of beef cattle NRC predictions in reciprocal Brahman-Angus F1 cross calves

- International partnerships for evaluation of reciprocal *B. indicus* × *B. taurus* and reciprocal tropically adapted crosses and large-scale genetic evaluations
- Prenatal stress effects on phenotypes and DNA structures of Brahman cattle
- Effects of telomere length in Brahman cattle
- Grazing management of F1 Hereford-Brahman cows and yearlings
- Forage cultivar breeding and release for subtropical conditions
- Improving genetics of Romana Red cattle of Dominican Republic to improve carcass merit, aid in export requirements, and assist in development of a regional market for beef
- Assisting the Republic of Vietnam in selecting U.S. genetics for export
- Characterization of the inheritance of eye pigmentation as adaptive protection against solar-induced eye cancer in cattle of Hereford ancestry
- Characterization of genetic control of udder changes and accumulation of abnormalities across lactation and lifetime in Brahman cows and cows of Hereford ancestry.
- Genomic comparison of Nellore and Angus with Hanwoo cattle
- Non-mendelian inheritance of growth and fertility of Brahman Angus reciprocal crosses

Meat Science and Carcass Quality

PIs: Russell Cross, Rhonda. Miller, Jeff Savell, Stephen Smith

Completed Research Projects

- Impact of large beef carcasses at retail and food service
- Tenderness and marbling assessment of *B. indicus*-influenced cattle
- Genetic evaluation of carcass and tenderness characteristics of *B. indicus*-influenced cattle.
- Evaluation of *B. indicus* sires on carcass, chemical and sensory characteristics
- Interaction of growth enhancement technologies with genetic tenderness markers in *B. indicus*-influenced heifers
- Relationship between animal temperament, live animal performance and eating behavior on beef carcass characteristics and beef tenderness
- Factors affecting palatability characteristics of beef top sirloin steaks
- Survey of quality attributes of beef from farmers market vendors in Texas, and benchmarking Texas palatability
- Impact of elevated aging temperatures, shelf-life, and consumer acceptability of beef
- Oleic acid in the absence of a PPAR γ agonist increases adipogenic gene expression in bovine muscle satellite cells
- Adipogenic/lipogenic gene expression and fatty acid composition in chuck, loin, and round muscles in response to grain feeding of Yanbian Yellow Cattle
- Glucose and acetate metabolism in bovine intramuscular and subcutaneous adipose tissues from steers infused with glucose, propionate, or acetate
- Oleic acid enhanced G protein coupled receptor 43 expression in bovine intramuscular adipocytes but not in subcutaneous adipocytes
- Adiposity, lipogenesis, and fatty acid composition of subcutaneous and intramuscular adipose tissues of *B. indicus*-influenced steers

Ongoing Projects and Future Directions

- Improving beef flavor and understanding of factors affecting beef flavor
- Impact of carcass weight and ribeye size on beef palatability and composition
- Sorting subprimals by ribeye size at the packer level to maximize utility and product uniformity in food service and retail sectors
- Promotion of lipid accumulation in adipose tissue by GPR43 and oleic acid.
- Alternative grass and grain feeding systems to improve beef quality
- Comparison of Akaushi steers (subtropically adapted), Akaushi crossbred steers, and Angus steers raised under grass and grain-fed systems.

Meat Safety

PIs: Alex Castillo, Sapna Dass, Russell Cross

Completed Research Projects

- Development and validation of methods for decontaminating beef carcasses and subprimals contaminated with bacterial pathogens
- Tracking pathogens in aerosols collected at beef slaughter plants in Texas
- Evaluation of novel methods for treatment application on carcasses
- Tracking of pathogens in air of feedlots

Ongoing Projects and Future Directions

- Cooling deviations and potential growth limitation. Establishing alternative cooling treatments and chemical methods to prevent outgrowth of *Clostridium perfringens* and *Bacillus cereus* in large fully cooked, uncured roast beef
- Enhancement, comparison, and validation of interventions for reducing bacterial pathogens on beef head meats
- Evaluation of sodium chlorate as an intervention to reduce *Salmonella* carriage in cattle
- Assessing the microbial diversity shift in beef cattle rumen facilitating *Fusobacterium necrophorum* to cause liver abscess
- Leading *Salmonella* blue ribbon task force across all species.

Nutritional Management

PIs: Gordon Carstens, Jenny Jennings, Luis Tedeschi, Tryon Wickersham, Reinaldo Cooke

Completed Research Projects

- Relationships between postweaning residual feed intake, forage consumption and utilization, body development, and reproductive responses in Bonsmara females
- Effects of temperament and breed composition on growth efficiency, feeding behavior, and carcass quality in finishing heifers
- Breed effects on brown-fat thermogenesis in newborn calves
- Phenotypic and genetic relationships of residual feed intake with performance and ultrasound carcass traits in Brangus heifers
- Role of oral hydration therapy and bovine respiratory disease incidence on rumen responses of newly received beef calves
- Energy costs of feeding excess protein from corn-based by-products to finishing cattle
- Use of new technologies to evaluate the environmental footprint of feedlot systems
- Effects of roughage inclusion and particle size on productivity of feedlot cattle

- Interaction of heat stress, supplemental yeast, and antimicrobial resistance in beef cattle
- Biometrics to determine body composition of cattle
- Water footprint of tropically adapted cattle
- Responses in the rumen microbiome of *B. taurus* and *B. indicus* steers fed a low-quality rice straw diet and supplemented protein
- Effect of monensin inclusion and withdrawal on intake, digestion, and ruminal fermentation patterns by *B. taurus* and *B. indicus* steers consuming bermudagrass hay
- Effect of source and level of protein supplementation on rice straw utilization by Brahman steers
- Strategic supplementation to enhance productive efficiency of *B. indicus*-influenced feedlot cattle under heat stress conditions
- Nutritional management of females during gestation to enhance offspring productivity
- Early life nutritional management has long-term impacts on beef cattle productive efficiency

Ongoing Projects and Future Directions

- Evaluation of phenotypic biomarkers for more cost-effective selection of residual feed intake in beef cattle
- Utilization of animal health monitoring systems to mitigate the economic impact of respiratory disease and improve animal welfare in beef cattle
- Evaluate the use of behavioral sensor technologies for accurate pre-clinical detection of respiratory disease and residual feed intake in beef cattle
- Using yeast-based and non-antibiotic additives to feedlot cattle.
- Performance, rumination, and rumen pH responses to different dietary energy density and feed management strategies in auction derived feedlot cattle
- Feeding agricultural byproducts and corn stalks to feedlot cattle
- Energy requirements of *B. indicus* × *B. taurus* cattle
- Antimicrobial additive affected by ruminal microbiome, differences between cattle subspecies
- Nutritional performance and metabolic characteristics of *B. indicus* and *B. taurus* steers fed with forages and supplemented with soybean meal
- Effect of supplemental protein degradability and level on nitrogen balance in *B. indicus* and *B. taurus* cattle fed rice straw
- Assessment of feed additives to substitute antibiotics in feedlot diets

Physiology of Reproduction

PIs: Fuller Bazer, Rodolfo Cardoso, David Forrest, Carey Satterfield, Ky Pohler, Tom Welsh, Garry Williams, Guoyao Wu, Reinaldo Cooke

Completed Research Projects

- Physiological roles of prostaglandin and interferon tau in conceptus development and endometrial function
- Collaborative learning initiative in maternal, perinatal, and infant health research
- Influence of seminal, physical and mating behavior traits of bulls on number of calves sired per bull in multi-sire herds
- Early pregnancy diagnosis by transrectal ultrasonography in dairy cattle

- Fertility associated antigen in peri-pubertal beef bulls
- Pregnancy rate in beef heifers after synchrony to random or programmed estrous cycles
- Quantifying and determining the timing of pregnancy loss in *Bos indicus* females
- Determining the effect of cattle subspecies in placental production
- Effect of sire subspecies in pregnancy success to artificial insemination
- Effect of subspecies in pregnancy associated glycoprotein genotype and secretion
- Development of early pregnancy test or factors in *Bos indicus* females
- Assessment of temperament and stress-responsiveness in purebred Brahman and crossbred tropically adapted beef cattle
- Development of Bee Synch I and II for synchronization of ovulation of *Bos indicus* influenced females
- Nutritional programming of puberty in *B. indicus* influenced heifers and evaluation of nutritional/metabolic epigenetic effects on adult phenotype
- Role of dietary fat as a reproductive nutraceutical for enhancing reproductive efficiency of the postpartum beef female
- Mechanistic basis of suckling-mediated anovulation in the postpartum beef female and managerial strategies for mitigation
- Impacts of temperament on heifer and cow reproductive efficiency in subtropical and tropical conditions
- Intensity of estrus expression dictates reproductive success in *B. indicus*-influenced cows
- Supplementation programs post-breeding to optimize reproductive efficiency in *B. indicus*-influenced females

Ongoing Projects and Future Directions

- Arginine and secreted phosphoprotein 1 mediate cell signaling to enhance conceptus development and survival in beef cattle
- Metabolic adaptations of conceptuses to maternal malnutrition and hypoxic environment
- Impact of perinatal nutrition on reproductive neuroendocrine phenotype in *B. indicus*-influenced heifers
- Prenatal stress modulation of the hypothalamic pituitary adrenal axis
- The use of sexed semen in fixed-timed artificial inseminated protocols for *B. indicus*-influenced beef heifers
- Factors that influence the pregnancy rate of in vitro produced embryos in a commercial environment
- Determining factors associated with late embryonic mortality in *B. indicus*-influenced cattle
- Determining the paternal contribution to pregnancy loss in *B. indicus*-influenced cattle
- Determine the effect of subspecies in uterine secretion of pregnancy associated glycoproteins
- Influence of prenatal stress upon postnatal health and productivity of *B. indicus*-influenced beef calves
- Improvement of health and feedlot performance of calves from the US Gulf Coast and Southeast
- Development of strategies for heifer development in confined systems within tropical and subtropical regions

Health Management

PIs: Tom Hairgrove, Reinaldo Cooke

Completed Research Projects

- Improving the understanding of bovine trichomoniasis and development novel diagnostic tools.
- Determining the seroprevalence of bovine anaplasmosis in Texas, its geographical distribution, and development novel diagnostic tools
- Determining the prevalence of epizootic hemorrhagic disease in Texas and the location of vectors for such diseases
- Determining the prevalence and control measures for bovine anaplasmosis and babesiosis in dairy cattle imported from the United States to Panama
- Vaccination protocols to mitigate incidence of respiratory disease in feedlot cattle
- Identification of stress-induced mechanisms that trigger inflammatory reactions in cattle

Ongoing Projects and Future Directions

- Study to assist with vector borne disease and how to predict cattle tick load using near infrared spectrometry
- Study to identify parasite resistance status in cattle adapted to tropical and subtropical environments
- Identification of inflammatory markers that facilitate development of stress-related diseases in cattle
- Selection of cattle resilient to stress-induced inflammation and subsequent incidence of respiratory diseases in the feedlot