Goat Newsletter

Cooperative Extension Program
Langston University

The Newsletter of the E (Kika) de la Garza American Institute for Goat Research *Winter 2015*

From the Director's Desk

The year is coming to a close and 2015 is Oklahoma's wettest year on record. Our state has already received 51 inches of rain this year, of which more than half came between April and July. The state's previous record was 47.88 inches occurring in 1957. The record rainfall has eliminated the three-year drought that we were experiencing, which is wonderful, but the green grass comes with a price, that is, increased parasite load. I am thankful that we have established a research program on selecting animals that are more resistant to internal parasites because if this rainfall pattern remains, then we will need the extra tools to combat internal parasitism. I don't know if this record wet year is an indication of climate change or not but we are preparing for that possibility with research on hair sheep. I have been following the 2015 Paris Climate Conference. According to the UN's Intergovernmental Panel on Climate Change (IPCC), global warming of more than 2°C (3.6°F) would have serious effects upon agriculture. The IPCC's 2014 report is informative and I have included one of the graphics from that report at the end of my section. The graphic displays key risks for each region of the world. While the United States and Europe will probably not suffer the risk of reduced food production/productivity, other regions may, such Africa, Asia, and Central and South America. We have many connections and friends in those regions, so we must research ways to mitigate those potential risks.

One of those connections/friends is Dr. **Sebastian Paez Lama**, whom I mentioned in the last newsletter. He has returned to the Instituto Argentino de Investigaciones de las Zonas Áridas, Centro Científico Tecnológico - Conicet - Mendoza in Argentine and will continue to summarize, tabulate, and analyze his research data. We wish Sebastian the very best and hope to meet him again as a collaborator on a future project.

Also in the last newsletter, I mentioned Dr. **Virginia Venturina** of the College of Veterinary Medicine at Central Luzon State University in the Philippines. We have had another group of Filipino scientists to visit. Dr. **Emilio Cruz**, Director of the Small Ruminant Center of Central Luzon State University, and two of his staff, Drs. **Neal del Rosario**, and **Alvin Soriano** came to Langston University (LU) to learn about performance evaluation of dairy goats and the Dairy Herd Improvement program and associated genetic evaluations from data collected through that program. Dr. **Roger Merkel** was their LU host and supervised their training at LU and on the study trip. You can read more about CLSU training on page 4 of this newsletter.

I had briefly mentioned two projects, resistance to internal parasites and resilience

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to climatic stressors, this newsletter and the last newsletter. Both projects have genomics, especially single nucleotide polymorphisms (SNP), as an integral part of the projects. I briefly explained, in my limited knowledge, about SNPs in the last newsletter but Drs. **Megan Rolf** and **Ralucca Mateescu** have a much better presentation on genomics, which is a chapter in our 2nd Edition of our Meat Goat Production Handbook. An abridged version of that chapter is presented later in the newsletter. Drs. **Rolf** and **Mateescu** are collaborators on several projects. Until recently, they were both faculty members at Oklahoma State University. Dr. **Mateescu** has moved to the University of Florida and Dr. **Rolf** will be moving to Kansas State University. We miss having them close by but our collaboration will continue. We wish them success in their new faculty positions.

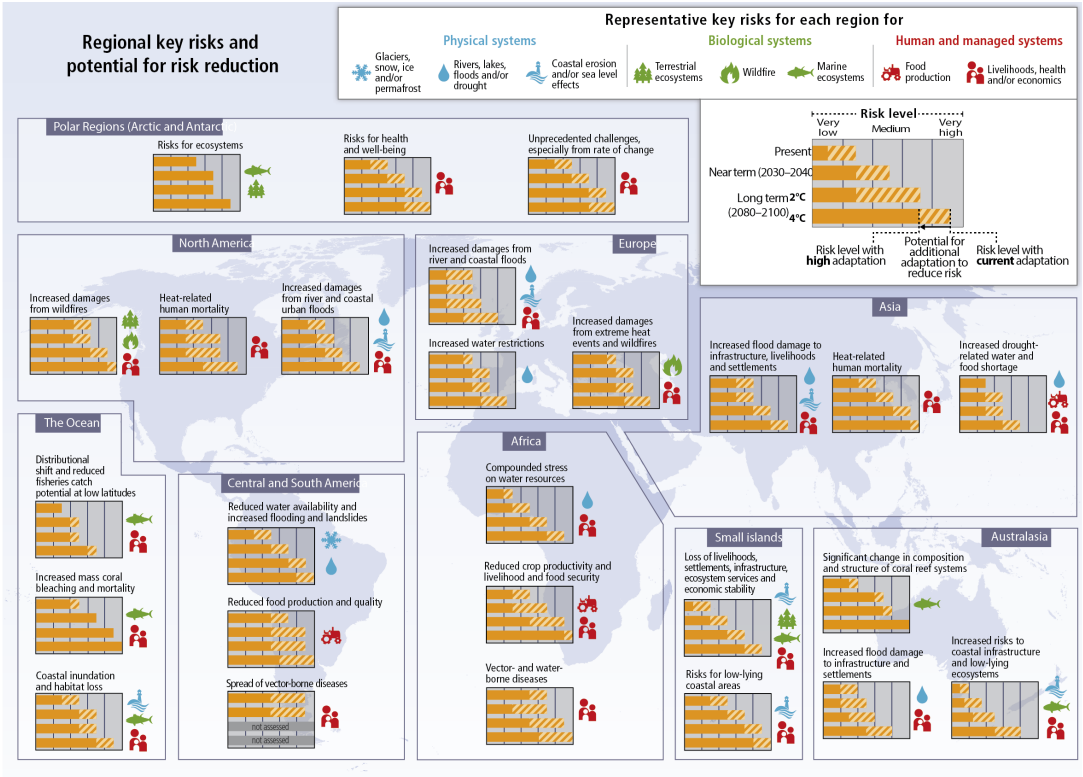


Figure 2.4 | Representative key risks for each region, including the potential for risk reduction through adaptation and mitigation, as well as limits to adaptation. Identification of key risks was based on expert judgment using the following specific criteria: large magnitude, high probability or irreversibility of impacts; timing of impacts; persistent vulnerability or exposure contributing to risks; or limited potential to reduce risks through adaptation or mitigation. Risk levels are assessed as very low, low, medium, high or very high for three timeframes: the present, near term (here, for 2030–2040) and long term (here, for 2080–2100). In the near term, projected levels of global mean temperature increase do not diverge substantially across different emission scenarios. For the long term, risk levels are presented for two possible futures (2°C and 4°C global mean temperature increase above pre-industrial levels). For each time frame, risk levels are indicated for a continuation of current adaptation and assuming high levels of current or future adaptation. Risk levels are not necessarily comparable, especially across regions.
IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp

Research Spotlight

Negative feedstuff associative effects.

Negative associative effects between supplemental concentrate and forage were investigated with 12 growing (53 lb BW) and 12 yearling (104 lb) Boer wethers in 8 simultaneous 3×3 Latin squares. Treatments in the different squares were 0, 0.6, 1.2, and 1.8 lb/cwt $BW^{0.75}$(dry matter; DM) of supplemental concentrate (primarily ground corn), and 3 sources of grass hay were consumed ad libitum (A: 5%; B: 8%; C: 12% CP). Forage intake in lb/cwt $BW^{0.75}$ was similar between animal types (3.5 and 3.1 for growing wethers and yearlings), greatest among forages for B (3.0, 4.3, and 2.6 for A, B, and C, respectively), and ranked 0 and 0.6 > 1.2 > 1.8 lb/cwt $BW^{0.75}$ of concentrate (4.9, 4.2, 2.6, and 1.5). There was an interaction in forage intake in lb/d between animal type and level of supplementation (1.0, 1.0, 0.8, and 0.4 for growing wethers and 1.8, 1.6, 0.8, and 0.5 for yearlings with 0, 0.6, 1.2, and 1.8 lb/cwt $BW^{0.75}$). There also was an animal type by concentrate level interaction in digestibility (57.3, 60.6, 61.4, and 58.4% for growing wethers and 56.6, 62.9, 56.8, and 30.0% for yearlings with 0, 0.6, 1.2, and 1.8 lb/cwt $BW^{0.75}$ of concentrate). The decrease in digestibility in yearlings given 1.8 lb/cwt $BW^{0.75}$ of concentrate was substantial compared with moderate effects of 1.8 lb/cwt $BW^{0.75}$ with growing wethers and 1.2 lb/cwt $BW^{0.75}$ with yearlings. A method of a web-based nutrient requirement calculation system for goats predicted a much greater decrease in forage intake with the lowest level of supplementation than occurred, suggesting need to increase the dietary concentrate level below which no negative associate effects are assumed. Considering that this method projects change in basal forage intake to also account for decreases in forage digestion to ultimately address supplementation effects on intake of ME, predictions with the moderate and high levels of supplementation were reasonable.

Dolebo, A.T., R. Puchala, T.A. Gipson, L.J. Dawson, T. Sahlu, and A.L. Goetsch. 2015. Effects of supplemental concentrate level and forage source on intake and digestion by growing and yearling Boer goat wethers and evaluation of a method of predicting negative feedstuff associative effects. Abstracts of the American Society of Animal Science Southern Section, p. 39.

Effect of water restriction on performance traits.

Thirty-six yearling Katahdin sheep and Boer and Spanish goat wethers were subjected to 2 water restriction treatments to develop a simple method of evaluating resilience to water restriction. Moderate quality grass hay was consumed ad libitum with supplemental concentrate at 0.5% BW. Baseline values over 2 weeks with ad libitum water intake, used as covariates, were 59, 74, and 45 lb body weight (BW), 1.1, 1.8, and 1.1 lb/day total dry matter intake (DMI), and 32.8, 58.1, and 31.3 fluid ounces/day water intake for Boer, Katahdin, and Spanish, respectively. Then availability was decreased by 10% of average baseline intake by individual animals every 1 (1X) or 2 week (2X) to a minimum of 40%, but the level of 40% for 1X also was 2 weeks. There was an interaction in BW between restriction treatment and level, with less loss at early stages of restriction and more later for 1X vs. 2X regardless of animal type. Restriction level and animal type interacted in total DMI, with the magnitude of change ranking Katahdin, Boer, and Spanish from greatest to least (1.3, 1.3, 1.1, 1.2, 1.0, and 0.8 lb/d for Katahdin, 1.2, 1.2, 1.1, 1.1, 1.0, and 0.9 lb/d for Boer, and 1.2, 1.2, 1,0, 1.0, 1.0, and 0.9 lb/d for Spanish, respectively, as level of restriction increased). There was an interaction in plasma osmolality (mean of samples at 07:00 hours before feed and water were offered and at 13:00 hours) between restriction treatment and level, with greater change over time for 1X vs. 2X (310, 311, 311, 314, 316, and 314 mosmol for 2X and 310, 309, 309, 312, 317, and 319 mosmol for 1X as level of restriction increased, respectively). In summary, BW and osmolality suggest less appropriateness of 1X than 2X for evaluating resilience of sheep and goats to water restriction, but also that more than 2 weeks at set levels would be necessary for stable conditions, and changes with stepwise decreases in water availability imply potential to lessen the number of steps and a lowest level greater than 40%.

Urge, M., R. Puchala, T.A. Gipson, T. Sahlu, and A.L. Goetsch. 2015. Effects of level and length of water restriction on body weight, feed intake, and plasma osmolality of Katahdin sheep and Boer and Spanish goat wethers. Abstracts of the American Society of Animal Science Southern Section, p. 42

Training Philippine Scientists in Performance Evaluation of Dairy Goats

From October 26 to November 5, the American Institute for Goat Research hosted Dr. Emilio Cruz, Director of the Small Ruminant Center of Central Luzon State University, and two of his staff, Drs. Neal del Rosario, and Alvin Soriano. Central Luzon State University has an on-going project with the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD) under the Dairy Goat Science and Technology program. That technology program has various aspects and this team came to the United States to learn about performance evaluation of dairy goats and the Dairy Herd Improvement (DHI) program and associated genetic evaluations from data collected through that program. Readers of the Fall 2015 newsletter learned that in August the Institute hosted Dr. Virginia Venturina of Central Luzon State as she received training in mastitis detection and treatment, another part of the Philippine Dairy Goat Science and Technology program.

Dr. del Rosario, Dr. Sahlu (AIGR Director), Dr. Cruz, and Dr. Soriano (l to r)

Learning about feeding systems with Ms. Manley (left).

The visit of Drs. Cruz, del Rosario, and Soriano was structured to provide them with information on DHI from on-farm sample collection through to genetic evaluation. The first week of their visit was spent at Langston University. The scientists learned about the management and milking procedures of the dairy goat research herd at the Institute farm. The farm staff and Dr. Lionel Dawson of Oklahoma State University performed an ultrasound demonstration for the visitors. To review the information on mastitis presented to Dr. Venturina, the scientists visited the Oklahoma Animal Disease Diagnostic Laboratory and the Center for Veterinary Health Sciences at Oklahoma State University. At Langston, the team received demonstrations on various mastitis detection methods used on-farm and in the laboratory.

Drs. Cruz, del Rosario, and Soriano spent time with Ms. Eva Vasquez and Dr. Terry Gipson in the DHI laboratory of the Institute. They learned about the DHI process conducted in the lab and the equipment and tests run. The scientists had the opportunity to conduct some of the analyses. They learned about DHI records and their interpretation and the procedures for DHI tester training and scale certification.

The Philippine team visited Prairie Thyme Goat Dairy, Middle Mountain Dairy, and Black Oak Farm in Oklahoma to learn of their production and husbandry

Learning about pregnancy detection using ultrasonography with Dr. Dawson (center with cap).

Learning about herd management with Dr. Loetz.

Learning about linear appraisal at the ADGA office.

practices. The scientists visited the Oklahoma Department of Agriculture, Laboratory Services Division, Dairy and Food Safety to learn how the safety of goat milk and products is tested and ensured in the state.

In the second week of their training, the team traveled with Dr. Roger Merkel to Spindale, NC to visit the office of the American Dairy Goat Association. The Philippine scientists met Ms. Shirley McKenzie of the ADGA who introduced them to two of ADGA's linear appraisers, Eric Jermain and John White. One morning was spent in a very fruitful discussion of the linear appraisal system and some of the important aspects of it as it relates to goat milk production. Following that discussion, the group visited Spinning Spider Creamery in Marshall, NC.

Dr. Soriano making friends at Prairie Thyme dairy.

From western North Carolina, the team traveled east to Raleigh, NC to the Dairy Records Management System office and met with Dr. John Clay. Dr. Clay explained how the DRMS processes DHI records, its organization, and the different organizations with which the DRMS works and supplies information. From there, the team traveled to Beltsville, MD for its final visit and met with Dr. George Wiggans of the Animal Genomics and Improvement Laboratory to discuss dairy goat genetic improvement programs and practical aspects of a data recording system.

Learning about conformation at Spinning Spider Creamery.

The group learned a great deal throughout its visit and received many suggestions and ideas to take back to the Philippines. The state of record keeping for dairy goats is in its infancy in the Philippines. Drs. Cruz, del Rosario, and Soriano will work to begin structuring a data collection system for dairy goats that, ultimately, could lead to genetic evaluations for use by Philippine goat producers.

Use of Genomics in Goats*

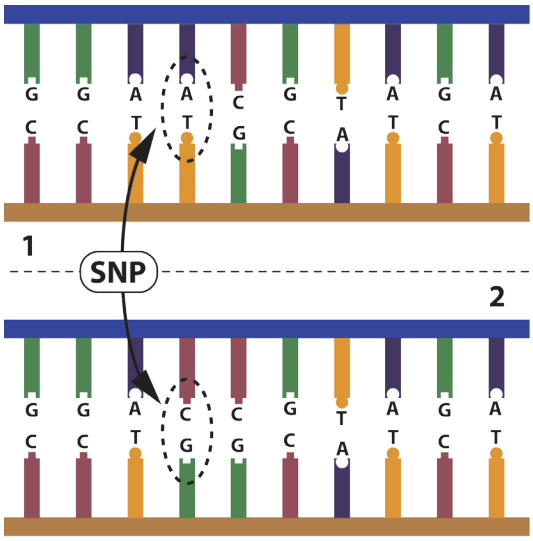
Use of genomic technologies in all livestock industries is ever-increasing. To understand the value and use of DNA markers, it helps to begin with a basic understanding of the genome and DNA (deoxyribonucleic acid). DNA provides the code needed to perform processes within an organism's body, both to keep it alive and to perform in an expected way. The structure of DNA is called a double helix, which is similar to a twisted ladder. The rails of the twisted ladder are composed of phosphate and sugar molecules and the rungs are compose of nucleobase pairs. These nucleobases are the building blocks of DNA and are coded A, C, T, and G, using the first letters of their corresponding nucleobase name, Adenine, Cytosine, Thymine, and Guanine. A pairs with T and C pairs with G. The nucleobases are bound together in long, twisted strings that are packaged into chromosomes within each cell. All of these chromosomes make up an organism's genome.

If a person were to print the entire goat genome on standard-sized legal paper, there are enough (nucleo) bases (letters) within the goat genome to yield approximately 4.5 pallets of paper (over 900,000 sheets of legal-sized paper). Keeping that amount of information in mind, think of the genome as a colossal stack of 60 giant phone books with each book having about 15,000 pages. One of these giant phone books is roughly equivalent to 33 New York City phone books. Each of the 60 phone books is like a chromosome, and the entire stack of books is the genome. The important information inside each of the phone books are the names and numbers, the same way that DNA sequence contains important information within the genome.

Goats have a total of 60 chromosomes, comprised of 30 pairs of chromosomes, 29 pairs of autosomal (non-sex determining) chromosomes and 1 pair of sex chromosomes (either XX for females or XY for males). Goats inherit one chromosome from each of their parents, so for every place in the genome, there are two different alleles (alternative forms of a gene). This is why genotypes (genetic make-up of an individual) are recorded in pairs (for example, AA, BB, or AB). Some regions of the genome are the same in all animals of a species such as in goats. Regions of the genome that vary between animals are mutations, and these mutations can be used as DNA markers. If an animal has two copies of the same mutation (AA or BB), they are homozygous (think homozygous polled, or horned). If an animal has two different copies of the mutation, they are heterozygous (think heterozygous polled).

There are several different types of DNA markers available for use in livestock industries, which can be used to test for desirable or undesirable characteristics in goats. The older type is called microsatellites, which are small pieces of DNA (a few bases) that are repeated over and over again. These markers would be scored and the genotype recorded as the number of repeats. For example, a heterozygous animal might have a genotype of 123/142 meaning that one chromosome has 123 repeats, and the other had 142 repeats. Microsatellite markers are often used in parentage testing. Because microsatellites are numbers of repeats, there are often more than two possible alleles at any given location. This makes microsatellites a very powerful tool, but also harder and more expensive to assay.

A newer type of marker, single nucleotide polymorphisms (SNPs, pronounced "snips"), have increased in popularity because they are simpler and less expensive to genotype than microsatellites. SNPs are a single base change in the DNA



SNPs find single base changes in strands of DNA. In the two uncoiled strands of DNA above, the circled AT nucleobase pair on DNA strand 1 would normally be paired with another AT nucleobase pair on DNA strand 2. Instead, DNA strand 2 has a CG nucleobase pair in its place. This base change is referred to as A/C or G/T, or more commonly by using generic coding, e.g., AB.
Illustration by K. Williams.

**abridged from the chapter entitled Use of Genomics in Meat Goats by M Rolf and R. Mateescu in the 2nd edition of the Meat Goat Production Handbook.*

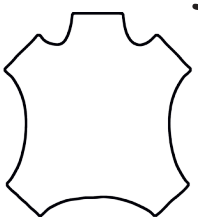
sequence and typically only have two possible alleles at any given location. A SNP genotype would look like A/C, or G/T if calling the bases directly, or AA, AB, or BB using generic coding.

Returning to the phone book analogy, think of microsatellites as common last names in the phone book. If you examine a phone book you will likely see the last name Smith or Jones repeated many times, just like you would see combinations of DNA bases repeated in a microsatellite. SNP markers are similar to finding small typos in the phone books. Only one letter has changed, but it can be identified and tracked within the phone book. When we perform a genetic marker test, it is akin to testing each phone book for the typos or repeated names at known positions. Unlike receiving the entire phone book, we only receive some of the "errors." Not every typo or repeat is surveyed, but given those that have been obtained, we can test for characteristics in important regions of the genome.

DNA markers are used in genomic applications just like one would use a marker on the side of a road while taking a long trip. Consider planning a trip across the U.S. from Boston, MA to San Diego, CA, which is about 3,000 miles. Since the caprine genome is about 3,000,000,000 base pairs, it makes an easy comparison. If there are only 300 road markers (300 SNP markers) for your road trip, you only have a marker every 10 miles (10,000,000 bases). If you have 50,000 road markers (like a 50K SNP chip, discussed in the subsequent section), you have a marker every 317 feet (60,000 bases). If you have 770,000 road markers (like a high density SNP chip in dairy cattle), you have a marker every 21 feet (3,900 bases). If you were given the task of finding an interesting landmark to visit on your trip, it would be much easier to find one with markers every 21 or 317 feet rather than every 10 miles. SNP markers within the genome work similarly; the more markers you have, generally the easier it is to locate interesting regions of the genome that affect economically important traits in livestock.

More markers make finding important genetic landmarks easier.
Illustration by K. Williams.

Tanning Goatskins Workshop



On Saturday, April 2, 2016, a tanning goatskins workshop will be held at Langston University from 8:00 a.m. to 12:30 p.m. The focus of the workshop will be tanning hair-on goatskins but the process of unhairing skins and making leather will also be discussed. After discussing the stages of tanning from how to handle and store a raw hide to softening and finishing a tanned skin, participants will have hands-on practice with goatskins in several of the different tanning steps. Various tanning methods will be discussed and examples of tanning kits and chemicals displayed. All of the tanning procedures presented and chemicals used are appropriate for home tanning with all of the work done by hand. The tanning processes learned can be used on goat, sheep, deer, coyote, and other skins. *Registration is limited to 10 participants. A registration fee of $20 is charged.* Refreshments will be provided.

For more information regarding the tanning goatskins workshop, contact Dr. Roger Merkel at (405) 466-6134 or rmerkel@langston.edu.

A registration form is available online at http://www2.luresext.edu/goats/extension/tanning.htm.

Noteworthy News

► In November, Dr. **Terry Gipson** traveled to Ethiopia to fulfill objectives of MOUs with Southern Agricultural Research Institute (SARI) and with Haramaya University (HU). He conducted an artificial insemination training course and consulted on a community-based breeding scheme for SARI and lectured on genetic improvement at HU.

► In November, Dr. **Steve Hart** participated in a grazing workshop for the Oklahoma Farmers and Ranchers Association in Oklahoma City, OK.

► In November, Dr. **Roger Merkel** conducted a training tour for Drs. **Emilio Cruz**, **Neal del Rosario**, and **Alvin Soriano** of Central Luzon State University. They traveled to North Carolina and Maryland to learn more about performance evaluation of dairy goats and the Dairy Herd Improvement program.

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