by cattle identified as "bottom dwellers" (previously observed on gentle terrain near water). Cattle may use rugged rangeland more uniformly after weaning and during periods when temperatures are more moderate (spring, early summer, and fall). Herding shows great promise for protecting sensitive rangeland. Preliminary data show that residual riparian forage in pastures where livestock were herded was up to two times higher than in a control pasture. The integration of herding and strategic supplement placement appears to be more effective than herding alone. Many concerns associated with the sustainability of grazing on arid rangelands can be resolved by manipulating livestock grazing behavior through management.

Key Words: Grazing, Distribution, Behavior

496 Whole ranch management systems to optimize forage use and meet multiple use goals. L. R. Roath*, *Colorado State University*.

Optimal forage use must account for the needs of the land and of the grazing animals, simultaneously! The challenge in designing systems to meet these criteria is to: 1) account for food choices of an array of grazing animals in time and space; 2) recognize what that means to relative food availability and relative depletion rates; 3) determine what the standing quantity of quality is and how many animals of what types it can supported (i.e. stocking rate); 4) determine the influence of the grazing use on the forage resource and feedback mechanisms; and 5) find and monitor reliable indicators of both plant and animal performance that will provide information on a time scale that will allow managers to adjust management choices to create sustainable management systems. This is a daunting job!

Prototype conceptual and applied models are being developed at Colorado State University to take some of the mystery out of this enormous task. The question of distribution of forage use and removal has been addressed scientifically by Dr. Larry Rittenhouse and Dr. Tom Hobbs. Progress is being made to use this conceptual information in predicting landscape use patterns and then making predictions of relative stocking rates for multiple grazing animal species. This work has allowed assessment of landscape level stocking rates and is now being tested for reliability. Preliminary indications are that the application of these models provides much additional information for the decision process about appropriate stocking rates but does not supplant the need for monitoring protocol for plants, plant communities, individual animals and populations. Monitoring tools like fecundity rates, animal weight, body condition for wild and domestic grazing animals and the Grazing Response Index, community dynamics, grazing pattern and rate of forage depletion for plants will be discussed, as well as, discussing the influences weather and growth dynamics of forage quality and availability. How managers might use these approaches to affect decisions on their operations will be suggested.

Goat Species Symposium: Assisted reproduction in goats

497 Update on estrus synchronization in a minor species. N.C. Whitley*, *University of Maryland Eastern Shore, Princess Anne, MD*.

Estrus synchronization allows for parturition at the most suitable time to take advantage of niche markets, feed supplies, labor and/or rising price trends. In the past, the synchronization of estrus in goats has focused primarily on dairy goats to allow for optimal timing of milk production. However, recent interest in meat goat production has resulted in attempts to use dairy goat, sheep and cattle synchronization regimes in meat goat management systems. Methods of synchronization have included techniques as simple as alteration of light patterns or manipulation of social inputs (i.e. the buck effect) and those as complex as varying timed hormonal treatments combined with light alteration and the buck effect. The synchronization of estrus using timed hormonal treatments seems to be more convenient in many meat goat production situations. Examples of hormones used include melatonin, progestagens (administered orally, as an injection or by using intra-vaginal releasing devices), gonadotropins/GNRH (or agonists) and/or prostaglandins alone or in combination. As is seen with sheep and cattle, breed and/or breed type, stage of production and environmental impacts can influence synchronization success in goats. The introduction of breeds developed in other countries for rapid growth, such as the Boer goat, and increased consumer and producer interest have added to the impetus for developing cost efficient and/or highly effective estrus synchronization regimes. New research is being conducted and various synchronization methods are being attempted in goats, a minor species, and the objective of this paper is to review these efforts.

Key Words: Estrus Synchronization, Meat Goats, Hormone

498 Current status of cryopreserving goat semen. P. H. Purdy*, [1]*USDA-ARS National Animal Germplasm Program, Fort Collins, CO*.

The success of goat sperm cryopreservation may be evaluated by multiple cellular characteristics. Classically, sperm cell motility, viability, acrosomal membrane integrity as well as other in vitro assays have been used to assess the success of cryopreservation and fertilizing potential. Ideally, multiple evaluations would be performed to evaluate how successful a freezing protocol is or how successfully a particular semen sample freezes. Successful cryopreservation of mammalian sperm is a relative concept, particularly when compared with sperm from other species. Dairy bulls have been selected for the ability to "freeze well" for generations and consequently these bulls have repeatedly high percentages of motile, viable sperm cells post-thaw that are capable of fertilizing oocytes. On the other hand, buck, ram, boar and stallion sperm is less consistent in these and other attributes post-thaw and potentially less fertile. The purpose of this review is to assess the current status of cryopreserving goat sperm and will include a review of literature that describes post-thaw motility, viability, acrosomal integrity, in vitro fertilization and other sperm cell attributes. In addition, the review will also compare the post-thaw sperm cell attributes of goats with that of other species to identify areas of research with consistent satisfactory results and those areas that could be enhanced to match the other species.

Key Words: Goat, Sperm, Cryopreservation

499 Effects of short-term nutritional priming and multiple superovulation regimes on superovulated dairy goats. N. Buzzell, S. Blash, M. Cutler, D. Melican, J. Jameson, P. Flanagan, M. Olson, and W. Gavin, *GTC Biotherapeutics Inc., Spencer MA*.

This study examined the effects of nutritional priming (NP) and multiple superovulation regimes on oocyte production in superovulated dairy goats using 389 non-lactating does, 1-10 years old, during the non-breeding season (December to May). The does were body condition scored (BCS scale: 1-5) and then randomly assigned to 2 equal groups. All does were fed hay ad lib; but the experimental group received an additional 0.5 kg/head/day of concentrated feed (DM crude protein = 19%) 2-3 weeks prior to oocyte collection. The donors were synchronized with progesterone vaginal implants (300 mg) on Day 0 and PGF2α (5 mg IM) on Day 7. The superovulation regime consisted of FSH twice daily (64mg/day IM) on Days 12-15. The implants were removed on Day 14 or 15 and GnRH was given (5mg IM) on Day 16. Estrus was detected by vasectomized bucks on Days 15 & 16. The reproductive response was assessed by exposing the uterus through a midline incision and by retrograde flushing of both oviducts to collect oocytes. The ova collected in donors with BCS 2, 3, 4 were 10.6$\pm$1.4, 10.1$\pm$0.5, 6.2$\pm$2.7 for NP does, and 8.7$\pm$1.0, 9.7$\pm$0.6, 12.6$\pm$3.7 for nonNP does, respectively. Two tendencies emerged that could not be verified statistically because of the variability of oocyte collection. First, nutritional priming appears to reduce oocyte production in overconditioned does. Second, compared to underconditioned does in the nonNP control group, experimental does with lower BCS tended to be more reproductively responsive to nutritional priming. Additionally, historical data for does with repeat superovulatory regimes were analyzed. Ova collected from donors in their first superovulation regime (12.10.5) were significantly greater than ova from donors in their fourth regime (40.9). Thus, when devising a protocol to maximize oocyte production, nutritional priming should be considered for underconditioned does but not for overweight

animals. Furthermore, multiple superovulation regimes will decrease the number of ova collected.

Key Words: Superovulation, Nutrition, Goat

500 Effect of breed and progesterone priming on pregnancy rates in anestrous meat goats in response to the buck effect. L. Nuti*, S. Woldesenbet, and G. Newton, *Prairie View A&M University, Prairie View, Tx 77446*.

Our goal was to test the effects of male introduction, with and without progesterone (P_4) priming on pregnancy rates in three breeds of meat goats. Female Boer (B, n=35), Spanish(S, n=46) and Myotonic (M, n=57) goats were selected during seasonal anestrus(May/June). Half of the does of each breed were vaginally implanted with a P_4) controlled internal drug release(CIDR-G) device on May 7. After 12 days each doe received 1 ml(5 mg)of prostaglandin F2-alpha(Lutalyse). After 14 days all does were sorted by breed into one acre breeding traps. A buck was then introduced for 30 days. Ultrasound examination 30 days after buck removal revealed differences in pregnancy rates occurred between breeds. None (0/46) of the S, 21% (12/57) of the M and 40.6%(13/35) of the B breed became pregnant overall for all groups combined. CIDR-G treatment had little effect on pregnancy rate in the B breed (6/18, 33% vs 7/17, 41%) but a marked effect on the M breed(11/25, 44% vs 1/32, 3%). P_4 profiles before male introduction (blood samples taken on day of CIDR-G implant, day 9 post implant and on days 3,5,7 15 and 20 after implant removal) indicated that 40%(14/35) of B, 24%(11/46) of S and 24%(14/57) of M goats had P_4 levels greater than 1.0ng/ml serum, which is indicative of luteal activity. However, few of those with P_4 greater than 1.0 ng/ml serum became pregnant (B=2/14, S=0/11, M=4/14). P_4 profiles in each breed after male introduction indicated that some does (B=7, S=1, M=9) exhibited typical estrous P_4 patterns but did not become pregnant which may be indicative of silent heats or sires which had low libido.

Key Words: Goats, Male effect, Anestrus

501 Ovarian response and fertility in postpubertal does and hair sheep ewes to an induced estrus using either MGA feeding or progesterone sponges. S. Wildeus*[1], J. R. Collins[1], and D. H. Keisler[2], [1]*Virginia State University, Petersburg, VA,* [2]*University of Missouri, Columbia, MO*.

There are few commercial products available for estrus synchronization in small ruminants in the U.S. Melengestrol actetate (MGA), used for estrus suppression in feedlot heifers, has potential as an extra-label use product to induce and synchronize estrus in sheep and goats. This experiment evaluated the use of dietary MGA (0.5 mg/head/day) and two types of vaginal sponges (500 mg progesterone, P4; and 50 mg methylhydroxy progesterone acetate, MPA) in 30 postpubertal does and ewes to induce and synchronize estrus in May. Species were equally allocated to treatment groups and either group-fed once daily a MGA/corn/soybean meal supplement at 1.5% BW (n=14), or fitted with P4 (n=8) or MPA (n=8) sponges for 8 d. All animals received ad lib chopped hay, and sponge-treated animals received a corn/soybean meal supplement. At the end of treatment, all animals were injected (im) with 2.5 ml of PG-600 (200 IU eCG/100 IU hCG) and placed with a fertile, libido-tested male of the appropriate species fitted with a marking harness. Estrus was observed at 4-h intervals for 96 h. The incidence and rate of ovulation was determined after 4 d via laparoscopy, and pregnancy and fetal numbers were determined via transrectal ultrasound after 28 d. Data were analyzed using GLM and chi-squares procedures of SAS. MGA and sponge protocols did not significantly differ in estrus response (50 and 80%, respectively) and time to estrus (57.7 and 52.1 h, respectively), but pregnancy rate (7 and 44%, respectively) and ovulation rate (0.4 and 1.5, respectively) were lower ($P<0.05$) in MGA-treated animals. There were no differences in response between sheep and goats, and no differences between the two sponge types. Results suggest that MGA feeding can be used to induce estrus, but that efficacy was lower than was observed for vaginal sponge treatments.

Key Words: Melengestrol Acetate, Goats, Hair Sheep

502 Effect of fat supplementation of goats in different body condition and under increased photoperiod upon ovarian activity and preovulatory endocrine profiles. C. A. Meza H.*[1,3], M. E. Hernandez L.[1], J. G. Chavez-Perchez[2], H. Salinas[3], J. Urrutia M.[3], and M. Mellado[4], [1]*Universidad Autonoma Chapingo-URUZA,* [2]*Radiodiagnostico y Ultrasonografia,* [3]*INIFAP,* [4]*UAAAN*.

The effect of fat supplementation level (FSL) and body condition (BC) upon ovarian activity (OA) and the preovulatory serum profile of GH, LH and insulin (INS) in goats subjected to natural increases in photoperiod (March and April), was evaluated. The study was carried out in northern Mexico (25 NL, at 1,117 m). Goats, 14 months old, were classified as low body conditioned (LBC, n=10, 26.811.2 kg, BCS=3.0) or high BC (HBC, n=11, 33.81.2 kg, BCS=3.8), and received either no by-pass fat (NF) or Ca fatty acid salt (WF, 120 g hd d-1), equivalent to 0.768 Mcal NE, during a 42-d experimental period. Goats received a basal diet of alfalfa hay (2.0% BW, 14.6% CP), water, shade and mineral salts. Once synchronized (two PGF2a injections, 11 d apart), blood samples were collected during the late follicular phase of the second estrus at 15-min intervals for 6 h to quantify pulsatility (PULSE) and area under the curve (AUC) of GH and LH, as well as serum INS levels. The number of follicles (TF), corpus luteum (CL) and total ovarian activity (TF+CL=TOA) was scanned during the late luteal phase after blood sampling. No differences ocurred ($P>0.05$) for either FSL or BC with respect to TF (2.90.35) and CL (2.50.28). Average serum concentrations for LH, GH, and INS, were 3.460.55, 7.490.96 and 1.640.05 ng/mL, respectively. While GH-AUC (2791.2366.6), GH-PULSE (3.50.52), and LH-PULSE (3.70.7) did not differ ($P>0.05$) between BC and FSL, supplemented goats depicted the largest TOA (5.0 vs 6.00.28, $P=0.04$) with concomitant increases ($P=0.07$) in LH-AUC and INS. Fat-by pass supplementation of yearling goats with only 56% of adult weight during the anestrus season positively affected their metabolic status and the hypothalamic-hypophyseal-ovarian axis response.

Key Words: Goats, Energy, Ovarian activity

Production, Management, & the Environment Symposium: Impact of animal feeding operations on the environment

503 Overview of nitrogen in the environment. J. N. Galloway*, *University of Virginia*.

Nitrogen is essential for life but useable N is in short supply; thus ecosystem productivity is often limited by N availability. Historically, biological nitrogen fixation (BNF) was the primary process that converted unusable molecular diatomic nitrogen to useable reactive N (Nr). However, in the current world, human activities (Haber-Bosch process, cultivation-induced BNF and fossil fuel combustion) are now more important than natural BNF in creating Nr. In addition, since denitrification is not keeping pace with enhanced Nr creation, Nr is accumulating in the atmosphere, hydrosphere and biosphere. There are a large number of consequences on ecosystems and people that occur as enhanced Nr moves along its biogeochemical pathway. Referred to as the Nitrogen Cascade, the same nitrogen atom can cause sequential effects in the atmosphere, in terrestrial ecosystems, in freshwater systems, in marine systems, and on human health. This presentation will review the cycling of N in the natural environment, in contrast with the current environment, and will include projections for nitrogen cycling in the future. The Nitrogen Cascade will be used to illustrate the impacts of Nr on environmental systems. The presentation will address a challenge facing society–namely, while the consequences of Nr accumulation are severe, the introduction of Nr into agricultural systems is necessary to sustain food production. The challenge facing society is how to optimize nitrogen management in food (and energy) production while maintaining environmental quality.

Key Words: Nitrogen, Cascade, Fertilizer