USDA-ARS Land Management Research Unit
Jornada Experimental Range, Las Cruces, NM
USDA United States Department of Agriculture Agricultural Research Service
NM State University
USDA Southwest Climate Hub U.S. Department of Agriculture

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The Jornada

Science-based Knowledge for Sustainability of Rangelands

Our mission is to conduct long-term, collaborative research to sustain agriculture and other land uses in rangelands. Our research group is collaboration of the USDA Agricultural Research Service, New Mexico State University, and USDA Natural Resources Conservation Service in Las Cruces, New Mexico. We link site-based research on ecosystem change, innovative livestock production systems, and ecological restoration with national and global research on land health monitoring and decision support tools. We are a part of the USDA Long-Term Agroecosystem Research and Long-Term Ecological Research Networks. We host the USDA Southwest Climate Hub and collaborate with the Asombro Institute for Science Education. See Jornada website

Editorial

Technological Innovations to Sustain Rangelands in a Changing Climate

by Brandon Bestelmeyer

We've heard loud and clear that our partners need not only long-term science results from research sites, but also technologies that allow for real-time and site-specific decision-making in their own lands. Our research demonstrates that ecosystem change in rangelands is rapid, patchy, and in many cases directional (not readily reversed) which makes it difficult for land managers to plan for livestock management and restoration activities. Fortunately, technologies are also rapidly changing to meet these challenges. New remote sensing and ground sensor technologies enable managers to understand conditions in any location over broad areas. Imagine livestock outfitted with GPS collars, stock tanks with water level sensors, and weather stations linked wirelessly to your cell phone. Sensor data can then be integrated with satellite-based information on long-term range condition and recent forage production across an area. Managers can add ground observations to the database using cell phone data collection applications, such as LandPKS being developed at the Jornada. We are working on how to integrate these information streams so that they are readily interpretable. Another approach the Jornada is developing is to link computer models to standardized vegetation measurements to provide information on multiple aspects of rangeland health used in decision making, including erosion rates, carbon storage, and wildlife habitat quality. Finally, it's clear we need more effective ways for land managers to connect to expertise when needed to help understand the data and their implications. This will require a major transformation of science training, incentive structures, and staffing strategies. The Jornada has been discussing new models of science co-production with the Malpai Borderlands Group. One idea is to have a corps of "distributed scientists" embedded in local communities that assist landowners with new technologies, make science and technologies locally relevant, test and improve technologies, and that are supported by scientists at their home research laboratories, like the Jornada, in experimentation, data analysis, processing, and visualization. Such a model of 'enhanced extension' is beginning to take root with partners of the USDA Climate Hubs, charged with assisting land managers in climate adaptation, and could expand with funding in future USDA budgets. Contact us if you'd like to discuss further.

Research Results

Four recently published papers are highlighted below. We constantly update our papers and abstracts--over 3,500 of them. To view papers go to Jornada Bibliography.

Movement, activity, and landscape use patterns of heritage and commercial beef cows grazing Chihuahuan Desert rangeland
Breed differences in resource selection and utilization were largest during the dormant season. See paper here.

Classification of daily crop phenology in PhenoCams using deep learning and hidden markov models
PhenoCam-based models can show the progression of crops from emergence to harvest and serve as a daily, local-scale dataset of field states and phenological stages for agricultural research. See paper here.

Long-term network research for the next agricultural revolution
The earlier agricultural revolution focused on increasing crop yields around the globe, and the next agricultural revolution must maintain or increase production while conserving natural resources for future generations and improving human well-being. See the paper here.

Can cattle geolocation data yield behavior-based criteria to inform precision grazing systems on rangeland?
Behavior metrics associated with forage intake processes, such as daily time spent grazing or resting, could be used to diagnose non-normal behavior of cattle on rangeland. See the paper here

News

Foraging Habits, Heat Tolerance, and Material Behavior of Heritage vs. Improved Beef Cattle Grazing Desert Rangeland

by Dr. Shelemia Nyamuryekung'e

We compared foraging habits, heat tolerance, and mothering style of heritage (Raramuri Criollo, RC) vs. commercial (Angus Hereford Crossbred, AH) beef cattle grazing Chihuahuan Desert rangeland. A group of eleven cows of each breed grazed separately in two adjacent pastures in a crossover design for four weeks in summer and winter during three consecutive years. A subgroup of individuals in each herd were fitted with sensors to track their location (GPS collars), body temperature (iButton loggers), and cow-calf contact events (Proximity loggers). Compared to AH, RC cows traveled farther at higher velocity, spent less time resting, more time grazing and traveling, and explored larger areas either individually or compared to its herd. RC cows exhibited a keener ability

to select patches of the pasture with differing surface temperature and greenness compared to AH counterparts. RC cows showed higher preference for patches with high shrub density and avoided areas with high density of black grama during dormancy. During summer, elevated ambient temperatures in the Chihuahuan Desert appear to impose fewer constraints on heritage RC movement patterns. RC cows maintained a lower body temperature than their AH counterparts. RC calves appeared to impose fewer constraints on their dams' movement and activity patterns. Nursing RC dams covered a daily grazing area almost three times larger than that of their AH counterparts. Differences in foraging strategies documented in this study provide support for the hypothesis that Raramuri Criollo cattle likely impose a lighter footprint on desert rangeland relative to commonly raised commercial beef cattle. Additional research will be needed to test this hypothesis.

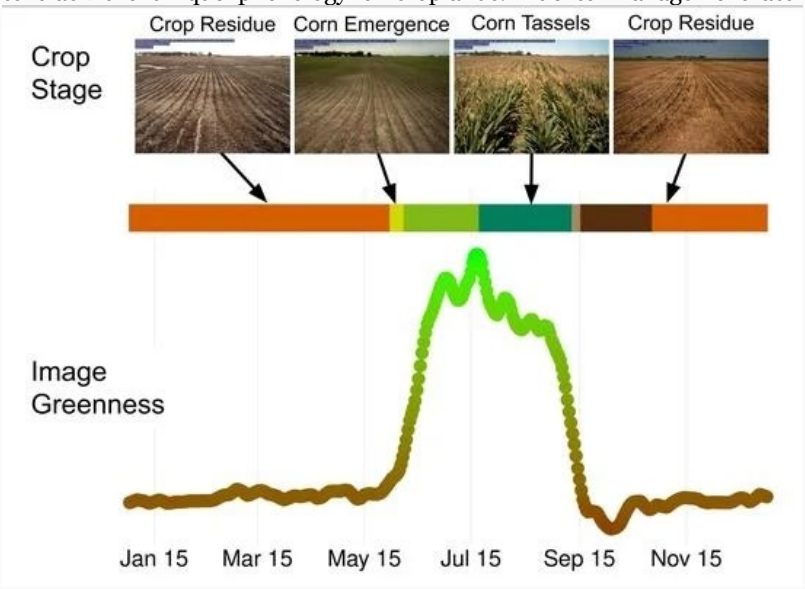
"Dr. Nyamuryekung'e received both his M.Sc. and Ph.D. from NMSU. His research interest includes studying animal-plant and climate interactions with the goal of achieving sustainable production in extensive cattle ranching systems of the southwest US. His current research covers grazing behavior, mother-offspring interactions, heat tolerance, and the use of telemetry devices as a tool for animal monitoring. He is currently working with the Southwest Beef project, and his contribution will be on the Precision Ranching and Breed Comparison research."

See more: Southwest Beef project

Classification of Daily Crop Phenology in PhenoCams Using Deep Learning and Hidden Markov Models

by Dawn Browning

Near-surface cameras, such as those in the PhenoCam network, are a common source of ground cover verification data in modelling and remote sensing studies. Despite having locations across numerous agricultural sites, few studies have used near-surface cameras to track the unique phenology of croplands. Due to management activities, crops do not have a natural vegetation cycle



which many phenological extraction methods are based on. For example, a field may experience abrupt changes due to harvesting and tillage throughout the year. A single camera can also record several different plants due to crop rotations, fallow fields, and cover crops. Current methods to estimate phenology metrics from image time series compress all image information into a relative greenness metric, which discards a large amount of contextual information. Here we used deep learning and hidden Markov models to classify crop status from time series imagery directly.

See more here.

Media

Science for Sustaining Rangeland Ecosystem Services in a Changing World

Dr. Brandon Bestelmeyer of the USDA-ARS, Jornada Experimental Range, addresses IV National Rangeland Forum of Mongolia

See video here.

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