Sustainable Southwest Beef
knowledge and tools for ranch and rangeland resilience

Sustainable Southwest Beef CAP Newsletter
October 2022

A Message From The Leadership

In recent Leadership meetings, we have identified the need to discuss business planning to better move toward key goals for our project.

For instance, as our Breed Comparison and Extension teams share information about the Raramuri Criollo, increasing numbers of ranchers are asking where they can get this breed. Currently, there really is not a good source. Our research is developing phenotypic and genotypic characteristics of the Raramuri to help standardize what is or is not in the Raramuri line. With few RC cows in the US to rapidly increase the numbers of calves available for purchase, the team has discussed the potential for semen harvesting from our bulls for artificial insemination or embryo transplants that would allow our genetics to be delivered from any breed of cow. Any of these would require good business planning and private sector partners.

Similarly, the precision ranching team is showing promising results with several of the technologies for robust on-ranch data collection and communication, analytics to produce useful information from the data to monitor on-ranch resources to assist in management, and uses of virtual fencing to support flexible and targeted grazing management. However, how to transfer the technologies into practical packages and support ranchers in the use will also require business planning and private sector partnerships, and a key deliverable of our project is the web-based Southwestern Beef Knowledge System.

This knowledge system will likely remain under stewardship of the Jornada and NMSU after the conclusion of the project, but it still requires good business planning to ensure the support and upgrading of this system beyond our project funding cycle.

In coming weeks, team members who are grappling with these issues will begin discussions on how to move forward. We may engage the NMSU

Arrowhead Center to benefit from their services, resources, expertise, and connections to help ensure our technologies are transferred to the broadest possible markets.
Stay tuned for updates on this important next step.

Welcome!

Dr. Maximiliano Spetter joined the project as a postdoctoral research fellow to calibrate a GreenFeed analyzer and implement precision monitoring tools to examine genomic and phenomic divergence in ruminant methane, feed efficiency and related grazing behavior. Dr. Spetter completed his Veterinary Science degree from Universidad Nacional de La Pampa, Argentina and his MS degree in Animal Science and a Doctorate Degree in Veterinary Science from the Universidad Nacional de Mar del Plata, Argentina. Maximiliano brings a solid experience in PCR and molecular biology techniques, ruminant nutrition and physiology and general animal pathology to the Breed Comparison and Precision Ranching teams.

Kelly Sayanagi, Asombro's Education Director, will be working with Asombro on development and delivery of K-12 lessons related to the Sustainable Southwest Beef project.

Shelby Hunt joined the OEIE external evaluation team.

Farewell

Well Wishes to Emilia Linley who has taken a job with the City of Las Cruces.

Congratulations to Zach Hurst on his new position with the Playa Lake Joint Venture where he will be working on developing conservation practices for environmental and ecological enhancement of the playas.

We wish Michael Miller well as he moves on from our team to opportunities within OEIE.

Kudos

Mackenzie Smithyman has been elected Graduate Student Director for the Western Section American Society of Animal Science Board. She is helping with the Breed Comparison.

Upcoming Events

Technologies for Ranch Management Workshop, NMSU Corona Range and

Livestock Research Center. October 21, 9-4:30, register by October 19th at https://nmbeef.nmsu.edu/. (See below for details).

OEIE will be finalizing the Advisory Board Interview Report in October and administering the Sustainability Assessment Survey in October/November.

Using Forensics to Teach Research

BlueSTEM AgriLearning Center (BALC) utilized a unique approach for teaching research techniques, strategies, and processes to its 23 high school students this fall. Dr. Kristy Ehlers, Director of School Partnerships for El Reno Public Schools and BALC, employed crime scene forensic science as a conduit for research development, data collection and analysis, and results presentation. Students discussed how a Crime Scene Investigator (a.k.a. researcher) looks at the big picture of a scene, records detailed evidence (a.k.a. data) using photography, measurements, environmental influences, patterns, cross contamination, and specialized equipment, and reports the facts of the evidence and collected data. The students recorded evidence of a constructed 12" x 12" crime scene, shoe impressions, their own fingerprints, latent prints, body measurements and physical attributes, and witness (a.k.a fellow classmates) interviews. Each student pair presented their evidence findings to the class who then discussed biases, hypotheses versus opinions, potentially missing information, and how to improve on each part of the process. Dr. Ehlers led the class in conversations comparing a CSI to a scientific researcher, evidence collection and data collection, reporting facts, making connections between prior crime scene evidence and findings (a.k.a. literature review) to the current crime scene, and delivering results in a comprehensive and logical manner. BALC students will design and implement their agriculture-based research projects throughout the remainder of this school year culminating in Spring 2023 presentations at an agriscience fair, research symposium, and other scholarly events.

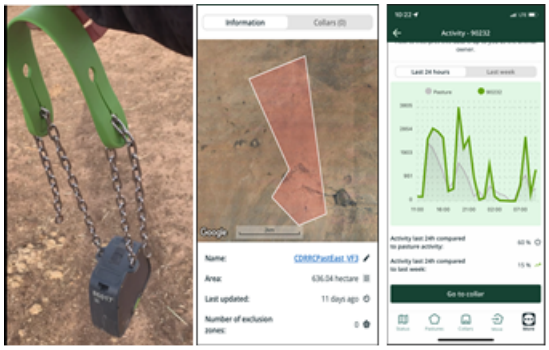
Digital Ranching

The Sustainable Southwest Beef Coordinated Project recently incorporated NoFence virtual fencing collars for testing and implementation of the technology on partnering project sites. NoFence has the manufacturing headquarters in Batnfjordsøra, Norway, and currently oversees over 48,000 collars deployed in cattle, sheep, and goats, across farming systems of contrasting terrain and climate features, and five continents.

What is Virtual fencing?

Until recently, attempts to manage livestock dispersal were usually based

on the use of permanent and temporary fencing, alteration of drinking water placement, herding, and supplementation. These practices demand significant labor, require high investment, and are regarded as being cost-prohibitive for implementation on extensive ranches of the southwest. Likewise, the control of livestock grazing distribution to preserve creeks and streams, protect fragile riparian zones, manage fire fuels, or rest rangelands impacted by fires, floods and droughts, has been under significant consideration among ranchers and land managers for several years now.



Collars use battery and solar power, communicate using 4G Network and bluetooth and have GPS and accelerometers to register animal positions and activity. (left). The system includes a user-friendly App for easy configuration and visualization of VF pastures (center). The systems gives 24/7 vigilance and security of cow activity and locations (right)

In a virtual fencing (VF) application, boundaries for livestock containment are defined without using physical barriers. Embedded microcontrollers first compute the animal's position, trajectory, and speed with reference to the position of a virtual fence line. As collared animals approach the virtual line, the system triggers a recognizable audible tone of increasing pitch to progressively warn proximity to a line. If the speed or trajectory is partially altered, pitch intensity is reduced. If the animal turns back and walks away of the line the tone is suspended. Conversely, if the animal continues toward the virtual fence, an electric pulse is applied on the animal's neck. As safety feature, only three consecutive warning and pulse cycles are allowed on escaping animals. Eventually, collars on escaping animals enter in 'sleep mode' until animals return to the designated VF area. Through proper conditioning, trained animals progressively rely on audio tones instead of reacting to electric pulses to remain within a designated area. Virtual fence instrumentation also offers detailed tracking of positions, warnings, and pulses. This feature allows real-time scouting of animals, analysis and inspection of movements, and evaluation of grazing densities. Virtual fence collars usually implement a fraction of the electric pulse used by commercial electric. Thus, effects on animal behavior are low or negligible on VF animals compared to animals that physically interact with a tape or wire electric fencing. Furthermore, any undesirable effects on animal behavior, animal comfort, and animal welfare can be reduced or even eliminated with training protocols that gradually introduce animals to the technology.

The more obvious benefit of VF is the (fenceless) control of livestock dispersal while keeping labor needs to handle and monitor animals to a minimum. Other implementations could include targeted grazing applications to manage fine fuels, brush and weed control, and enclosing of fragile rangeland areas, such as sensitive riparian zones. The adoption of the technology is gaining traction among many ranchers and farmers around the world and the southwest US, but gaps of knowledge still exist about most cost-efficient and effective ways to introduce naïve livestock to VF and about how to implement the technology to prescribe grazing and vegetation management goals.

Figure 1. Pen feeding trials were used to train and familiarize Brangus cows to the NoFence collar system (Top). Animal positions 24 h before (left)

First training trials

Preliminary training and testing trials were conducted using Nursing Brangus cows (n=11) of the NMSU's Chihuahuan Desert Rangeland Research Center. Cows were exposed for periods of 3 days to feeding areas (0.19 ha) treated either with vs. without exclusion of VF feeding zones. The process was repeated over two periods to allow testing of extinction and/or residual learning effects. The NoFence collars operated on battery and solar power, communicated using either 4G network or bluetooth connection, and reported animal positions and activity at 15-minute and 30-minute intervals, respectively. An average of 139 warnings and 52 electric pulses per group were registered throughout the training. Exposure to VF triggered greater warnings and pulses per cow in period 1 vs. period 2, suggesting a

persisting learning effect (Figure 2). Over time cattle progressively avoided electric pulses while relying increasingly on tones for navigation. The reduction of pulses over tones over time suggest that cows were able to learn associations between the warning tones and rectifying impulses. After short exposure to VF, cows remained most of the time inside the inclusion zone while reducing significantly the time spent on the excluded zone (Figure 3). With this training protocol, cows readily adjusted to new VF configurations within periods of 1-3 days. Thus, trained cows minimized the frequency of pulses, while relying increasingly on warning tones, and reducing the ratio of pulses to warning tones over time. Preliminary testing of virtual fencing shows very promising results. Innovative applications of the technology are being implemented to facilitate achieving specific livestock management objectives, extend the season of grazing and define conservation and restoration objectives in heterogeneous desert grasslands.

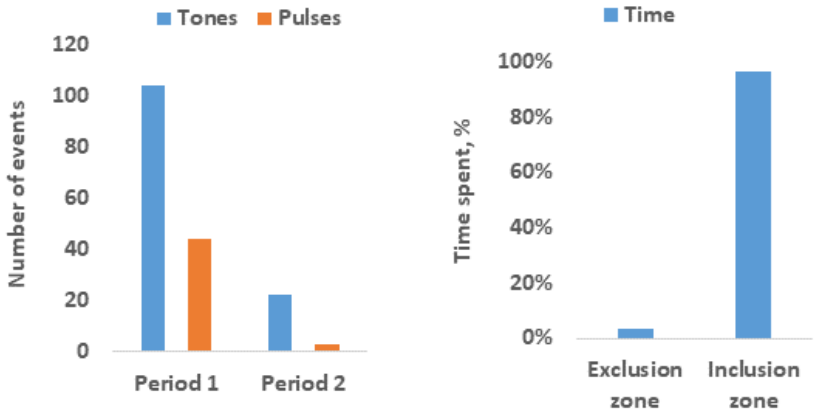


Figure 3. Cows responded to the VF systems by reducing both pulses and warning tones (left) and the ratio of pulses and tones over time, indicating that cows relied increasingly on tones and not on pulses to interact safely with the VF. The VF system was very effectiveness to contain cows within the designated inclusion zones (right) **Figure 3.** NoFence C2 collars have been incorporated to the project.

New Fact Sheets and Workshop to Showcase Precision Ranching Technologies

The extension team is excited to introduce three new fact sheets covering components of the precision ranching system being studied in this project. You can now read up on the ultrasonic water level sensors, tipping bucket rain gauges, and gps cattle location collars, all of which transmit data in real time through a network of receiving stations and will ultimately be integrated into a dashboard app accessible from a smartphone or computer. You can find these and other fact sheets on our website: https://southwestbeef.org/factsheets.

We are also hosting a workshop on Technologies for Ranch Management. This is a great opportunity to come out and see some of the technologies out there that are designed to make ranch management easier or more efficient. Remotely monitoring water levels, virtual fencing and fire management, and technology for range management are just some of the topics that will be covered. The workshop will be held in-person at the Corona Range and Livestock Research Center, in Corona, NM, on October 21st, 9:00 am – 4:30 pm. Lunch is provided. Registration is free but required; please register by October 19th if you plan to attend. Register at: https://nmbeef.nmsu.edu/ or https://techranch.ezregister.com.

Products

OEIE submitted the Year 3 Publications Impact Summary and the Progress and Collaboration Survey Summary as well as the Year 4 external evaluation activities timeline.

Presentations & Proceedings

Nyamuryekung'e, S., McIntosh, M.M.;Duff. G., Cibils, A.F., Estell, R.E., Funk, M., Cox, A., Cao, H., Chen, H., Spiegal, S., Perea, A., Rahman, S., Utsumi, S.A. Daily distance calculation using real-time LoRa-WAN sensors for precision livestock applications. Proceedings of the 2nd US Precision Livestock Farming Conference, May 21-24, 2023, Knoxville, Tennessee.
Nyamuryekung'e, S., Cox, A., Perea, A, Estell, R.E., Cibils, A.F., Holland J. Waterhouse, T., Duff, G., Funk, M., Aney S., McIntosh, M., Spiegal, S., Bestelmeyer B., Utsumi, S.A. Training beef cattle for using a virtual fence system. Proceedings of the 2nd US Precision Livestock Farming Conference, May 21-24, 2023, Knoxville, Tennessee.

Waterhouse, T., Holland J., Utsumi, S.A., Morgan-Davis C., Walker A. Resource use and proximity technology in extensive systems - getting useful information on livestock at lower costs? Proceedings of the 2nd US Precision Livestock Farming Conference, May 21-24, 2023, Knoxville, Tennessee.

Publications and Links

SPECIAL SECTION: MANURESHEDS—RECONNECTING LIVESTOCK AND CROPPING SYSTEMS
Envisioning the manureshed: Toward comprehensive integration of modern crop and animal production
Peter J. A. Kleinman, Sheri A. Spiegal, Maria L. Silviera, John M. Baker, Curtis J. Dell, Shabtai Bittman, Raj Cibin, Peter A. Vadas, Michael D. Buser, Teferi Tsegaye

- Pages: 481-493
- First Published: 24 June 2022

Link to Journal

Flynn, K.C., Spiegal, S., Kleinman, P.J., Meinen, R.J., Smith, D.R., 2023. Manureshed management to overcome longstanding nutrient imbalances in US agriculture. Resources, Conservation and Recycling 188, 106632.
Link to Article

Our mailing address is:
beefsw@gmail.com

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of Beef Production Systems in the Western United States."