36th Annual

RANGE LIVESTOCK WORKSHOP & TOUR

Arizona/Utah

April 8, 2014 | KCNEC/Carroll Arena
Orderville, Utah

April 9, 2014 | Washington County Fairground
Hurricane, Utah

April 10, 2014 | Bundyville
Tour

REGISTRATION: 7:30 AM *Utah time* | 6:30 AM *Arizona time*

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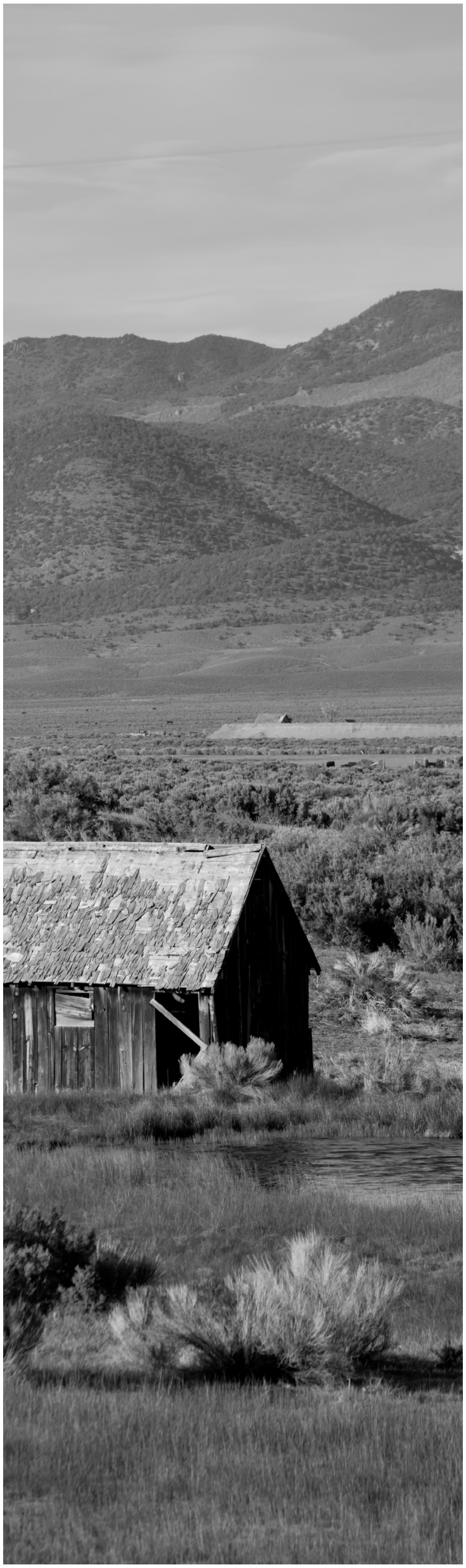
"The Utah/Arizona Range Livestock Workshop and Tour

In the mid 1970s, livestock grazing was a contentious issue in southern Utah, northern Arizona and southern Nevada, due to the completion of the "Hot Desert" Environmental Impact Statement and listing of the Desert tortoise as an endangered species. During this time, federal agencies closed grazing allotments which forced ranchers out of business. Heated arguments and emotions ensued on both sides of the issue. Both ranchers and land management agencies requested Utah State University (USU) Extension and University of Arizona Cooperative (U of A) Extension to collaborate on a science-based workshop to improve knowledge and understanding of the issues. Early on, this science-based educational program developed productive relationships among all parties. Since the first workshop in 1978, more than 7,500 participants benefited from this workshop. Success of this workshop is due to excellent partnerships and collaboration, industry sponsors, addressing current and sometimes controversial issues, and effective evaluations. The annual workshop brings cutting-edge, science-based knowledge to the participants and strengthens relationships among all parties."

WORKSHOP RECOGNITION



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PROGRAM FUNDING ASSISTANCE

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Western Region Sustainable Agriculture-Research and Education Program

$500
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Rifle drawing participants must be 18 years of age.

36TH ANNUAL AZ/UT RANGE LIVESTOCK WORKSHOP AGENDA

7:30 AM	Registration
8:15 AM	Welcome and Introductions
8:20 AM	Tribute to Jim Bowns by Chad Reid, Utah State University Extension
8:30 AM	Measures of Feed Efficiency in the Beef Industry: How do They Apply? Dan Faulkner, University of Arizona
9:15 AM	Cattle Rustling and Auction Scams: Ways to Protect Yourself. Leatta McLaughlin, AZ Department of Agriculture with Invited Panel Discussion
9:50 AM	Sponsor Introductions
10:00 AM	Visit with Sponsors/Refreshment Break
10:15 AM	History and Livestock Management of the Bundy Ranch, Ed Bundy, AZ Strip Rancher
10:45 AM	Keystone Aboriginal Burning: How Human-set Fires Created and Maintained Western Ecosystems Prior to European Settlement, Dr. Charles Kay, Utah State University
11:45 AM	Survive or Thrive; Establishing Your Cowherd Legacy, Ken Bryan, Cargill Ruminant Nutritionist
12:15 PM	Lunch, Sponsored by Cargill Animal Nutrition and Utah Farm Bureau Federation
1:00 PM	Risk Management Update: 1) USDA/RMA Pasture, Rangeland, Forage (PRF) Program Overview and 2) Livestock Market Outlook, John Mangus and Brett Crosby, Custom Ag Solutions, Sponsored by the Utah Farm Bureau Federation
1:30 PM	How to Select for the Proper Phenotype, Fertility, Glandular Function, Butterfat, and Adaptability in Your Cows, Replacement Heifers and Bulls, Steve Campbell, Triangle C Livestock
2:45 PM	Refreshment Break
3:15 PM	(Continue with Campbell Presentation)
4:30 PM	Evaluations and Wrap Up

IN MEMORY OF DR. JAMES EMERSON BOWNS

Our Friend, Colleague, Teacher and Inspiration

50 year career as Professor and Extension Specialist with joint appointment at USU and SUU

Charter committee member, contributor and frequent presenter at the Utah/Arizona Range Livestock Workshop

Taught thousands of students of all ages about Natural Resources

Served on several state, regional and national committees and testified before congress

Awarded the prestigious Friend of Extension Award by USU Extension

Inducted into the SUU Hall of Honor; his portrait now hangs in the Great Hall, an extraordinary honor; in addition, the Native Plant Garden and Herbarium at SUU are named in his honor

Presented the Lifetime Achievement Award by the International Society for Range Management
Happy trails Jim, until we meet again!

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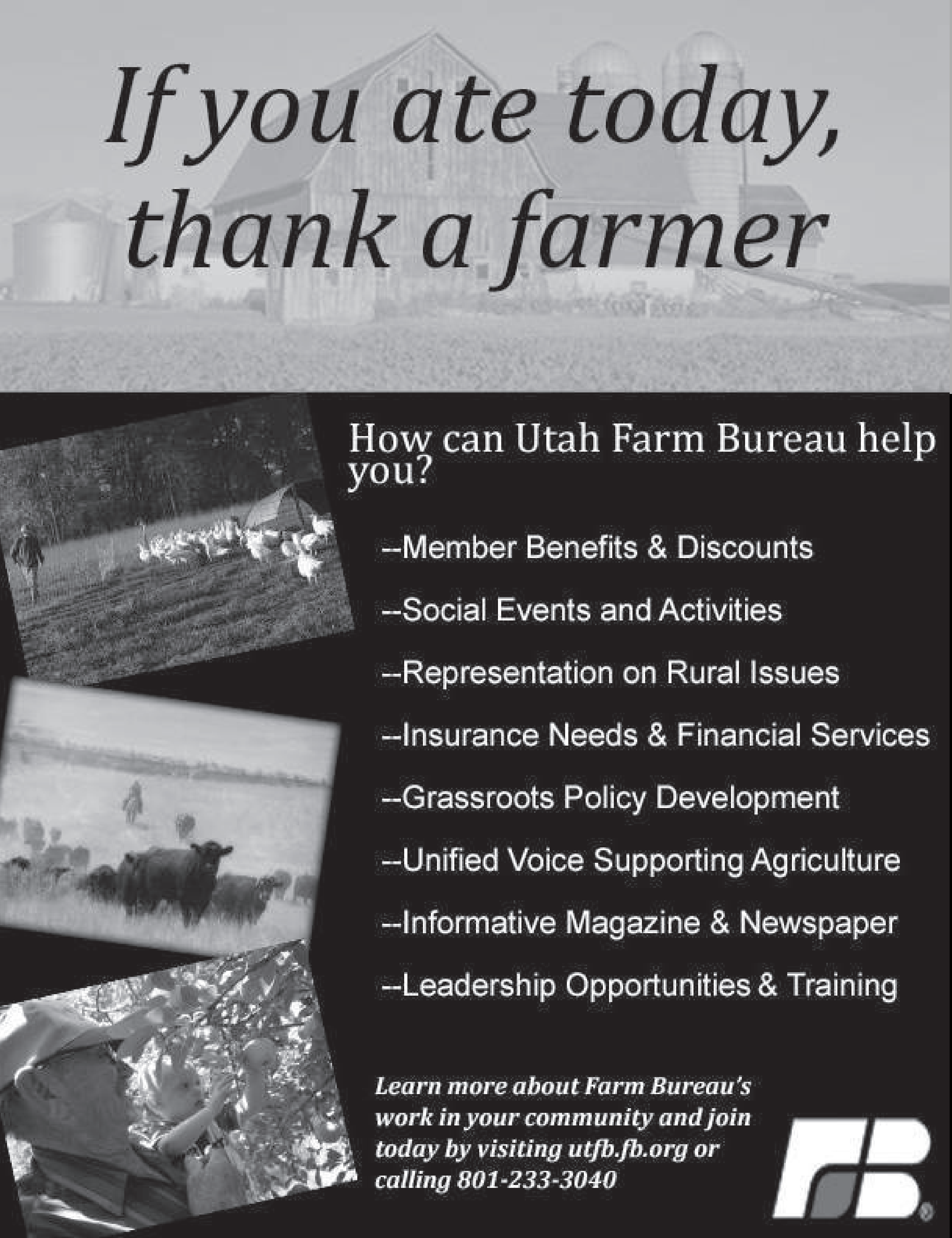
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BEEF CATTLE INTAKE AND FEED EFFICIENCY

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Summary

In order for the beef cattle industry to continue to thrive with increasing input costs, producers need to focus on cow herd feed efficiency. Many management factors can be utilized to improve feed efficiency. When determining an effective measurement of feed efficiency, residual feed intake (RFI) appears to be the most valuable tool for cow/calf producers. This is primarily due to the fact that RFI is independent of production traits and size. Selecting cattle based on RFI, which is moderately heritable, has been shown to be effective in improving feed efficiency. This is done without having a negative impact on the animals' growth, carcass characteristics, or cow production traits. In the feedlot, feed:gain or residual gain (RG) are better measures of feed efficiency to utilize due to the associated increase in final weight. A combination of RFI and RG may be the most effective measure of efficiency on an industry-wide basis. It is important for the future for the beef cattle industry to make strides in improving feed efficiency to remain competitive with other livestock species.

Since current methods of measuring feed efficiency are expensive and time consuming, an alternative approach must be identified. An opportunity exists to estimate feed intake using a dense set of single nucleotide polymorphism markers distributed throughout the bovine genome. The bovine "SNP Chip" is a tool which may be used for that purpose. Once a genomic pattern differentiating feed intake and growth have been identified, then information may be obtained early in a calf's life and incorporated into the estimation of EPDs. However, the use of molecular markers in food animal selection is still a relatively new concept to many producers and consumers. Based on the substantial amount of variation present in RFI within a population, it is likely that commercial cow/calf producers will demand an EPD for efficiency from their seed stock suppliers. As a result, future cattle selection will probably include the conventional growth and carcass traits, newly-expanding reproduction traits, and efficiency traits such as RFI.

Introduction

The National Cattlemen's Beef Association identified cost efficiencies as a major profitability driver for beef production. Approximately 60% to 70% of overall energy costs for beef production go into the cow herd. Of that amount approximately 70% goes for maintenance energy (Ferrell and Jenkins 1982). This is the energy that a cow needs just to stay alive. It does not include energy for growth, lactation, or gestation. Thus, approximately 46% of all energy required to produce a pound of beef is used to simply keep the cows alive and maintain their body weight. While little progress would be made in decreasing feed costs with regards to gestation, reproduction, and lactation, data would suggest that maintenance costs can be decreased through selection. It has been shown that variation does exist in maintenance energy requirements among cows, but maintenance requirements of cattle appear to have been largely unchanged during the past 100 years (Johnson et al. 2003). Identifying and understanding the nutritional, metabolic, genetic, and endocrinological differences among animals will aid in the determination of why certain animals are more feed efficient than others. This knowledge will allow producers to manage beef cattle production systems in a manner that minimizes feed consumption relative to output. Cow efficiency has been studied for nearly 100 years. While much has been learned, the beef industry has yet to develop a consensus as to how to improve beef cow efficiency, but it does recognize most of the genetic improvement for a beef herd comes through bull selection.

New tools in the fields of genomics, bioinformatics, and nutrition provide opportunities to advance our understanding of the regulation of nutrient utilization. A major limiting factor in improving the efficiency of nutrient utilization in beef cows are reliable, quantitative methods of measuring daily nutrient intake of grazing animals. Feed intake equipment does not measure individual feed intake for animals that are grazing, making cow intake more difficult to measure (Arthur and Herd 2008).

Feed Efficiency Measurements

Many ways of measuring feed efficiency for growing cattle are utilized. The most common method is using gross efficiency or a feed conversion ratio (FCR). This is defined as the ratio between gain and feed inputs and is commonly expressed as Gain to Feed (G:F), (Archer et al., 1999). Brelin and Brannang (1982) showed strong correlations (-0.61 to -0.95) between an animal's growth rate and FCR. A newer form of expressing feed efficiency is residual average daily gain (RADG). The American Angus Association (AAA) developed this tool and created an expected progeny difference (EPD). The AAA states that the quickest way, other than doing a feed test, to find out whether RADG is a comprehensive genetic evaluation is to include a vast array of genetic evaluations for several trait markers. Some of these traits include weaning weight, post weaning gain, subcutaneous fat thickness, calf DMI, and DMI genomic values (www.angus.org). These genetic values are coupled with animal ADG and fat which are the predictors of an animal's RADG potential. A regression equation is used to determine the animals predicted ADG which is subtracted from the actual ADG resulting in RADG (**www.angus.org**). When analyzing the RADG data, it is important to realize that a positive or high value is desired because greater gain is achieved (www.iowabeefcenter.com). RADG is moderately heritable (0.31 to 0.41), so it can be effective in improving efficiency of feedlot cattle. RADG and FCR both work well for feedlot animals, but they are problematic for cow-calf producers because selection for these measures yield bigger, heavier cows with potentially higher nutrient requirements. In fact, the AAA indicates that "RADG is not a cow efficiency tool" (www.angus.org).

Another way of measuring feed efficiency is residual feed intake (RFI). RFI is measured by subtracting an animal's actual intake from a predicted intake. The predicted intake is determined by using a regression equation that accounts for animal weight and body composition (Archer et al. 1999). Therefore, RFI allows selection for efficiency independent of animal size. Koch et al. (1963) first proposed the idea of RFI in beef cattle by suggesting that the feed intake could be adjusted for weight gain and body weight. It can then separate feed intake into two parts: the feed intake expected for the given level of production and a residual portion. The animal's expected or predicted intake is found by using feeding standards (NRC, 1996) or formulating a regression equation using the animal's actual data from a feeding period (Arthur et al. 2001). The residual portion measures how much animals differ from their expected intake. Therefore, the more efficient animals in terms of RFI have negative values. Unlike other forms of measuring feed efficiency, RFI allows for measurement without being correlated to any phenotypic trait that is used in its estimations (Basarab et al. 2003).

The testing phase for RFI requires measuring DMI and growth over a period of time. One of the most important things of this testing phase is to control as many factors as possible such as; age, sex, diet composition, and testing procedures (Arthur and Herd 2008). The fact that individual intake and performance must be measured to calculate RFI makes it very expensive to test for. This serves to be one of the major limitations in successful implementation of RFI into all facets of beef cattle industry.

Byerly (1941) was one of the first to acknowledge that individuals of the same body weight have vastly different feed requirements for the same amount of production. Many biological factors are shown to have an effect on the variation that exists in beef cattle feed efficiency. Richardson and Herd (2004) listed and gave the amount of variation explained by the different factors.

Research shows that RFI as well as FCR are moderately heritable across a multitude of breeds of beef cattle (Herd and Bishop 2000, Arthur et al. 2001, Robinson and Oddy 2004, Nkrumah et al. 2007). They showed that RFI is correlated to the animals FCR (0.45 – 0.85). As a result, selection for RFI will also result in an improvement in FCR. However, unlike the FCR, RFI can be selected for without having an effect on animal growth. Genetic correlations to animal growth traits have been shown to be close to zero and no phenotypic correlations have been reported when correlating RFI to ADG and metabolic weight. It is correlated genetically and phenotypically with DMI (0.43 – 0.73) with low RFI cattle consuming less feed.

Measuring feed efficiency in terms of RFI has the potential to play a major role in feeding cattle in the future and today's industry. RFI is a heritable trait and this heritability has been shown to be effective in the feedyard. Both heifers and steers, sired by either "good" RFI sires that possess a low RFI value, or "bad" RFI sires that possess a high RFI value have been evaluated at the University of Illinois. The preliminary data show that progeny sired by the "good" RFI sires have a more desirable RFI value and are 5% more efficient independent of size or growth rate (Retallick et al. unpublished). This further illustrates the heritability of RFI and its ability to improve efficiency in the feedyard.

Simple linear phenotypic correlations among variables (Retallick et al., 2013).

	ADG	DMI	REA	HCW	Marb	Yield Grade	F:G	RFI	RG	RIG
ADG, kg/d	1	0.54*	0.23*	0.54*	0.15*	0.35*	-0.64*	0.00	0.67*	0.40*
DMI, kg/d		1	0.15*	0.57*	0.27*	0.43*	0.26*	0.45*	0.00	-0.27*
REA, cm2			1	0.48*	0.00	-0.34*	-0.7*	-0.12*	0.21*	0.20*
HCW, kg				1	0.32*	0.51*	-0.06	0.00	0.16*	0.09*
MS					1	0.41*	0.06	0.03	-0.03*	-0.09*
Yield Grade						1	-0.02	0.14*	-0.08*	-0.13*
F:G							1	0.37*	-0.71*	-0.64*
RFI								1	-0.42*	-0.84*
RG									1	0.84*
RIG										1

*** P < 0.05*

Cow Efficiency

When considering the beef cow, optimum forage utilization is especially important because of the positive relationship between meeting energy requirements for maintenance and the genetic potential for growth or milk production (Webster et al., 1977; Ferrel and Jenkens 1987). This challenges animals with a high genetic potential for productivity putting them at a disadvantage when the environment they occupy becomes nutritionally or environmentally restrictive (NRC 1996). The environment including the forage quality and/or quantity can become unfavorable due to several conditions including: weather, overstocking, or inadequate forage management. Beef cows usually do not consume the amount of energy that matches their requirements for maintenance, gestation or milk production, so in an unfavorable environment energy reserves within the cow are depleted (NRC 1996). This condition continues until the forage source is replenished causing energy status to improve allowing for production to resume (NRC 1996).

The energy status of the cow is often measured by condition or amount of fat cover on the animal. Cows are often evaluated for this visually and assigned a body condition score to represent the cow's current energy status. Cows that are too fat or too thin are at risk for metabolic problems and diseases, decreased milk yield, low conception rates, and difficult calving (Ferguson and Otto 1989). This makes management of energy reserves a critical component to the economic success with beef cows; however, this is challenging because forage quality varies dramatically across the United States. The cow/calf producer is encouraged to match the breed(s), growth and milk production of their cows to the forage quality in order to optimize production and profitability.

When considering the measure of efficiency, animal metabolism is determined to contribute most significantly toward variation in feed efficiency. In fact, 37 percent of feed efficiency differences have been equated to animal metabolism and protein turnover alone (Richardson and Herd 2004). Cow or cattle feed intake is an important component of feed efficiency. Energy concentration of the diet is highly related to feed intake because as the diet becomes lower in energy, generally more fibrous intake increases to meet energy demands. As the diet increases in concentration or energy density, intake decreases because the diet is more energy dense and can meet the animal's requirements with less intake. This is based on the fact that consumption of less digestible, low energy (often high fiber) diets is regulated by physical factors such as rumen fill and digesta passage; whereas, consumption of highly digestible, high-energy, (low-fiber, high concentrate diets) is controlled by the animal's energy demands and by metabolic factors (NRC, 1996). Preliminary data at the University of Illinois by Retallick (unpublished) shows that replacement heifers fed a forage diet for 70 d and then a grain diet for 70 d had RFIs which correlated at an r-square of 0.35. Cattle receiving a grain diet through the duration of the trial correlated at 0.57. While the forage and grain RFIs are significantly correlated, diet type clearly has an effect on the correlation strength. This is expected because some factors influencing efficiency are common for both high grain and high forage diets (i.e., metabolic factors), but as discussed earlier the mechanisms of intake are quite different for these two types of diets. You might expect that the genetic control of intake for the two types of diets might also be different. In two separate studies, rank correlations between steer sire groups on a high concentrate diet and their heifer contemporary sire groups on a high forage diet were quite low (0.28). This further illustrates that the two types of diets share some common efficiency factors, but they are not highly related, probably due to differences in intake regulation. Recent unpublished data show that RFI measured on forage or grain-based diets is the same.

Cow intake is additionally influenced by physiological factors including body composition, age, gestation, lactation, and size (weight and (or) frame size)(NRC 1996). Environmental factors also have an effect with temperature, humidity, wind, precipitation, mud, and season also causing fluctuation in feed intake (NRC 1996). Management factors can also play a large role as they are related to forage availability, forage processing, offering additional feed additives (i.e., monensin), presence of nutrient deficiencies (particularly protein), and ensiling process of forages (NRC 1996). These factors should be controlled in order to accurately evaluate animals for efficiency. The NRC (1996) developed intake prediction equations that account for these variables and prove to be accurate for groups of cattle at similar physiological states. These predictions, however, may not be as accurate for individual animals.

The accuracy of these predictions was shown by Adcock et al. (2011). When the NRC (1996) prediction model for individual animal intake was utilized, the prediction was poorly correlated (0.14) with actual individual intake. When using the NRC (1996) model to predict the intake of the group of cattle at each time period, predictions are correlated well at 0.53. This clearly illustrates that the NRC (1996) model is effective in predicting intake for groups of cattle, but it is less effective for individual cattle.

Once cows mature they are no longer in a growing state, therefore production and metabolism are the main energy demanders. A cow's value is based upon her ability to maximize production with minimal feed intake explaining why cow economic efficiency is primarily related to feed intake. Shuey et al. (1993) calculated efficiency by measuring the feed intake of both the cow and her offspring over an entire production cycle, defined as the time from weaning of one calf to another. Results suggested that fasting heat production, highly related to the metabolizable energy of maintenance ($r2$ = 0.73), could be used as an indicator of fed maintenance requirements (Shuey et al.1993). Similar results have been found by Herd and Arthur, 2009, Webster et al. 1975, and Standing Committee on Agriculture 2000, denoting variation in intake to maintenance requirements in ruminant animals. When cow intake is increased this causes an increase in visceral organ size, thus increasing maintenance requirements. Since these organs serve as biologically active tissues, an increase in size regulates energy expenditures and metabolic rates which decrease efficiency (Herd and Arthur 2009). When considering the selection of animals on RFI, animals with lower RFIs have decreased intakes, which have the potential to decrease maintenance requirements in relation to high RFI cattle. Duration of the meal and rate of intake are components of intake which affect feed efficiency deeming them factors to consider when determining economic profitability of cattle (Adam et al. 1984). Selection of animals on RFI could have a substantial impact in improving these components. Richardson (2003) showed that high RFI cattle exhibited a trend for an increase in number of meals compared to low RFI cattle. Robinson and Oddy (2004) also showed that high RFI cattle had an increase in meal numbers and meal duration and that these are shown to be moderately heritable traits in cattle.

Heifer RFI and Mature Cow Intake

RFI testing to date has mainly been conducted in the feedlot animals which are harvested when they reach a certain desired endpoint. Data regarding replacement heifer RFI is limited especially describing the repeatability of RFI once heifers are put into production. Adcock et al. (2011) measured forage intake (in four stages of production) for two groups of first calf heifers previously tested for RFI on forage as growing heifers. Intake as first calf heifers exhibited extreme variation between individual animals. For example, two heifers with identical intake predictions and requirements (based on size, milk production, age, and stage of production), ate 13.7 kg/day vs. 24.3 kg/day (2.2 or 3.9% of body weight) over four time periods.

When predicting intake as cows with RFI, the most important factor in estimating intake was RFI value measured as heifers (Adcock 2011). It was even more important than physiological measures like weight and milk production. For every 1 kg difference in RFI as growing heifers, there is a 1.2 kg/day difference in feed intake during lactation as first calf heifers and 1.4 kg/day difference as dry heifers after they had raised their first calf. There were no correlations between RFI and intake, indicating that RFI can be used to select cows that eat less independent of other factors like cow size and milk production. Cassidy et al. (2013) found that good RFI cows ate 4 kg less than bad RFI cows on both good and poor quality forage. Hafla et al. (2013) also observed that heifer post-weaning RFI but not RG were positively correlated with cow forage intake ($r = .38$). They observed a 16% reduction in forage intake for good RFI cows compared to poor RFI cows.

Meyer et al. (2008) conducted a study using two replicated ($n = 7$/replicate) low and high RFI classified cows in an 84 d grazing study. Intake was measured by grazing enclosures, weekly rising plate meter readings, and forage harvests every 21 days. There was no difference in BW change or BCS change between the two groups, however the low RFI cows had a 21 percent decrease in DMI compared to high RFI cows (Meyer et al. 2008). Recently, we measured forage intake on cows that have survived under Arizona range conditions at the UA V-V ranch. We found that the average RFI for the cows was -1.5 lb (good), that 74% of the surviving cows had a negative (good) RFI, and had better condition (only 18% of the cows were less than BCS 5 while in the high RFI cows it was 50% less than BCS 5). There was no relationship of RFI to body weight. The low RFI cows consumed hay at 1.9% of BW while the high RFI cows consumed hay at 2.4% of BW. This is a field observation of only 40 cows, but it suggests that RFI may be useful in selecting cows that survive under arid range conditions.

There are two important benefits to utilizing RFI in a cow herd. First, economic benefits since cattle have decreased DMI on the same overall performance making them more profitable due to lower input costs particularly when harvested forages are being fed. In a grazing situation, stocking rates can be increased or more forage will be left which can improve range condition.

The second is an environmental impact. Reduction of methane production due to less forage consumption can affect the environment. Methane is the major gas emitted by ruminants as a by-product of enteric fermentation. Livestock produce methane as well as nitrous oxide which have 21 and 310 times greater global warming potential than carbon dioxide (AGO, 2001). Methane, along with nitrous oxide, can be produced from manure given certain types of management schemes (AGO, 2001). Agriculture does in fact account for some percentage of greenhouse emissions throughout the world. Livestock production is reported to be responsible for 18 percent of the worldwide greenhouse gas emissions (Steinfeld et al., 2006). This estimate encompasses not only the actual production of enteric fermentation by-products from the animal but also fuel emissions and plant emissions associated with livestock production.

Relating RFI to methane production, Angus steers (n = 76) from lines selected for either low or high RFI have a significant relationship to methane production (P = 0.01) with low RFI steers producing less methane (Hegarty et al. 2007). Nkrumah et al. (2006) revealed that crossbred steers (n = 27) have a significant correlation of 0.44 (P < 0.05) when considering individual RFI and methane production. These differences in methane production accounted for low RFI animals having 16,100 less L per year of methane emissions than the high RFI steers (Nkrumah et al. 2006). In conclusion, RFI could serve as not only a feed efficiency measure but as a tool to help lower the greenhouse gas emissions from ruminants.

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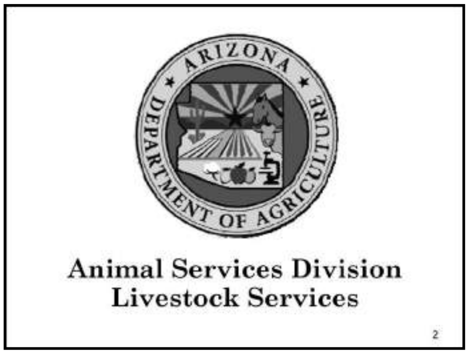
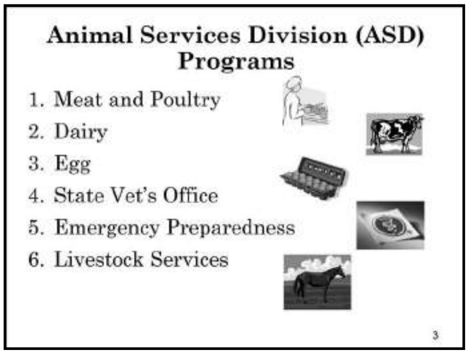
CATTLE RUSTLING AND AUCTION SCAMS: WAYS TO PROTECT YOURSELF

Leatta McLaughlin, AZ Department of Agriculture

PRESENTATION **NOTES**





Livestock Services Field Staff

4

Livestock Services Statutory Obligations

- Livestock definition – cattle, equine, sheep, goats, and swine (except feral pigs)
- Stray, theft, ownership dispute, and welfare/neglect cases
- Required to inspect livestock (except equines) within 48 hours for health, marks, and brands before they are slaughtered, sold, purchased, driven, transported, shipped, or conveyed
  - Exception: Self-Inspection Program

5

Self-Inspection Program (for AZ only)

- Includes cattle, sheep, and goats
- Branded range and feedlot cattle, unbranded dairy cattle, and sheep/goats can move to auction, inspected slaughterhouse, feedlot, arena, and pasture-to-pasture within own ranch
- Can be used for change of ownership, except for branded cattle
- Can't be used for custom slaughter

6

Inspection Fee Structure

Livestock Inspections

- $10/call + $0.25/head for cattle or $0.05/head for sheep
- Can't charge for goats, pigs, or custom slaughter
- Horses are exempt

Self-Inspections

- $0.20/head for beef cattle, feedlots, and dairies
- Can't charge for sheep and goats
- Pigs aren't included in self-inspection

7

AZ Import Requirements

- Equine – health certificate (negative Coggins-good for 12 months)
- Goats/Sheep – health certificate (no bluetongue or scrapie, negative Brucella Ovis for rams 6+ months), entry permit #, premise ID
- Swine – health certificate (no pseudo-rabies vaccine or fed raw garbage), entry permit #, premise ID
- Dairy cattle – health certificate (negative TB for 2+ months and negative brucellosis for 18+ months), entry permit #, individual ID, OCV
- Beef cattle – health certificate, entry permit #, individual ID, other specifications depending on age and sex

8

Transfer of Livestock Statutory Requirements

3-1291. Bill of sale required in transfer of livestock

Upon the sale or transfer of livestock, except dairy calves under thirty days of age, delivery of the animals shall be accompanied by a written and acknowledged bill of sale from the vendor to the purchaser.

3-1292. Sale of livestock without lawful brand, bill of sale or power of attorney; classification; defenses

A person who knowingly sells or offers for sale or trade livestock without the person's recorded brand, or for which the person has neither a bill of sale, as provided by section 3-1291, nor power of attorney from the owner authorizing the sale, is guilty of a class 5 felony, unless the person proves that at that time the person was the owner, acted by direction of the owner or acted in good faith.

3-1307. Unlawfully killing, selling or purchasing livestock of another; classification; civil penalty; exception

A. A person who knowingly kills or sells livestock of another, the ownership of which is known or unknown, or who knowingly purchases livestock of another, the ownership of which is known or unknown, from a person not having the lawful right to sell or dispose of such animals, is guilty of a class 5 felony.

B. A person who knowingly attempts to take or does take all or any part of a carcass of any such animal, pursuant to subsection A, for such person's own use, the use of others or for sale is guilty of a class 5 felony.

C. In addition to any other penalty imposed by this section, a person depriving the owner of the use of his animal or animals under subsection A or B of this section shall be liable to the owner for damages equal to three times the value of such animal or animals.

D. This section shall not apply to taking up animals under the estray laws.

9

Livestock Theft Investigations

During CY 2013, the department investigated the following theft cases:

- Cattle – 13
- Equine – 13
- Goats – 2
- Sheep – 2
- Swine – 0

10

Livestock Theft

- Crime of opportunity
  - People think they can get away with it
  - The animals are usually unbranded
- Planned crime
  - Get to know a person's habits
  - May work or have worked for the producer
  - May be a relative or someone close
  - May take documents – bills of sale, brand inspections, auction receipts, health certificates, breed registration papers, etc.
  - Frauds and scams

11

Livestock Theft Prevention

- Brand your livestock, which is proof of ownership
- Document everything
  - Some of you may think that getting a brand inspection OR completing a self-inspection is a waste of your time and money. **IT IS NOT.** It is the paper trail that is needed when an officer is putting together a case. They become the building blocks of "traceability."

12

Livestock Theft Scenario #1

A rancher bought heifers from 2 different out-of-state ranches, and both told him they were unable to get a hold of a brand inspector or veterinarian for a health certificate. Both gave the buyer a bill of sale. One of the sellers gave the buyer an older brand inspection and health certificate from when he originally bought the heifers.

The rancher brought them to his ranch in Arizona, put his brand on them, and had them bangs vaccinated. Two weeks later the rancher had a health inspection done on them so he could send them to another state to be pastured. The rancher then calls Arizona for a brand inspection.

While inspecting the cattle, the Livestock Officer saw the prior owner's brands on the heifers. The officer wanted to know where the heifers had come from and asked to see the brand inspection, health inspection, and /or the bills of sale.

The rancher brought out the papers given to him by the seller. The officer saw that the brand inspection and health certificate were in someone else's name so he told the rancher that he ran out of inspection papers and would come back the next afternoon. The officer checked with the state the heifers came from and learned some were reported stolen.

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Livestock Theft Scenario #1 Outcome

- One seller was the actual owner of 6 heifers, but he didn't think it was important to get a brand inspection or health inspection. It's a crime not to have the required paperwork.
- The other seller was a former employee of the other rancher. He knew the routine of the rancher and stole the brand and health inspection papers. This former employee had a criminal record and had used 3 different aliases.
  - Take proper care of inspection paperwork and limit access to them. They are "indicia of ownership" – treat them like you would a deed or title to a vehicle.
  - Do not accept delivery of cattle without a valid and current brand inspection and health certificate – it is for YOUR OWN PROTECTION.
  - When branding purchased cattle, DO NOT remove the ear tags of the former owner to replace them with yours. If those tags are "Official ID" tags, they are to remain with the cow for their entire life.

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Livestock Theft Scenario #2

A rancher saw a pickup and trailer that he did not recognize on his range so he called and told his inspector who happened to make a note of the date and time. The rancher also reported it was strange that he found 6 pairs of cattle trapped on a water lot, but blamed it on those "stupid hunters." The rancher also told the inspector that he had seen and talked to a BLM employee that same day.

Sometime later, another rancher called the inspector to say it looked like someone had loaded some cattle out of a corral he shares with a neighbor. The inspector went to investigate, and he could see where a trailer had been backed up to the chute. The ground had been wet when the truck and trailer had been there.

About a month later, the first rancher moved his cattle and was short 6 pairs.

The inspector started looking into it and decided that all the information above was connected. He suspected the cattle were stolen and had several leads to follow-up.

15

Other Livestock Theft Scenarios

- "Sleepers" – Usually involves "absentee owners" and calves that are NOT branded but are ear marked/tagged. Owner sees the tag/earmark and believes the animal is branded. When owner is "absent," the suspect brands animal with their brand and may or may not change tag/earmark. -- e.g. pasture cattle, employees, or family members
- Agistment – Missing livestock as a result of placing animals in care and custody of another person's pasture and/or feedlot. Livestock may be re-branded by the feedlot, placed with other cattle, or pastured at other locations. In Arizona, feedlot cattle are not required to be inspected by field staff before being shipped from the facility.
- Paper fraud – Use of brand inspections, health certificates , pasture agreements, or leases to "claim" ownership. SECURE YOUR PAPERWORK.
- Unauthorized signatures - Usually on brand inspections or bills of sale for corporation or trust owned brands. COMMUNICATE with your inspector on who is authorized to sign for cattle (e.g. employees and/or family members).

16

Livestock Auction Theft Scenarios

- Bidder and seller working together – bidder bids up price, seller gets check from auction and cashes it ASAP, bidder doesn't pay
- Dispute of ownership – horses stolen from auction pens, now under lock and key at auction pens or kept at different location
- Stolen horses sold at auction – sellers have to sign affidavit or have bill of sale because hauling cards no longer required, voluntary hauling cards are encouraged
- Inspections need to occur before the auction and not at the auction
- Problems with sellers not having required paperwork
- Won't accept fresh brands unless calves are mothered up or prior approval from inspector

17

Livestock Theft Prevention

- Be more observant when you are out in your pasture and around areas where animals can be trapped.
- Look at other pickups and trailers on or near your property. If you don't recognize them or something doesn't seem right, make a note of the date, time, and their description.
- Count your cows when you move pastures and keep a record.
- Make a note of weather conditions (e.g. rain, snow).
- Keep your notes (notebook, tally book, etc.) where you can easily find them.
- Vary your routine. If the cows know what time you are going to throw some feed, so do the "bad guys." Go out on horseback – go look at your property and animals.
- Water lots, enclosures, and corrals should always have two entry/exit points so animals can't be trapped by closing one gate.
- Remove or lock back gates on enclosures so only you can use them to trap the animals.

18

Livestock Theft Prevention

- If you find animals trapped on water, and you did not cause that to happen, then be very suspicious -- KNOWN tactic for theft from range.
- Remove tracks (e.g. vehicle, people, and animal) from loading and unloading areas when you are done working so it's easier to see if someone else is using that facility. Carry a broom on truck or in trailer.
- Treat "Indicia of Ownership" as such – the visor of the pickup is not a place to secure paperwork.
- Brand your animals as soon as practicable.
- Don't assume anything. If it seems suspicious, report it as soon as possible. Something that happened six months ago is harder to deal with than something that happened within the last day or so.
  - Federal agencies investigate "federal crimes." Livestock theft is not a federal crime.
  - Report suspicious activity and/or missing animals to: SHERIFF's OFFICE and/or DEPARTMENT OF AGRICULTURE – AZ or UT.

19

Livestock Health

- Always get a health certificate (Certificate of Veterinary Inspection – CVI) when you import and/or export livestock.
- If you have a transit herd (winter in one state and summer in another state), you still need to comply with the requirements of both states.
- Disease can cause a huge expense and loss.
- Someone who illegally brings livestock into the state could be bringing a disease to their (and your) herd, range, or neighborhood. DON'T TURN A BLIND EYE – IT COULD HURT YOUR POCKET BOOK!
- Our officers and inspectors can't be every where so if you see something, call us so we can investigate.

20

Animal Disease Traceability (ADT) – Federal Rule

- USDA's rule for improving the traceability of U.S. livestock moving interstate became effective March 11, 2013
  - Includes cattle, bison, sheep, goats, swine, equine, captive cervids, & poultry
- Animals moving interstate have to be officially ID'ed and accompanied by a CVI or other movement document
  - Exceptions: tribal land with its own traceability system, direct movement to a custom slaughter facility, chicks moved from a hatchery, and beef cattle under 18 months of age (unless they are moved interstate for shows, exhibitions, rodeos, or recreational events)
- All animals (unless otherwise specifically provided for) transported or moved into AZ must be accompanied by a CVI
- Always check with the other state for their import/ export requirements

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ADT (continued)

- Producers may apply official ID to their own animals
- Metal ear tags are available at authorized tag distributors in AZ
- 4 authorized tagging sites in AZ – Arlington Cattle Co., Marana Stockyards, Westlake Cattle Growers, and JBS Five Rivers
- Commuter herd agreement – for cattle moving across state lines between 2 premises under retained ownership for grazing purposes
  - For up to 1 year, can be renewed annually
  - Has to be approved by both shipping and receiving state health officials
  - AZ requires an AZ registered brand to roam the range

22

AZ Contact Information

Leatta McLaughlin: 602-542-7186
lmclaughlin@azda.gov

State Veterinarian's Office: 602-542-4293
chilgen@azda.gov

Dispatch: 602-542-0799, 1-800-294-0305 x3

Self-Inspection: 602-542-6407
selfinspection@azda.gov

Horse Hauling Permit: 602-542-6406

Brands: 602-542-3578

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Livestock Inspection Bureau

Utah Department of Agriculture and Food

UDAF

24

Daily Objectives - Inspectors

Verify proper ownership of livestock before they are sold, shipped out of state, or sent to slaughter.

Verify proper ownership of horses, mules, and donkeys before they are sold or shipped out of state.

Respond to reports of lost, found, or stolen livestock.

25

Importance of Brand Inspector Responsibilities

Brand Inspection Program is designed to deny a market to potential thieves & to detect the true owners of livestock.

Proper application of responsibilities allows the livestock identification program to achieve and maintain a high degree of integrity.

26

Brand Laws

Utah Livestock Brand and Antitheft Act 4-24

- Definitions
- **Brand Registration**
- **Open Range vs. Enclosed Livestock**
- **Change of Ownership**
- **Transportation of Livestock**
- Hides & Pelts
- Livestock Markets
- **Unlawful Acts**
- Brand Inspector Powers

27

Laws - Brand Registration

All Brands & earmarks used to show ownership must be registered with UDAF. Registration will be recorded in a central registry & shall show: name & address of owner; diagram of brand/mark; location of mark on livestock; date the brand was registered.

Expire every 5 years (2005, 2010, 2015)

28

Laws - Open range vs. Enclosed livestock

No livestock, except goats, and unweaned calves or colts, shall forage on open range w/o a recorded brand or mark.

Livestock enclosed in pastures, paddocks, corrals, pens, etc. are not required to be branded.

29

Laws - Change of Ownership

The ownership of cattle, horses, or mules shall not be transferred through sale, trade, barter, or otherwise without a brand inspection.

Brand inspections shall be conducted in daylight hours. If livestock bear a brand different than that of the owner or has no brands the brand inspector will need evidence of ownership before issuing a BIC.

30

Laws - Change of Ownership cont.

All cattle, upon transfer of ownership, shall be rebranded within 30 days of transfer.

Exceptions: unweaned calves, registered/certified cattle, youth project calves, dairy cattle held on farms

A brand inspection must be conducted on all cattle, horses, mules, before slaughter, unless the livestock carcass is for the owners own use.

31

Laws – Transportation of Livestock

Cattle, horses, & mules may not be transported out of state until they have been inspected & issued a BIC.

Sheep, cattle, horses, & mules may not be transported w/in the state w/o a BIC or other proof of ownership in the transporters possession.

32

Laws - Transportation

If transporting livestock for another person, must have a transit permit signed by the livestock owner.

The permit must show:

- Name of transporter
- Date of transportation
- Place of origin
- Destination
- Date of issuance, &
- # of livestock being transported

33

Laws – Unlawful Acts

It is unlawful to:

- Permit any unbranded or unmarked cattle, sheep, horses, or mules, except unweaned calves or colts to forage on open range
- Use an unrecorded brand or mark on livestock
- Obliterate, change, or remove a recorded brand or mark
- Destroy, mutilate, or conceal any hide with intent to remove evidence of ownership
- Use any vehicle for the transportation of stolen livestock or carcasses

34

The Relevant Utah Laws

- 76-6-412 (b) Theft of Livestock - 3rd Degree Felony
- 4-24-15 Ship livestock out of state w/o brand inspection (horses, cattle, elk, mules)
- 4-24-17 Transporting livestock w/o proof of ownership (except hogs)
- 72-9-502 Failure to Stop at a Port of Entry – Class A Misdemeanor
- 4-31-9 R52-1-4 Livestock entry into the state w/o health certificate (all animals)

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UT Contact Information

State Veterinarian's Office: 801-538-7162 bking@utah.gov

Cody James: 801-538-7166 codyjames@utah.gov

Brand Recorder: 801-538-7137 brands@utah.gov

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HISTORY AND LIVESTOCK MANAGEMENT OF THE BUNDY RANCH

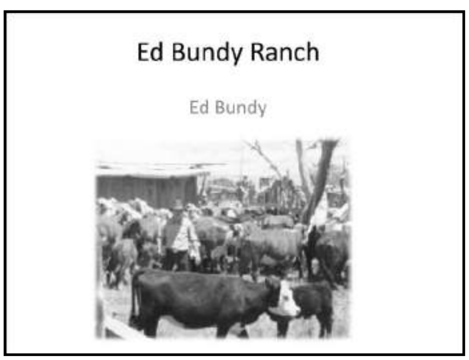
Ed Bundy, AZ Strip Rancher

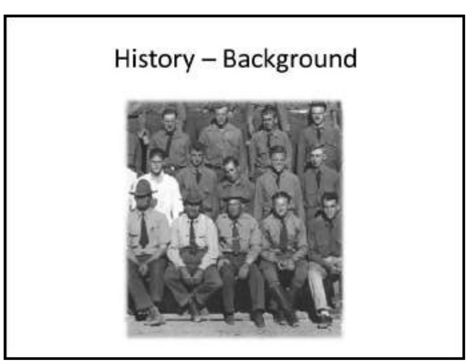
The Ed and Connie Bundy Ranch History

My Grandfather, Abraham Bundy, brought his family from Nebraska in the late 1800s to Utah. He then went to Mexico where my Father, Chester Bundy, was born the very night they got there. They then moved to Beaver Dam, Arizona.

Abraham had a job hauling ore with his team and wagon from Grand Gulch Mine to Moapa, Nevada, to the railroad. It was so hard on horses that one day he sent his boys east from the mine to see what was there. They told grandpa there was lots of grass and it looked very good, so they eventually went there and homestead what is known as Bundyville. My father and his brothers homesteaded land also. All of my siblings but one were born at Mt. Trumbull and went to grade school there. We have kept the ranch operating with a very few head of cattle. Thanks to my wife, Connie, sons, Weston and Waylon, and daughter, Kayla, for their help in continuing this tradition. This is a way of life for us, as we have had to hold down other jobs to maintain our tradition and heritage.

PRESENTATION **NOTES**





Summer Pastures

- Turn out May 15
- 5 Pastures (private)
  - Airport, Dike, Vicks, Iverson and Woods Pasture
- Rotate between the 5 pastures

Winter Pastures

- Mule Canyon
  - 90 head permit, but only run 60 head
- Turn out Nov 1st
- Stay until May 15th

Winter Mineral Supplementation

- I've tried a lot:
  - Compressed mineral block 13% protien
  - Molasses mix/Chrystalix
  - Vitalix
- Need better research on protein supplements

Operation changes

- Changed from running straight Herfords to running Limousine
  - Limousine's have better feet and legs
- Used to keep the bulls in with the cows year around. Now we have a bull turn in date.

Water Development

- My father utilized water from lots of created slick rock pockets
- In 1939, he built one of the first slick rock water catchments
- In 1985, installed holding tanks for more capacity

Beef Cattle Management

- Calve in April/May (spring green up)
- Put bulls in on May 15th when moving the cows
- Brand 1st of June
  - 7-way/pnemonia
- Wean in late October
  - Fall check up, pregnancy test, and de-worm

Marketing Livestock

- Historically, there were lots of small order buyers
- Hauled to the Cedar Livestock Market
- Still trying to develop a market for small order buyers

Future

- Generational transfer
  – You can't keep splitting up the ranch

ARE LIGHTNING FIRES UNNATURAL? A COMPARISON OF ABORIGINAL AND LIGHTNING IGNITION RATES IN THE UNITED STATES

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Abstract

It is now widely acknowledged that frequent, low-intensity fires once structured many plant communities. Despite an abundance of ethnographic evidence, however, as well as a growing body of ecological data, many professionals still tend to minimize the importance of aboriginal burning compared to that of lightning-caused fires. Based on fire occurrence data (1970–2002) provided by the National Interagency Fire Center, I calculated the number of lightning fires/million acres (400,000 ha) per year for every national forest in the United States. Those values range from a low of <1 lightning-caused fire/400,000 ha per year for eastern deciduous forests, to a high of 158 lightning-caused fires/400,000 ha per year in western pine forests. Those data can then be compared with potential aboriginal ignition rates based on estimates of native populations and the number of fires set by each individual per year. Using the lowest published estimate of native people in the United States and Canada prior to European influences (2 million) and assuming that each individual started only 1 fire per year—potential aboriginal ignition rates were 2.7–350 times greater than current lightning ignition rates. Using more realistic estimates of native populations, as well as the number of fires each person started per year, potential aboriginal ignition rates were 270–35,000 times greater than known lightning ignition rates. Thus, lightning-caused fires may have been largely irrelevant for at least the last 10,000 y. Instead, the dominant ecological force likely has been aboriginal burning.

Keywords: *aboriginal burning, Indian burning, lightning-caused fires, lightning-fire ignition rates, potential aboriginal ignition rates.*

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Introduction

It is now widely acknowledged that frequent, low-intensity fires once structured many plant communities in the United States. Anderson (2005), Stewart (1956, 1963, 2002), Zybach (2003), Lewis (1973, 1977, 1985), Pyne (1982, 1993, 1994, 1995), and others (Blackburn and Anderson 1993, Kay and Simmons 2002, Carloni 2005, Gassaway 2005) contend that, historically, most fires were set by native people to manage their environment. Vale (2002), Baker (2002), and their colleagues (Houston 1973, Loope and Gruell 1973), however, maintain that the case for aboriginal burning has been overstated and that most fires, historically, were started by lightning. According to Baker (2002:41–42), "Ignitions by Indians were . . . probably numerically insignificant relative to lightning ignitions . . . [and] Indians were a small part of a large Rocky Mountain wilderness, with a fire regime . . . essentially free of human influence for millennia." However, neither Vale (2002) nor Baker (2002) presented data on actual lightning ignition rates nor compared known lightning ignition rates with potential aboriginal ignition rates. In this paper, I present data on lightning-fire ignition rates for every national forest in the contiguous United States and then compare those figures with potential aboriginal ignition rates based on hypothetical estimates of native populations and the number of fires accidentally and purposefully set by each individual per year.

Lightning-Fire Ignition Rates

The National Interagency Fire Center in Boise, Idaho, provided data on the number of known lightning-caused fires that occurred on individual national forests from 1970 to 2002. Based on the area of each forest, I then calculated lightning-fire ignition rates/ million acres (400,000 ha) per year (Table 1). Those data range from a low of <1 fire/400,000 ha per year to 158 fires/400,000 ha per year on the Plumas National Forest in California. Ponderosa pine (Pinus ponderosa)–dominated forests

Table 1. *Lightning-fire ignition rates on national forest lands in the United States. Fire occurrence data (1970–2002) provided by the National Interagency Fire Center, Boise, ID.*

National forest	Number of lightning fires/400,000 ha per year
Western United States	
Arizona	
Apache-Sitgreaves	81
Coconino	150
Coronado	49
Kaibab	97
Prescott	43
Tonto	61
California	
Angeles	26
Cleveland	17
Eldorado	49
Inyo	31
Klamath	64
Lassen	52
Los Padres	8
Mendocino	23
Modoc	51
Plumas	158
San Bernardino	121
Sequoia	75
Shasta-Trinity	38
Sierra	65
Six Rivers	18
Stanislaus	57
Tahoe	56
Colorado	
Arapaho-Roosevelt	12
Grand Mesa–Uncompahgre–Gunnison	8
Pike–San Isabel	25
Rio Grande	5
Routt	7
San Juan	32
White River	7
Idaho	
Boise	47
Caribou	14
Challis	16
Clearwater	70
Nez Perce	65
Panhandle	27
Payette	49
Salmon	31
Sawtooth	12
Targhee	12
Montana	
Beaverhead	8
Bitterroot	65
Custer	46
Deerlodge	13
Flathead	16
Gallatin	8
Helena	21
Kootenai	39
Lewis and Clark	9
Lolo	45
Nebraska	
Nebraska	73
Nevada	
Humboldt	7
Toiyabe	25
New Mexico	
Carson	22
Cibola	38
Gila	105
Lincoln	35
Santa Fe	55
Oregon	
Deschutes	54
Fremont	43
Malheur	83
Mount Hood	20

National forest	Number of lightning fires/400,000 ha per year
Ochoco	79
Rogue River	68
Siskiyou	14
Siuslaw	1
Umpqua	59
Wallowa–Whitman	50
Willamette	43
Winema	45
Umatilla	59
South Dakota	
Black Hills	64
Utah	
Ashley	22
Dixie	34
Fishlake	28
Manti-La Sal	33
Uinta	16
Wasatch-Cache	10
Washington	
Gifford Pinchot	14
Mount Baker–Snoqualmie	7
Okanogan	35
Olympic	6
Wenatchee	27
Wyoming	
Bighorn	8
Bridger–Teton	11
Medicine Bow	18
Shoshone	6
Eastern United States	
Alabama	
All national forests	6
Arkansas	
Ouachita	9
Ozark–St. Francis	4
Florida	
All national forests	51
Georgia	
Chattahoochee–Oconee	3

National forest	Number of lightning fires/400,000 ha per year
Illinois	
Shawnee	0.3
Kentucky	
Daniel Boone	1
Louisiana	
Kisatchie	2
Michigan	
Hiawatha	1
Huron–Manistee	1
Ottawa	1
Minnesota	
Chippewa	1
Superior	6
Mississippi	
All national forests	1
Missouri	
Mark Twain	1
New Hampshire	
White Mountain	1
North Carolina	
All national forests	2
Ohio–Indiana	
Wayne–Hoosier	0.1
Pennsylvania	
Allegheny	0.1
South Carolina	
Sumter–Francis Marion	3
Tennessee	
Cherokee	4
Texas	
All national forests	3
Vermont	
Green Mountain	0.3
Virginia	
George Washington–Jefferson	2
West Virginia	
Monongahela	0.4
Wisconsin	
Chequamegon	1
Nicolet	1

in Arizona and New Mexico also have high lightning-fire ignition rates but, surprisingly, most national forests have relatively low lightning-fire ignition rates—this is especially true of national forests in the East (Figures 1, 2). Even the majority of western national forests, though, have relatively low lightning ignition rates (Figures 1, 2). Several national forests in Montana, Wyoming, and Colorado have <10 lightning-caused fires/400,000 ha per year (Table 1). National forests also have higher lightning-fire ignition rates than surrounding, lower-elevation, Bureau of Land Management (BLM), state, and private land (Barrows 1978). When those data are included, the mean lightning-fire ignition rate on all lands in the western United States is approximately 19 fires/400,000 ha per year (Table 2).

These data then do not support the idea that the United States, or even the West, is awash in lightning-started fires. Popular misconceptions regarding the frequency of lightning fires may be due to media coverage during recent extreme fire seasons, as well as the fact that many fire-history studies have been done on the few national forests in California, Arizona, and New Mexico that have relatively high lightning-fire ignition rates.

Potential Aboriginal Ignition Rates

Any estimate of aboriginal ignition rates must consider at least three factors—the number of landscape fires started inadvertently per person per year, the number of fires purposefully set per person per year, and the number of people. Unfortunately, how many people there were in the Americas prior to Columbus' landfall is not a settled issue. In fact, the entire subject is exceedingly contentious and highly charged, as it impinges directly on various national creation beliefs, charges of genocide by remaining indigenous inhabitants, and core environmental values, such as the idea of wilderness (Stannard 1992, 1998; Loewen 1995; Churchill 1997; Kay and Simmons 2002; Vale 2002; Mann 2005). Then, too, there is the problem that European-introduced diseases, such as smallpox, decimated native populations well in advance of actual European contact.

Smallpox, to which Native Americans had no acquired or genetic immunity, entered the Americas around 1520 and, according to Dobyns (1983), native people attempting to escape Spanish domination in Cuba fled to Florida in ocean-going canoes and brought smallpox to the mainland. Dobyns postulated that at least three major pandemics swept North America and reduced aboriginal populations by 90% or more before the Pilgrims arrived at Plymouth Rock. Needless to say, Dobyns' hypothesis has caused a great deal of debate, but recent archaeological work by Ramenofsky (1987), Campbell (1990), and Kornfield (1994) has documented a major aboriginal population collapse in the northern Rockies and on the northern Great Plains ca. 1550—250 y before explorers like Lewis and Clark (1804–1806) set foot in the West. Thus, we are left with a range of estimates—from a low of only a few million aboriginal inhabitants to a high of 200–300 million in the Americas ca. 1491 (Mann 2005). The only certainty is that Europeans have consistently underestimated the antiquity of aboriginal occupation, as well as the political and technical sophistication of America's original inhabitants (Mann 2005).

To be conservative in my evaluation of potential aboriginal ignition rates, I started with the lowest, published and commonly accepted estimate that I could find, namely 2 million native people in the continental United States and Canada ca. 1491 (Mann 2005). As there are approximately 1.5 billion ha north of Mexico, this yields a density estimate of 428 people/400,000 ha. Assuming there were only 500,000 natives in that area, as Alroy (2001) calculated for the end of the Pleistocene, then the density estimate is 107 people/ 400,000 ha. Both seemingly insignificant figures.

Escaped Campfires—Inadvertent Landscape Burning

Another thing that can be stated with certainty is that no one has ever found a Smokey Bear poster in an archaeological site anywhere in North or South America. In fact, no evidence exists that native people ever purposefully extinguished their heating or cooking fires. Most likely, they simply walked away and left their campfires burning.

In a very extensive search of the literature, I discovered almost no reference that natives anywhere carefully extinguished fires. . . . Everywhere that man traveled, he made campfires and left them to ignite any and all vegetation in the vicinity [Stewart 1956:118].

If native people routinely used water or soil to put out campfires, we would expect to find large pieces of charcoal in archaeologically recovered fire pits, but charcoal is rare or absent from such features—all that is commonly found is white ash or exceedingly fine charcoal particles. Wright (1984:20 –21), who conducted extensive archaeological research in the Yellowstone ecosystem, noted:

We have recorded nearly three dozen archeological sites spanning about 4,000 years of occupation. Rock broken from the heat of campfires is abundant, but charcoal is virtually absent. Even though it requires only four grams of charcoal for a C-14 analysis, on not one site has enough been collected for a date. There is obvious evidence of extensive cooking, so what has happened to the burned wood? At Blacktail Butte the firepits were shallow and the wind blows hard. No doubt much of the charcoal was dispersed by the wind, quite probably as still burning embers. The chance of accidental fires was quite high.

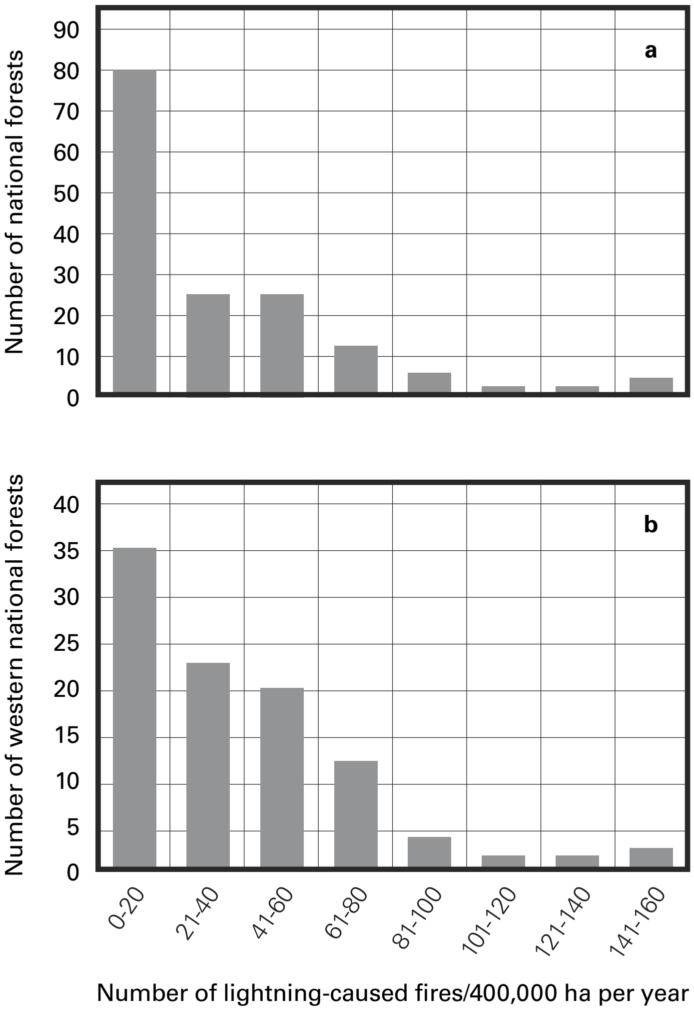

Fig. 1. *Lightning-fire ignition rates on national forests in the contiguous United States (not including national grasslands). (a) All national forests (not including Alaska). (b) National forests west of the 100th Meridian (not including the Chugach and Tongass national forests, Alaska).*

The only cases in which large pieces of charcoal have routinely been unearthed in archaeological settings are where habitation structures were set on fire, and this is usually interpreted as a sign of conflict or warfare (William Hildebrandt, Far Western Anthropological Research Group, personal communication).

Similarly, anthropologists who work with modern day hunter–gatherers living in South America, Australia, and Africa report that their subjects never extinguish heating or cooking fires unless under duress by Europeans (Jim O'Connell, University of Utah, personal communication; William Preston, California Polytechnic State University, personal communication; Richard Chacon, Winthrop University, personal communication). Peter Fidler, who traveled with a band of Piegan natives in what is today central and southern Alberta during the winter of 1792–1793, reported how aboriginal attitudes toward fire differed from those of Europeans:

2 Tents [of Piegan] joined us that was tenting 3⁄4 mile to the Eastward of us. They did not put out their fire when they left it, which spread amongst the dry grass and ran with great velocity and burnt with very great fury, which enlightened the night like day, and appeared awfully grand. The wind being fresh drove it at a great distance in a little while [Haig 1992:58].

This observation was recorded on 18 January, a time of year when lightning-started fires are nonexistent on the northern Great Plains (Higgins 1984).

So, to begin with a simple and conservative assumption that there was only 1 escaped campfire/y per adult aboriginal inhabitant, and using the previous estimate of 428 native people/400,000 ha, this produces an estimate of 428 escaped fires/400,000 ha per year, which is 2.7 times the highest known lightning ignition rate in the West or 350 times the lightning ignition rate for national forests in the East (Table 1). If, on the other hand, we assume there were 20 million native inhabitants, possibly a more realistic figure (Dobyns 1983, Mann 2005), then the estimated escaped-campfire ignition rate is 27 times higher than the highest known lightning ignition rate and 3,500 times higher than the lightning ignition rate in much of the eastern United States. If we assume 10 escaped campfires/y per aboriginal inhabitant, instead of 1, then the accidental ignition rate is 270 times the highest lightning started rate and 35,000 times the lightning-fire ignition rate in the East.

Unlike Europeans, aboriginal people without metal cutting instruments, which included all the Americas before 1492, tended to build relatively small cooking and warming fires. First, it took work to collect the necessary firewood and second, because large fires were more likely to be detected by enemies. Thus, no more than 6–8 native people usually sat around a single campfire (Binford 1978, Kelly 1995, Hill and Hurtado 1996). Assuming that 8 people shared a single campfire, that there were 2 million aboriginal inhabitants north of Mexico, and that each group of 8 lit only 1 campfire/d, this calculates out to 19,500 fires/ 400,000 ha per year—all of which were presumably left burning. This is 124 times the highest known lightning ignition rate (Table 1). However, it should be noted that some large villages of native peoples did occur in the East in the 1500s and were associated with extensive agriculture, such as near present-day Tallahassee in North Florida (Masters et al. 2003). This would likely decrease the potential for escapes in our hypothetical example.

Baker (2002:41) dismissed aboriginal burning as a significant ecological force, in part because he contended that "only about 30,000" native people inhabited the

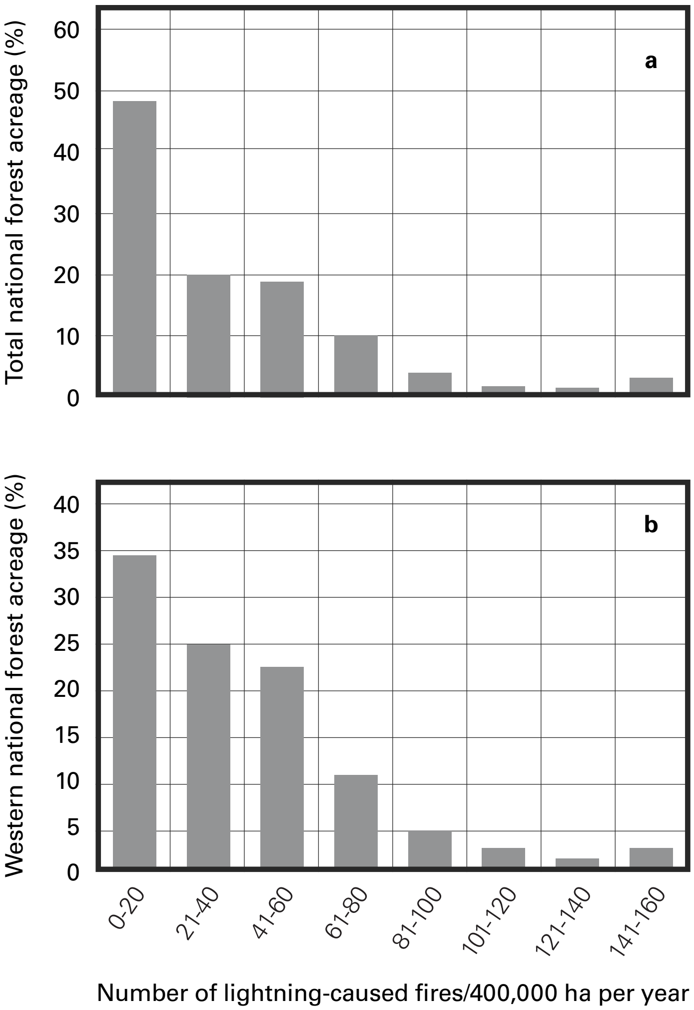

Fig. 2. *Lightning-fire ignition rates by area for national forests in the contiguous United States (not including national grass- lands). (a) All national forests. (b) National forests west of the 100th Meridian (not including the Chugach and Tongass national forests, Alaska).*

northern Rockies. Baker did not define what he considered the northern Rockies but if we assume this includes one-half of Colorado, one-half of Montana, one-half of Wyoming, and one-third each of Idaho and Utah, we have an area of 610,000 km2 (235,000 mi2) or 1 aboriginal inhabitant/19 km2 (7.3 mi2). Again, a seemingly insignificant figure. A number, however, that translates to 212 people/400,000 ha. The mean lightning ignition rate for national forests in the northern Rockies, though, is only 17.6 fires/400,000 ha per year (Table 1). Assuming only 1 escaped campfire/ aboriginal person per year, the accidental ignition rate is still 12 times the lightning ignition rate. Any other assumptions, as to the number of escaped campfires, only put more fire on the landscape. Thus, this hypothetical example does not support Baker's (2002: 41) conclusions that aboriginal fires were "insignificant" or that the Rockies were a wilderness untouched by the hand of man.

Similarly, Griffin (2002:81) suggested that there may have been no more than 1 native person/23 km2 (8.9 mi2) in the Great Basin and therefore aboriginal burning was unimportant compared to lightning-started fires. Griffin's aboriginal population estimate translates to 176 people/400,000 ha. For comparison, national forests in Nevada have a lightning ignition rate of only 17.8 fires/400,000 ha per year (Table 1). Using the conservative assumption of 1 escaped campfire/ person per year, the accidental aboriginal ignition rate was 10 times the known lightning ignition rate. Thus, available data suggest that accidentally started aboriginal fires were 1, 2, or 3 orders of magnitude greater than known lightning ignition rates in the United States—depending on location and vegetation type (Fechner and Barrows 1976:19). For other reviews of the methodology used by Vale (2002), Baker (2002), and Griffin (2002), see LaLande (2003) and Pyne (2003). Finally, despite an extremely successful antifire public relations campaign, fire bans, and other measures, including closing entire national forests during high fire danger, 49% of the fires recorded in the National Forest System from 1940 to 2000 were caused by humans, not by lightning—and those human-set fires accounted for 57% of the area burned (Stephens 2005).

Purposeful Burning—Management-Set Fires

Although there is little doubt that Native Americans used fire to purposefully modify their environment (Stewart 1963, 2002; Lewis 1973, 1977, 1985; Anderson 2005), ethnographers have failed to record the number of fires set/person per year. The only data that I have been able to locate on this subject come from Australia where, in a few locations, aboriginal people still use fire to purposefully modify the vegetation as their ancestors are thought to have done for the last 45,000–50,000 y (Hallam 1975, Lewis 1989, Flannery 1994, Fensham 1997, Russell-Smith et al. 1997, Bowman 1998, Bowman et al. 2004, Vigilante and Bowman 2004). In Australia, most of the aboriginal-set management fires are started by men and each individual sets 100 or more fires/y, mostly at the end of the wet season and the beginning of the dry season—a time when lightning-fires are rare to nonexistent. This creates a vegetation mosaic that not only is more productive for the indigenous inhabitants but which also prevents large-scale, high-intensity, lightning-caused fires during the height of the dry season. Aboriginal-managed areas have also been shown to have higher plant and animal biodiversity than adjacent national parks, where lightning-caused fires are allowed to burn unchecked but where aboriginal burning is prohibited (Yibarbuk et al. 2001, Fraser et al. 2003).

So if we conservatively assume that each Native American purposefully set only 1 fire/person per year, and that there were only 2 million native people north of Mexico, the aboriginal burning rate would have been 2.7–350 times greater than known lightning ignition rates (Table 1). If 10 fires/person per year were set, possibly a more realistic assumption (Boyd, T., 1986; Turner 1991; Gottesfeld 1994; Boyd, R., 1999; Anderson 2005), the aboriginal burning rate would have been 27–3,500 times greater than known lightning ignition rates. If there were 20 million Native Americans, instead of 2 million, that would add another order of magnitude to the estimated rate of purposefully set fires. Finally, if estimates of accidentally started aboriginal fires are combined with estimates of purposefully set management fires, the overall aboriginal burning rate would have been 2–5 orders of magnitude greater than known lightning ignition rates. Even if we assume there were no more than 500,000 native people in the United States and Canada, aboriginal ignition rates would still have overshadowed lightning fires. Thus, there have been more than enough people in the Americas for the past 10,000 or so years to completely alter fire regimes and vegetation patterns.

Moreover, widespread aboriginal burning, by consuming fuels and creating patches of burned and unburned vegetation, limited the spread and extent of any lightning fires that may have started, similar to what has been documented in Australia (Kay 1998, 2000). This would suggest that lightning-caused fires have been largely irrelevant in structuring plant communities throughout many areas in North America. It also turns out that it does not require very many native people to completely alter fire regimes because lightning ignition rates were so low and aboriginal ignition rates so high.

Table 2. *Average lightning-fire ignition rates on protected state, private, and federal lands in the western United States, 1960–1975 (Barrows 1978:4).*

State	Number of lightning fires/400,000 ha per year
Arizona	46
New Mexico	21
Colorado	11
Wyoming	6
Idaho	25
Montana	17
Nevada	3
Utah	7
California	28
Oregon	30
Washington	19
All western states	19

Extent of Aboriginal Burning and Vegetation Modification

There are several ecological examples that suggest aboriginal burning not only structured a wide range of plant communities but actually created many of the vegetation associations heretofore thought to be "natural." Perhaps the most compelling evidence is from eastern United States forests.

For the last 8,000–10,000 y, much of the east-central United States was dominated by oaks (Quercus spp.), American chestnut (Castanea dentata), and pines (Pinus spp.), all fire-tolerant, early to mid-successional species (Delcourt et al. 1986, 1998; Clark and Royall 1995; Cowell 1995, 1998; Olson 1996; Delcourt and Delcourt 1997, 1998; Bonnicksen 2000). Since European settlement, however, oaks and pines have increasingly been replaced by late-successional, fire-sensitive species, such as maples (Acer spp.), even in protected areas (Botkin 1990:51–71; Abrams 1998, 2003, 2005; Batch et al. 1999; Bonnicksen 2000; Rodewald 2003; Roovers and Shifley 2003; Aldrich et al. 2005; Rentch and Hicks 2005). This and related fire history studies suggest that the species composition of eastern forests had been maintained for thousands of years by frequent landscape-level burning (Black et al. 2006, Stambaugh and Guyette 2006). Now, this portion of the United States does have one of the highest lightning-strike densities in North America (Orville and Huffines 2001, Orville et al. 2002) but as noted in Table 1, these forests have the lowest lightning-fire ignition rates in the country. This is because when most lightning strikes occur during June, July, and August, eastern deciduous forests are often too green or wet to burn. In fact, eastern deciduous forests will readily burn only when the trees are leafless and the understory is dry—conditions that occur late in the fall, during winter, or early in the spring; all times when there are virtually no lightning strikes and hence no lightning-caused fires.

Thus, the only way for eastern forests to have displayed the open stand characteristics and species composition that were common at European settlement is if those communities had regularly been burned by native people as part of aboriginal land management activities (Kay 2000, Mann 2005). Without humans actively managing these systems, the forests would be entirely different. It is also likely that aboriginal burning created the many eastern prairies and "barrens" reported by early Europeans (Campbell et al. 1991, Belue 1996, Barden 1997, Bonnicksen 2000, Mann 2005). Canebrakes (Arundinaria gigantea), too, likely owed their existence to native burning and other aboriginal land management practices (Platt and Brantley 1997).

Southern Canadian Rockies

Fire-history studies and repeat photographs both indicate that Banff and Jasper national parks once experienced a high frequency of low-intensity fires. Since the parks were established, however, lightning-caused fires have been exceedingly rare. In some vegetation types, fire return intervals are now 100 times greater than they were in the past (Wierzchowski et al. 2002). Lower montane valleys that once burned every 5 y or less now do not burn at all. Based on this and other evidence, Parks Canada has concluded that native burning, not lightning-caused fires, was critical in maintaining what heretofore was believed to be the "natural" vegetation mosaic of the southern Canadian Rockies (Kay et al. 1999). That is to say, there simply are not enough lightning-caused fires to account for historical burn and vegetation patterns (Wierzchowski et al. 2002).

Yellowstone National Park

Prior to park establishment, Yellowstone's northern grasslands had a fire return interval of once every 25 y (Houston 1973). Yellowstone has had a "let burn" policy for over 30 y now, yet during that period, lightning-caused fires have burned practically none of the northern range. In 1988, fire did burn approximately one-third of the area, but according to agency definitions that was "unnatural" because the fire was started by man, not by lightning. Besides, the 1988 fires are thought to be a 100- to 300-y event, so similar fires could not have caused the original 25-y fire frequency (Kay 2000). Lightning strikes occur frequently on the northern range, but when they do during June, July, and August, the herbaceous vegetation is usually too green to carry a fire (Kay 1990). Thus, it is likely that the park's original 25-y fire frequency was entirely the product of aboriginal burning.

Aspen Ecology

Repeat photographs and fire-history studies indicate that western aspen (Populus tremuloides) communities burned frequently in the past, yet experience has proven that aspen is extremely difficult to burn (Brown and Simmerman 1986). Terms such as "asbestos type" and "firebreak" are often used to describe aspen (DeByle et al. 1987:75). Even raging crown fires in coniferous forests seldom burn adjacent aspen communities (Fechner and Barrows 1976). At current rates of burning, "it would require about 12,000 years to burn the entire aspen type in the West" (DeByle et al. 1987:73). Something is clearly different today from what it was in the past.

Research has shown that aspen communities will readily burn only when the trees are leafless and understory plants are dry, conditions that occur only during early spring and late in the fall (Brown and Simmerman 1986). Prior to 15 May and after 1 October, though, there are few lightning strikes and virtually no lightning fires in the northern or southern Rocky Mountains (Kay 1997, 2000, 2003). So, if aspen burned at frequent intervals in the past, as fire-frequency data and historical photographs indicate it did, then the only logical conclusion is that those fires had to have been set by Native Americans.

San Juan Mountains

Researchers in the southern Rockies contend that fire-history data obtained from fire-scarred conifers do not support the idea that aboriginal burning had any significant influence on "natural" fire regimes (Allen 2002, Vale 2002). Grissino-Mayer et al. (2004:1708), for instance, reported that they could find "no compelling evidence that Native Americans influenced fire regimes" in Colorado's San Juan Mountains. Lightning-fire data, though, do not support that conclusion. According to Grissino-Mayer et al. (2004:1716), "57% of all fires prior to 1880 occurred during the spring dormant season" based on microscopic analysis of when fire scars were actually formed. Yet lightning fire occurrence data provided by the National Interagency Fire Center show that only 11% of lightning fires occur during that period, and they account for only 3% of the area burned (Figure 3). This would suggest that something other than lightning was responsible for the earlier fires (Kay 2000:20–21).

Northern Great Plains

Baker (2002:51–66) questioned the validity of using early historical accounts to support the idea that native people routinely used fire to manage their environment. According to Baker, few Europeans actually observed Native Americans setting the fires that early explorers attributed to native people, and early explorers were also ignorant of the role lightning played in starting fires, when they attributed fire after fire to aboriginal ignitions. In addition, Baker (2002: 52) claimed that Europeans were biased in attributing fires to natives because whites wanted "to paint . . . Indians as reckless savages and poor land stewards who did not deserve to keep their land." That is to say, because Europeans thought fires were "bad," attributing landscape burning to native people would put aboriginal inhabitants in an unfavorable light. While there is some truth in this argument (Decker 2004), alternatively, early explorers could have attributed most fires to native people because native people started most fires (Pyne 2003).

One way to answer the questions raised by Baker is to look at the current distribution of lightning-caused fires and to compare those data with observations from the early 1800s. Higgins (1984) reported that the majority of lightning fires on the northern Great Plains occur during June, July, and August (Figure 4a). Currently, there are few lightning-caused fires early in the spring or late in the fall because there are few lightning strikes outside of June, July, and August. Alexander Henry the Younger (Gough 1988) manned a trading post on the northern Great Plains from 1800 to 1807, and in his daily journal

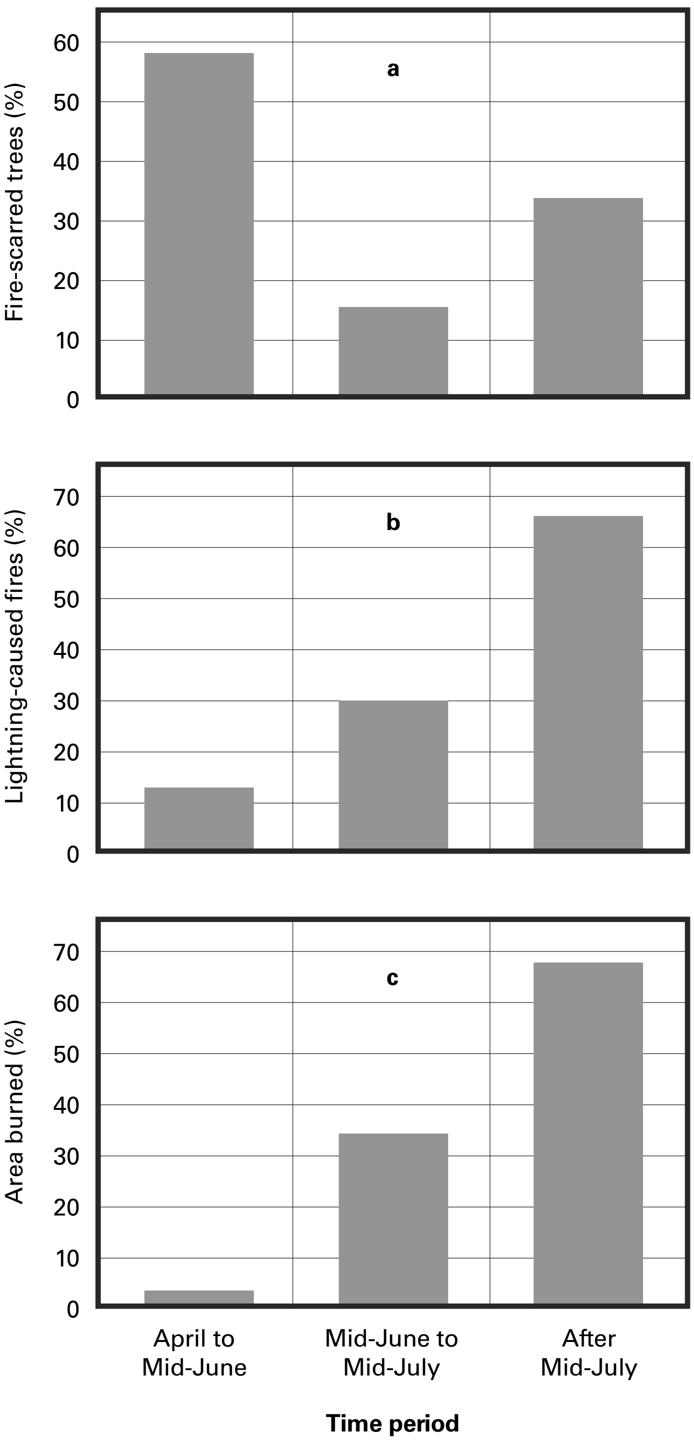

Fig. 3. *Fire history of Colorado's San Juan Mountains. (a) The proportion of trees scarred by fire during different time periods prior to 1880, as reported by Grissino-Mayer et al. (2004). (b) The distribution of lightning-caused fires reported on the San Juan National Forest from 1970 to 2002. Data provided by the National Interagency Fire Center, Boise, Idaho. (c) The distribution of the area burned by lightning-started fires on the San Juan National Forest from 1970 to 2002. Data provided by the National Interagency Fire Center, Boise, Idaho.*

he recorded when the surrounding prairies were on fire. Henry observed prairie fires early in the spring and late in the fall but failed to report a single fire during June, July, or August (Figure 4b).

Vegetation on the northern Great Plains is often too green to burn during the June, July, and August growing season, but during droughts, lightning can set the prairies on fire during those months—these are the fires we see today. In the past, though, fire commonly swept the northern plains during early spring and late fall when the grasses are normally cured-out. Because there are virtually no lightning strikes early in the spring or late in the fall, all the fires reported by Alexander Henry the Younger likely were set by native people, whether or not Henry actually saw natives set those fires.

Then, too, there is Peter Fidler's journal (Haig 1992), a source not cited by Baker (2002). During the winter of 1792–1793, Peter Fidler traveled with a band of Piegan natives from Buckingham House east of present-day Edmonton, Alberta, to the Oldman River just north of the U.S. border. Fidler entered the southern Canadian Rockies and his journal is the earliest, firsthand, European description of the Rocky Mountains. Fidler repeatedly described how native people, both inadvertently and purposefully, set the plains on fire. And, most amazingly, during winter, well outside what is today the "normal" burning season. As there are no lightning strikes on the northern Great Plains during winter, every fire reported by Fidler must have been set by native people.

In addition, Fidler reported that the plains were commonly afire during spring and fall, but he made a mistake by attributing the spring and fall fires, which he did not personally observe, to lightning, and not to natives (Haig 1992:36). As there are no lightning fires on the northern Great Plains during spring or fall (Higgins 1984, Wierzchowski et al. 2002), all the burning reported by Fidler can be attributed to native people. In the spring of 1793, Fidler left the southern Alberta prairies and returned to Buckingham House, a journey of approximately 480 km. Over that distance, Fidler reported that they could find virtually no unburned ground on which to pasture their horses, such was the extent of aboriginal burning:

Grass all lately burnt the way we have passed this Day towards the Mountain, but not to the South of us, but at a good distance in that direction the Grass is now burning very great fury, supposed to be set on fire by the Cotton na hew Indians. Every fall & spring, & even in the winter when there is no snow, these large plains either in one place or other is constantly on fire, & when the Grass happens to be long & the wind high, the sight is grand & awful, & it drives along with amazing swiftness [Haig 1992:36].

West Coast Forests

Frequent fires once shaped many coastal forests in northern California, Oregon, and Washington. Coastal redwoods (Sequoia sempervirens), for instance, historically were visited by fire every 10–20 y or less (Brown and Baxter 2003, Stephens and Fry 2005). Frequent fire also once maintained a multitude of prairies, balds, and open areas within the forest mosaic (Zybach 2003). Lightning fires in these forests, however, are virtually nonexistent and these areas have some of the lowest lightning-fire ignition rates in the West (Table 1). Thus, many ecologists and anthropologists attribute the earlier burning to native people, who used fire to improve the productivity of various plant communities (Norton 1979, Boyd 1986, Lewis 1990, Liberman 1990, Brown and Baxter 2003, Wray and Anderson 2003, Zybach 2003, Anderson 2005, Carloni 2005, Keeley 2005, Stephens and Fry 2005). In the absence of regular native burning, prairies and balds are now overrun by encroaching conifers. The entire Willamette Valley, for instance, which was largely a grassland at European contact, reverts to forest in the absence of regular burning (Habeck 1961, Boyd 1986, Zybach 2003).

Whitlock and Knox (2002), though, contend that declining fire frequencies are due to climatic change and that, historically, aboriginal burning was unimportant. Whitlock and Knox, however, failed to explain how global climatic circulation patterns could change to such an extent that lightning-strike densities would increase in coastal areas. Moreover, even if known lightning-fire ignition rates were 100 times higher in the past, they would still have been overshadowed by human ignition rates, as coastal areas of northern California, Oregon, and Washington were densely populated by a vast array of aboriginal people due to abundant stocks of salmon (Oncorhynchus spp.), vegetal foods, and marine resources (Zybach 2003). Whatever climatic changes may have occurred were inconsequential given the level of aboriginal burning that existed.

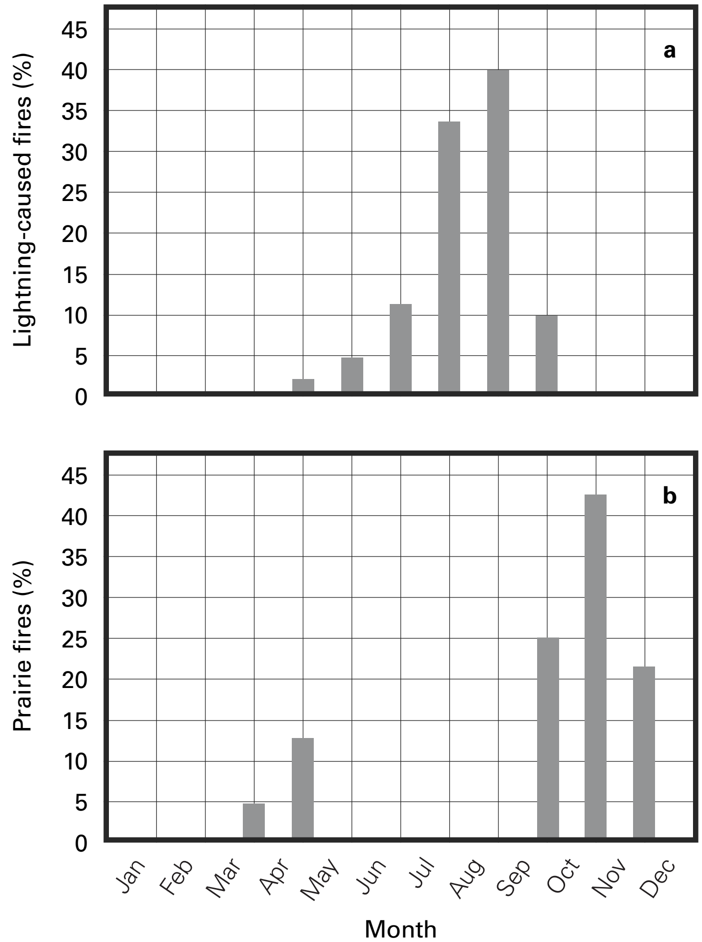

Fig. 4. *The distribution of fires on the northern Great Plains. (a) The distribution of lightning fires that occurred from 1940 to 1981, as reported by Higgins (1984). There are few lightning fires during spring or fall because there are very few lightning strikes during those periods. (b) The distribution of prairie fires as reported by Alexander Henry the Younger from 1800 to 1807 when the northern Great Plains were under aboriginal control (Gough 1988).*

First Contact

A similar debate has been going on for many years over what caused Pleistocene megafaunal extinctions as modern humans spread out of Africa (Kay and Simmons 2002). One school holds that climatic change drove the extinctions, while the other contends that humans killed-out the megafauna in the Americas and around the world—see Kay (2002) for a detailed discussion of this debate.

To separate between these competing hypotheses, Miller et al. (2005) looked at carbon isotopes in emu (Dromaius novaehollandiae) eggshells and wombat (Vombatus spp.) teeth—records that span 150,000 y in Australia. Miller et al. (2005) reported an abrupt change in feeding habitats 45,000–50,000 y ago when humans first colonized Australia. As noted by Johnson (2005:256), "The fact that the distributions and feeding habits of both species changed so little in response to climate extremes, but so much when people arrived, tells us that the impact of human arrival far exceeded the effects of any of the climate changes of the past 140,000 years." Miller et al. (2005:290) suggested, "that systematic burning practiced by the earliest human colonizers may have converted a drought-adapted mosaic of trees and shrubs intermixed with palatable nutrient-rich grasslands to the modern fire-adapted grasslands and chenopod/desert scrub." Similarly, Robinson et al. (2005:295) reported a sharp rise in charcoal recovered from sediment cores at the time humans initially colonized eastern North America and suggested that this represented anthropogenically driven "landscape transformation" on a grand scale. As humans drove the megafauna to extinction by hunting, escaped campfires and purposeful burning completely reconstituted vegetation communities.

Conclusions

According to Parker (2002:260), who discounted the ecological impact of aboriginal burning, "nostalgia and political agendas are no substitute for valid evidence," and I concur, as do others (LaLande 2003, Pyne 2003). The evidence suggests that lightning-caused fires were never more frequent than native-set fires—either escaped campfires or purposefully started fires at even the lowest aboriginal population estimates. Various ecological examples also suggest that native burning was a much more important ecological factor than lightning-caused fires. There is also the problem that reported fire return intervals do not present a true measure of how often areas once burned. It has been known for some time that low-intensity surface fires, which were the norm in many ecosystems prior to European settlement, do not scar each tree they burn, even if that tree had been previously scarred.

The only experimental data that I have been able to locate are for oaks in eastern forests where researchers repeatedly prescribed-burned stands at 1-, 2-, or 3-y intervals and then cut down the trees to count fire scars (Smith and Sutherland 1999, Sutherland and Smith 2000). On average, only one-third of burned trees were actually scarred by fire (Elaine Sutherland, U.S. Forest Service, personal communication). Similarly, Skinner and Taylor (2006) noted that 86% of Douglas-fir (Pseudotsuga menziesii) stumps with internal fire scars had no external evidence of the trees having been burned. When those hidden fire scars were taken into account, the estimated fire return interval declined by nearly 50% (Skinner and Taylor 2006:204–206), while Shirakura (2006) observed that only one in seven fires were recorded by oaks in east central Oklahoma. This would suggest that published fire-history studies tend to underestimate the true frequency of burning.

How often did areas burn in the past? As often as native people wanted them to burn. There is little doubt that Native Americans fully understood the benefits they could receive by firing their environment (Anderson 2005). To suggest otherwise is to assume aboriginal people were ecologically incompetent (Andersen 2005), a supposition that is not supported by any reading of the historical or ethnographic record (Mann 2005). Thus, the idea that the Americas were a pristine wilderness, untouched by the hand of man (Vale 2002) is a statement of belief, not a fact supported by science (Kay 2002, Pyne 2003).

Finally, this paper is a first attempt at estimating how many fires native people may have started and, as such, I did not consider cultural differences or how aboriginal burning may have varied over time, under different subsistence strategies, or by area. I also assumed that native people were systematically distributed across the landscape, which was surely not the case with more settled societies. Nevertheless, even with the simplifying assumptions that were employed, aboriginal use of fire most likely overwhelmed lightning ignitions as Stewart (1956, 1963, 2002), Anderson (2005), and others contend.

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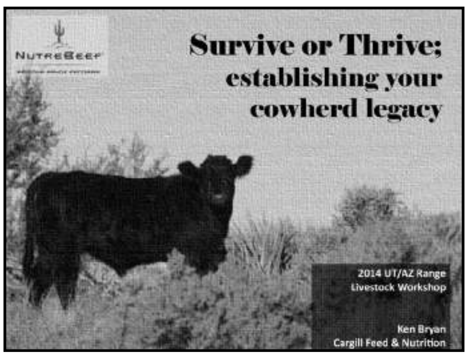
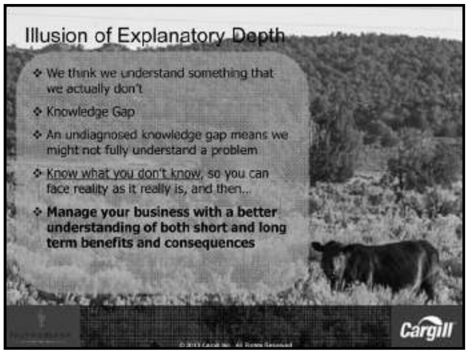
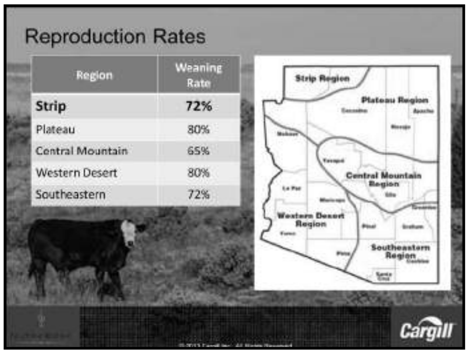
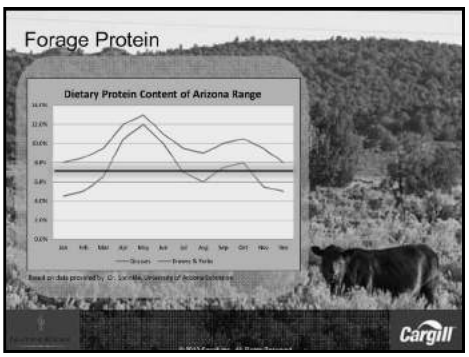
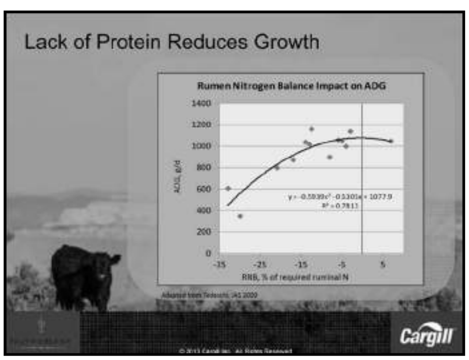
PRESENTATION | **NOTES**

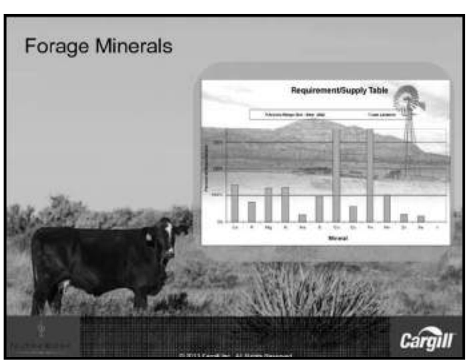


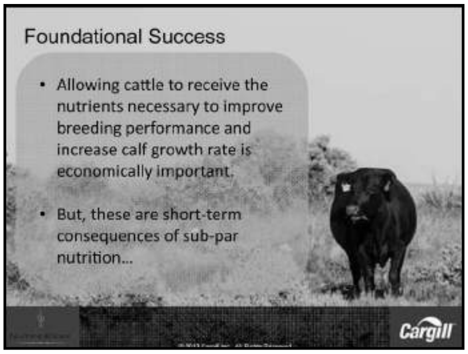

Illusion of Explanatory Depth
❖ We think we understand something that we actually don't
❖ Knowledge Gap
❖ An undiagnosed knowledge gap means we might not fully understand a problem
❖ Know what you don't know, so you can face reality as it really is, and then...
❖ Manage your business with a better understanding of both short and long term benefits and consequences
Cargill

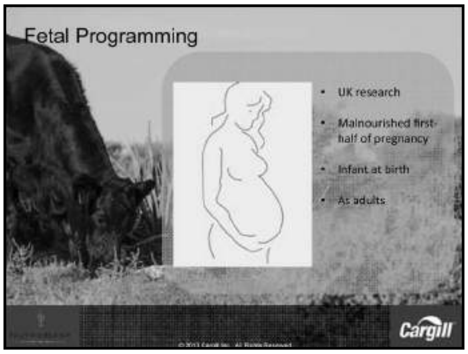

Reproduction Rates
Region | Weaning Rate
Strip | 72%
Plateau | 80%
Central Mountain | 65%
Western Desert | 80%
Southeastern | 72%
Strip Region
Plateau Region
Central Mountain Region
Western Desert Region
Southeastern Region
Cargill

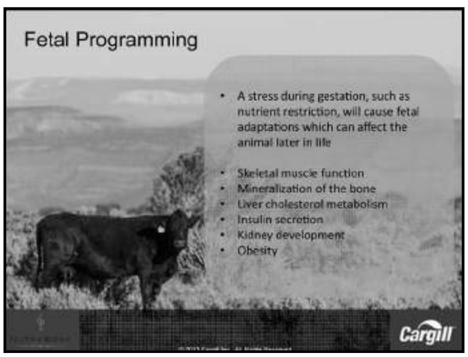

Forage Protein
Dietary Protein Content of Arizona Range
Cargill

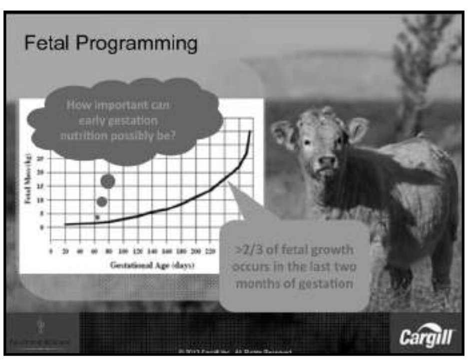

Lack of Protein Reduces Growth
Rumen Nitrogen Balance Impact on ADG
ADG, g/d
RNB, % of required ruminal N
Cargill

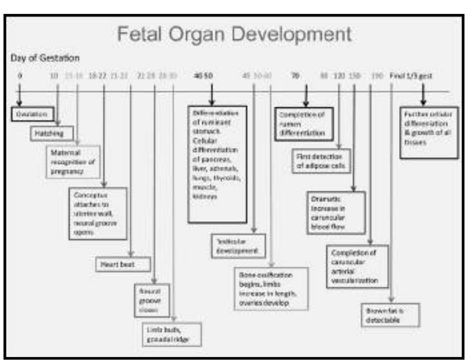

Forage Minerals
Requirement/Supply Table
Cargill

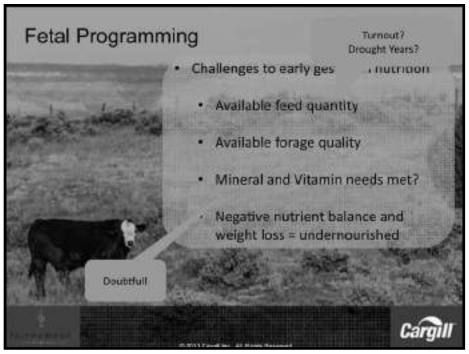

Foundational Success
Allowing cattle to receive the nutrients necessary to improve breeding performance and increase calf growth rate is economically important.
But, these are short-term consequences of sub-par nutrition…
Cargill

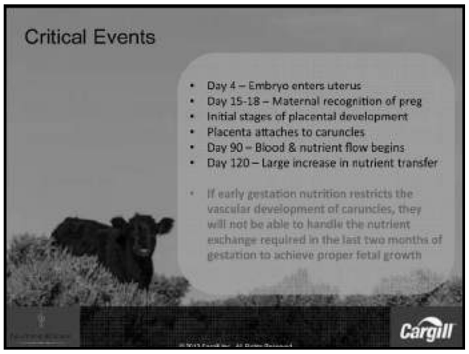

Fetal Programming
UK research
Malnourished first-half of pregnancy
Infant at birth
As adults
Cargill


Fetal Programming
A stress during gestation, such as nutrient restriction, will cause fetal adaptations which can affect the animal later in life
Skeletal muscle function
Mineralization of the bone
Liver cholesterol metabolism
Insulin secretion
Kidney development
Obesity
Cargill

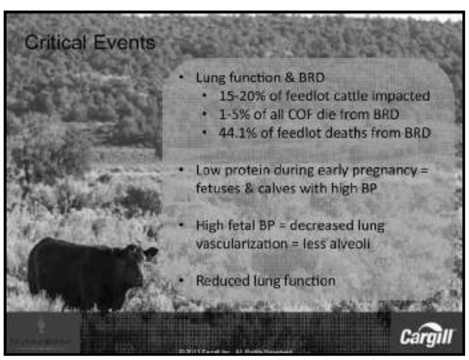

Fetal Programming
How important can early gestation nutrition possibly be?
Fetal Mass (kg)
Gestational Age (days)
>2/3 of fetal growth occurs in the last two months of gestation
Cargill

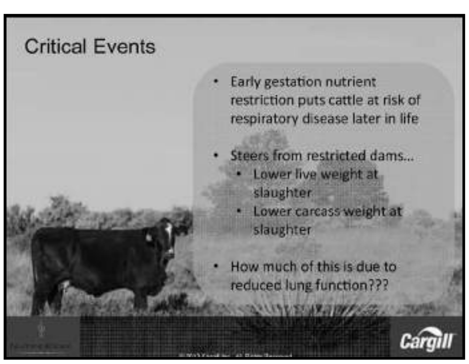

Fetal Organ Development
Day of Gestation
0
40 50
70
Final 1/3 gest
Ovulation
Hatching
Maternal recognition of pregnancy
Conceptus attaches to uterine wall, neural groove opens
Heart beat
Neural groove closes
Limb buds, gonadal ridge
Differentiation of ruminant stomach. Cellular differentiation of pancreas, liver, adrenals, lungs, thyroids, muscle, kidneys
Testicular development
Bone ossification begins, limbs increase in length, ovaries develop
Completion of rumen differentiation
First detection of adipose cells
Dramatic increase in caruncular blood flow
Completion of caruncular arterial vascularization
Brown fat is detectable
Further cellular differentiation & growth of all tissues


Fetal Programming
Turnout?
Drought Years?
Challenges to early ges nutrition
Available feed quantity
Available forage quality
Mineral and Vitamin needs met?
Negative nutrient balance and weight loss = undernourished
Doubtfull
Cargill

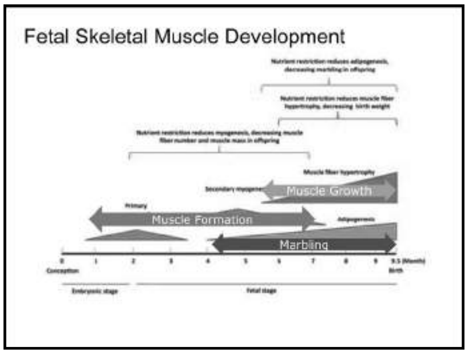

Critical Events
Day 4 – Embryo enters uterus
Day 15-18 – Maternal recognition of preg
Initial stages of placental development
Placenta attaches to caruncles
Day 90 – Blood & nutrient flow begins
Day 120 – Large increase in nutrient transfer
If early gestation nutrition restricts the vascular development of caruncles, they will not be able to handle the nutrient exchange required in the last two months of gestation to achieve proper fetal growth
Cargill

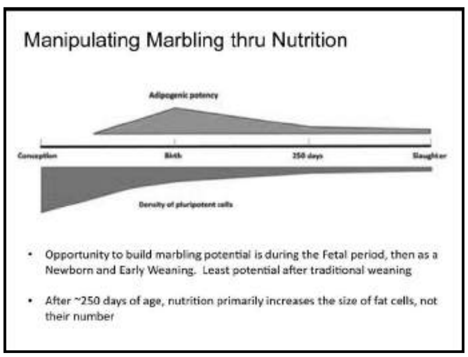

Critical Events
Many or veloped at
Each of these organs is susceptible to maternal undernutrition at different points in time!
Day 50-60 - Ovaries
Cargill

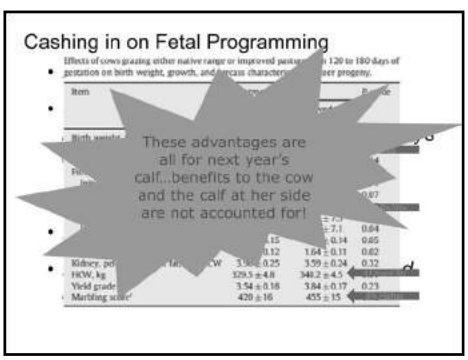

Critical Events
Lung function & BRD
15-20% of feedlot cattle impacted
1-5% of all COF die from BRD
44.1% of feedlot deaths from BRD
Low protein during early pregnancy = fetuses & calves with high BP
High fetal BP = decreased lung vascularization = less alveoli
Reduced lung function
Cargill


Critical Events
Early gestation nutrient restriction puts cattle at risk of respiratory disease later in life
Steers from restricted dams…
Lower live weight at slaughter
Lower carcass weight at slaughter
How much of this is due to reduced lung function???
Cargill

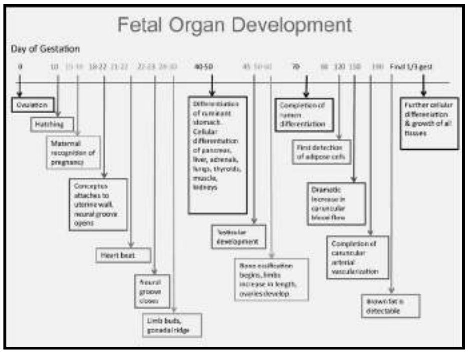

Critical Events
• Day 1-60 – Primary muscle fibers formed
• Day 60-210 – Secondary muscle fibers formed
• There is no net increase in muscle fibers after birth, so reduced formation is permanent
• Decreased fiber numbers reduces muscle mass and negatively affects animal performance
• Maternal nutrition that supports proper fetal growth will increase the number of intramuscular fat cells, and thus the marbling potential of the offspring
Cargill


Fetal Skeletal Muscle Development
Muscle Growth
Muscle Formation
Marbling
Conception
Birth
Embryonic stage
Fetal stage


Manipulating Marbling thru Nutrition
Adipogenic potency
Conception
Birth
250 days
Slaughter
Density of pluripotent cells
• Opportunity to build marbling potential is during the Fetal period, then as a Newborn and Early Weaning. Least potential after traditional weaning
• After ~250 days of age, nutrition primarily increases the size of fat cells, not their number


Cashing in on Fetal Programming
These advantages are all for next year's calf...benefits to the cow and the calf at her side are not accounted for!


Critical Events
• Heifers from protein supplemented dams:
• Heavier at pre-breeding, preg-check and beginning of 2nd breeding season
• Heifers from protein deficient dams:
• Same age at puberty, but fewer became pregnant,and fewer calved during first cycle
• More heifers from protein deficient dams failed to reach puberty prior to the breeding season
Cargill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Ovulation
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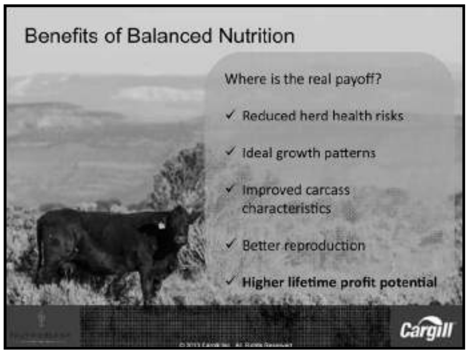
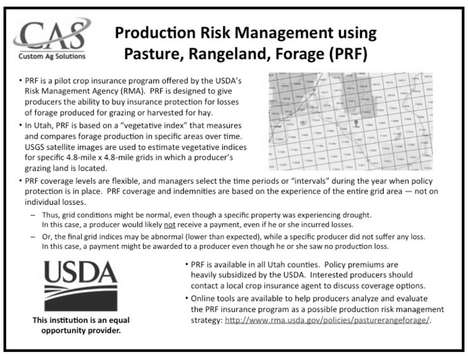

Benefits of Balanced Nutrition
Where is the real payoff?
✓ Reduced herd health risks
✓ Ideal growth patterns
✓ Improved carcass characteristics
✓ Better reproduction
✓ Higher lifetime profit potential
Cargill

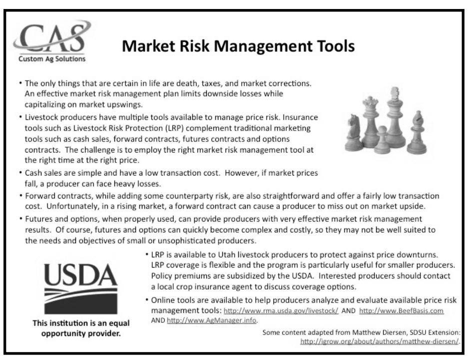

NutreBeef
Thank you!

LIVESTOCK MARKET OUTLOOK

John Mangus and Brett Crosby, Custom Ag Solutions

PRESENTATION





NOTES

HOW TO SELECT FOR THE PROPER PHENOTYPE, FERTILITY, GLANDULAR FUNCTION, BUTTERFAT, AND ADAPTABILITY IN YOUR COWS, REPLACEMENT HEIFERS AND BULLS

Steve Campbell, Triangle C Livestock

Steve has been around cattle in one capacity or another since the age of 12. His epiphany moment came in 1999 while recovering from a ranching injury. The resulting refocusing of his energies into learning about soil, plant, animal and human health since that time has led him to: some very old books; like-minded thinkers and mentors; on-farm experiments with soil fertility; and to numerous speakers, farm visits, and conferences over the past dozen years. From the Weston A. Price philosophy for human health to Carey Reams and Maynard Murray for soils to Jerry Brunetti, Dr. Richard Olree, Gearld Fry and the teachings of numerous authors of yesteryear; Steve has spent that period learning from these wise men (and women) to not only change his personal eating habits...but to extrapolate those learned principles of nature into his own farmland and animals and to help others make similar improvements on their farms and with their families' health.

Steve has spoken one or more times at: The MOSES Conference (Midwest Organic Sustainable Education Service), Northern Plains Sustainable Agriculture Society, Red Devon USA, Dixon Water Foundation School, North Central Texas College, North American Devon Association, the American Herbataurus Society conference and was the keynote speaker at The 21st annual GrassWorks Grazing Conference in January of 2013 along with presenting numerous times in conjunction with Gearld Fry.

Steve owns Tailor Made Cattle and Triangle C Beef. You can reach him at.

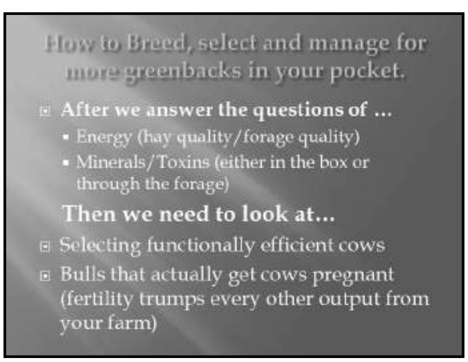
trianglec3@gmail.com

208-315-4726

Trianglecbeef.com

Tailormadecattle.com

PRESENTATION



NOTES

Do I See What I am Looking at

Let's stop laundering money for the bank and the industrial complex

What works best in your environment with your management

LARRY CSONKA

Commercial

BARRY SANDERS

Niche Market

- Technological improvements including vaccines, implants, beta-agonists, ionophores, anthelmintics and *improved* genetics have increased cattle productivity by 80% in the last 50 years.
- But these so called *improvements* have come with a hefty price tag, and too often the only businesses that see their profits increase are the ones selling the technology.
- We have created animals that are very productive in a high-input environment but they are often ill-adapted to thrive under natural, low-input conditions.

Relationships for a natural, low input environment

- **Genetics** = efficiency, repeatability and tenderness of the grazing animal
- **Phenotype** = efficiency, adaptability and meat-to-bone of the grazing animal
- **Butterfat** = easier keeping cows and easier fleshing calves
- **Rumen** development = higher efficiency of digestion of what is eaten. 55% vs. 70%
- Glandular function = cows that naturally resist diseases and parasites

Glandular Function

- **Selecting** for good **glandular function should be number one priority**
- Our **ancestors** knew and used these landmarks
- Did any of you get a degree in Animal Husbandry?
- Do you know how to preg-check your cows without putting on a glove?
- You can tell the sex of a calf by looking at the hair on the tail of a the cow.

Energy partitioning by the cow

1) Basal metabolism
2) Activity
3) Growth
4) Basic energy reserves
5) Pregnancy
6) Lactation
7) Additional energy reserves
8) Estrus cycles and initiation of pregnancy
9) Excess reserves
10) Too fat to conceive

Abundant Nutrition = Genetic Expression

"It is not what we eat but what we digest that matters."

What to do if the minerals are not in their feed…we have to buy supplements

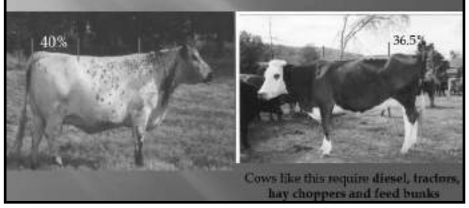
- What if they have available minerals but are "failing to thrive"
- Glandular function
- Rumen development

What does a fully developed rumen do for the animal

- Allows them to get more out of what they eat.
- 55% vs. 70% utilization of feed
- Money spent now pays you back many fold over the life of the animal ~ 10% less feed X 12 years
- Come weaning day, select your replacements and **put them back with their mothers**. You may have to supplement the mothers for one winter, but the replacement heifers will **cost you less to feed rest of their lives**.

"Let's make a Rumen" "Door number 4 please Bill"

Do you want a cow or a cow that can help Create



Minerals for the soil and for the cow

- 90 of the 92 minerals in sea solids can be taken up by grass.
- Trace minerals act as keys which unlock the ability of the immune system to ward off invaders.
- Cody Holmes moved every day.

Nutrition and lifestyle (*Epigenetics*) determines the expression of the available genetics. *Dr Arden Anderson*

Every Organism inherits certain potentialities, but the extent to which these are realized **depends on the environment.** *(Epigenitics)*

"Cancer is the wrong expression of the right gene because **the wrong minerals** were present." *Dr. Richard Olree*

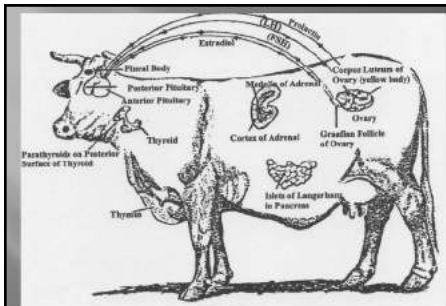
Low maintenance is dependent upon

- Glandular function/butterfat
- Management/development
- Phenotype
- Environment
- Nutrition

Low Maintenance Cows

- Nature helps us to select animals to fit our environment, if we will pay attention.
- Weaning weight increase begins to slow significantly around 1100 lb cow weights.
- Similarly the gland system for a large cow is like putting a 350 CFM gland system on a 429…we can only get so much air through that carburetor.
- How many 6' 8" spry old men have you seen???

I would like to remind you of some things that have been forgotten.



Man Must Measure Dr. Jan Bonsma

Selection… where to start?

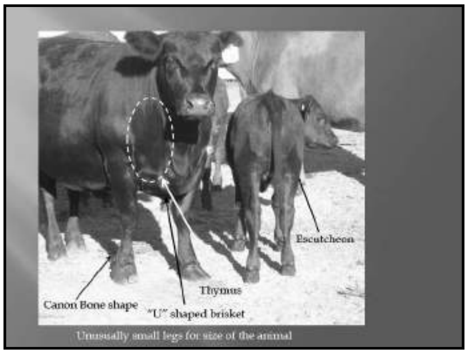
Adrenal, Escutcheon and Thymus

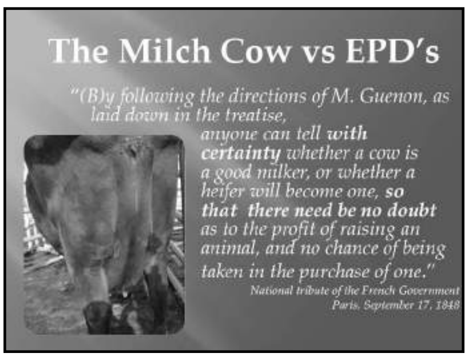
Pancreatic

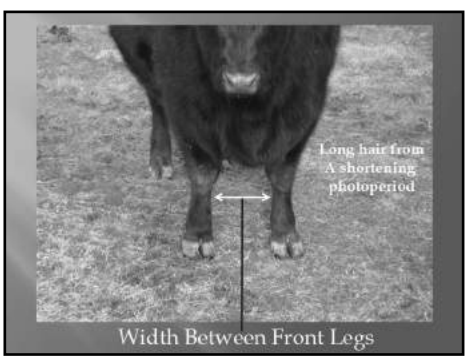
Selection

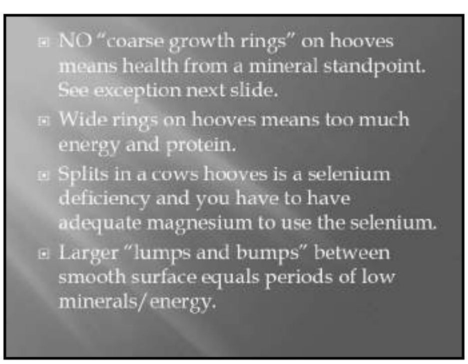
- Pointed poll
- Neck folds
- Unusually small legs
- Broom tailed cow
- Wide mouth
- Bald udder
- Extra teats
- Good escutcheon
- Adrenal in the right place
- Flat bottom line width between front legs
- "U" shaped brisket/Upside down U in the back
- Toes straight forward and the back hoof landing in the same track the front just left


Adrenal
Pointed Poll


Escutcheon
Thymus
Canon Bone shape
"U" shaped brisket
Unusually small legs for size of the animal


The Milch Cow vs EPD's
"(B)y following the directions of M. Guenon, as laid down in the treatise,
anyone can tell with certainty whether a cow is a good milker, or whether a heifer will become one, so that there need be no doubt as to the profit of raising an animal, and no chance of being taken in the purchase of one."
National tribute of the French Government
Paris, September 17, 1848


Long hair from
A shortening
photoperiod
Width Between Front Legs


NO "coarse growth rings" on hooves means health from a mineral standpoint. See exception next slide.
Wide rings on hooves means too much energy and protein.
Splits in a cows hooves is a selenium deficiency and you have to have adequate magnesium to use the selenium.
Larger "lumps and bumps" between smooth surface equals periods of low minerals/energy.

- A heifer/cow will grow a **very tiny ring** on her hooves every time she cycles. Rings will stop once she gets pregnant.
- If she aborts she will cycle again and the rings will start showing up again.
- Adrenal hair lays down when pregnant
- Pancreatic whorl enlarges = pregnant
- Horns of a cow will tell you if she has aborted just like they will tell you periods of infertility in a bull.
- We are simply observing the effects of estrogen and progesterone

Inheritance from Cow and Bull

- 120 days on the best feed
- Choice of cow and bull
- Intra-uterine environment
- Mineral dump 3 weeks pre calving
- Butterfat for the calf
- Mineral-rich grasses
- Wean onto the same plane of nutrition.

Dick Diven Low Cost Cow/Calf

Calving ease and higher conception rates

- If you are calving when the potassium is at its greatest in the spring, you will have fewer calves to pull.
- Less Dystocia with adequate Potassium
- If you art putting your bulls in when the native grasses in your area are going to seed, there will be more manganese in the bull and cow's feed.
- Manganese is vital for reproduction
- Next slide is from Dick Diven

Impact of BCS and Day Length on the Postpartum Interval of Cows at 40° N

(Why it is hard to get skinny cows to breed back on time in the winter)

Month	Photoperiod (Hours)	Days Postpartum BCS 5	Days Postpartum BCS 6
[illegible]	[illegible]	[illegible]	75
February	9.5	79	73
[illegible]	[illegible]	[illegible]	66
April	11.7	63	56
[illegible]	[illegible]	[illegible]	47
June	14.2	45	38
[illegible]	[illegible]	[illegible]	[illegible]
August	14.6	43	36
[illegible]	[illegible]	[illegible]	[illegible]
October	12.2	59	53
[illegible]	10.9	69	62
December	9.7	78	71

Impact of Latitude (Day Length) on the Postpartum Interval of Cows in BCS 6

(Fighting mother nature gets more costly the further North we live)

Month	35°	40°	45°	50°
[illegible]	[illegible]	[illegible]	[illegible]	84
February	70	73	76	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
April	56	56	57	57
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	41	38	35	31
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
August	39	36	32	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October	53	53	52	52
November	61	62	64	66
December	66	68	71	74

What do the last two slides actually mean to you

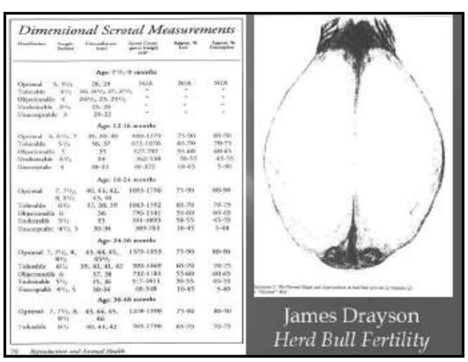
- When the Potassium is highest in your grass in the spring, you should be 1/3 through calving.
- Why? Potassium helps prevents dystocia. Simply by changing the date you calve you will pull fewer calves
- You should put your bulls in when the native grasses in your area are going to seed.
- Why? Seed heads have Manganese. Manganese is vital for reproduction.
- *Human aside. We sit on heated seats and eat seedless watermelons and grapes…and then take fertility drugs???*

All calves are born with summer hair coat

Fertile Bulls

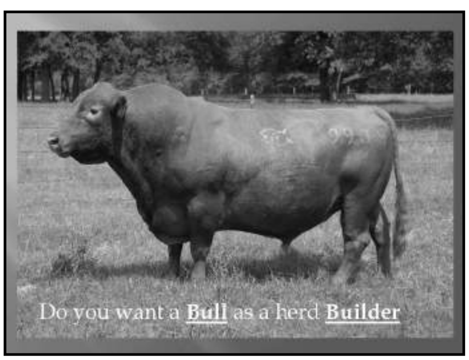
- Average bull today only breeds/impregnates 25-30 cows & leaves 10-15% of those cows open first 45 days of breeding season
- Highly fertile bulls get 80% of cows pregnant first 21 days of breeding season
- Highly fertile bulls impregnate 50-60 cows in 45 days, 95-99% of all cows served are pregnant
- S/W minus R/L The larger the difference the shorter the gestation length.

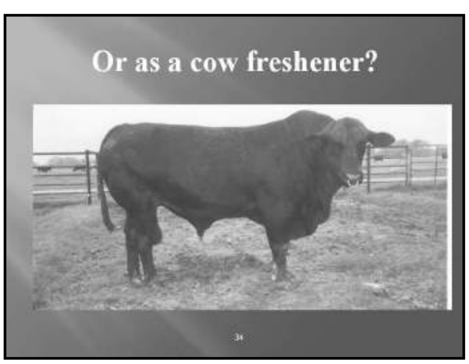
- According to Dan Drake, the University of California–Davis study
- All ranches used a 25:1 cow-to-bull ratio in breeding pastures of 100 acres or less.
- "One bull actually sired 64 calves in a crop. One bull sired one calf, and more than one bull sired no calves at all."
- It was not uncommon for one-third of a bull's single-season progeny to have been sired during one 24-hour period.
- "It wasn't the bulls with the highest weaning weight or yearling weight EPDs. It was not the sires of the heaviest calves," said Drake. "**It was the bulls that sired the most calves.**"

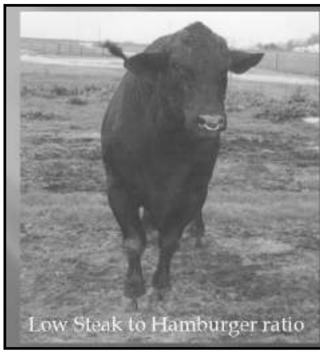


Semen Standards for Fertile Bulls

1) 90% live sperm count
2) 80+% motile cells
3) 5% abnormal; *Thermo-regulatory mechanism*
4) 1.5+ BILLION cells per cc seminal fluid
5) These bulls will impregnate 85-90% of cows in the first 21 days of breeding season






Low Steak to Hamburger ratio

Measure the width from shoulder blade to shoulder blade.
On a yearling you will have between 3.5" - 8.5"
This tells you the "Steak to Hamburger" ratio on his sons

When to bring your new bull home.

- It takes 120 days to change out all of the red blood cells in our or a bovine's body.
- Dr Fred Provenza found that an animal will never perform as well as on the pastures he was developed on (Unless a higher plane of nutrition).
- Pick your bull up a day or two before you want to start using him.
- Within 60 days of a move to your pasture, his semen quality and quantity will be down because of different feed, adaptation and **"his job!"**

Selecting heifers

- The day they are born…
  - Bald udder/extra teats
  - Shape of Escutcheon
  - Placement of Adrenal
  - Born in the first 21 days

  Flank minus girth needs to be 2" or more

  Rump length percent needs to be 38-40%
- Early shedding in spring denotes healthy glandular function.
- Normally developed vulva.
- She indicates she is cycling regularly.

Developing heifers

- Leave them on their mothers 10 months.
- Spend a little extra on their mothers this winter to save 10-15% per year, for 10-12 years, on the next generation of cows in your herd.
- They really need to be bred when their brisket starts filling. (*If we are using grain to do this, we are only cheating ourselves!*)
- Filling brisket means they are developed enough to breed but not too fat for milk production

Linear Measuring the Bull & Cow For Grass & Reproductive Efficiency

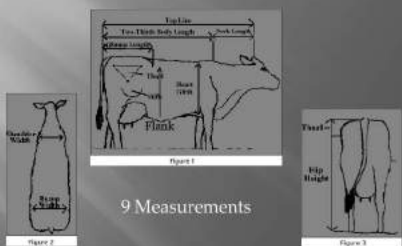

- Linear Measurement accurately and objectively evaluates what the animals is.
- We have to know what animals will work in our environment and select for them.

- Wide shoulders with a deep chest are critical for optimum grass utilization & reproduction.
- A wide rump is a major indicator for femininity & reproduction in the cow.
- Wide shoulders and a large crest are the major indicators for masculinity in the bull.
- Correct top line and bottom line with a full loin is necessary for high carcass yield & greatest return. (37#)

For every 2" additional heart girth will result in 1 less pound of feed to get a pound of gain.

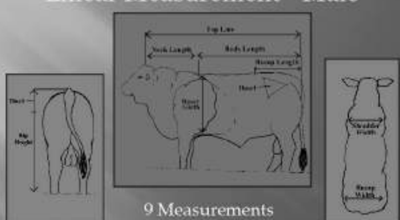
- The bovine body has to be balanced for true functionality, longevity & reproductive efficiency

Linear Measurement - Female



9 Measurements

Linear Measurement - Male



9 Measurements

For every inch shoulders are wider than rump length (*at one year of age*) = average 2.5 fewer days of gestation.

Top line/Heart Girth

- Top line is the measurement form the pin bones to the poll.
- Heart girth is taken just behind the front legs
- For every inch the heart girth is greater than the top line, there are 37 more pounds of red meat in the animal *(and that mother cow is much more functional*).

Linear measurement can help you train your eye

Cows like this require **diesel, tractors, hay choppers and feed bunks**

HEART GIRTH is directly related to feed efficiency/rebreeding/adaptability/ability to handle stress/disposition

- Basal metabolic rate is .77/100 mega cals +/- 15% (which equals 10 mega cals).
- The range of cows will be .77-.87/100 mega cals
- 67 is an easy keeper
- You can determine this by comparing her H/G to 1.5 X her 2/3 line PLUS is easy keeper. MINUS is a harder keeping animal.
- A hard keeping heifer winds up being the one that does not rebreed most of the time.

Importance of Heart Girth/body length

- A large factor in Meat-to-Bone Ratio
- "Rain nor sleet not chill of night" cause a disruption in this animals day.
- Usually comes attached to easy keeper
- Typically comes with a wider and longer rump = *calving ease in cows and extra beef in steers.*
- **Secretariat** … a factory with enough room for the "equipment" to work.

Why don't we pay attention when mother nature says our selection processes are not working.

- In the North we need a large heart girth shaped like a big round "O"
- In the South we need a large heart girth shaped like an "oval" to dissipate heat.
- The further North we go, the harder it is to calve every twelve months if we calve too early.

Perfect Body Conformations

- Rump length = 38-40% of Back
- Length of back & rump height are same.
- Neck of cow is half of body length
- Neck, bull 2-3 inches shorter half of back
- Heart girth equal to top line or greater
- Flank of cow 4+ inches greater top line
- Flank of bull equals top line
- Large crest neck of bull

We want a rump width 44% or greater on a bull

Note upside down "U"

Perfect Body Conformations

- Shoulders of bull 4 inches or more wider than rump length
- Shoulders of cow same width as rump length
- Rump width of cow 3-5 inches wider than rump length
- Bull rump width to height ratio 46%+
- Cow rump width to height ratio 42%+

How to see this in the animal

- The less of a cow or bull's height from knees down the better.
- Structurally correct shoulders shows elevated testosterone and estrogen.
- Narrow shoulders represents a high maintenance individual, gives a low return on any feed [*grass or grain*] that is consumed.
- 37 pounds of red meat…Each one inch difference in the top line/heart girth either gains or takes away 37 pounds of red meat in the animal.

How to see continued

- Toes pointed straight forward (*front and rear…not "Cow Hocked"*)
- "U" shaped Brisket
- Upside down "U" in the rear
- Rear hoof lands where the front leaves.
- Flat bottom line
- Full loin
- No chine or grow bone sticking up above the back.
- Width between front legs

- **Meat-to-bone ratios**
  - 2.0 approximately a 55% ratio
  - 2.5 approximately a 59% ratio
  - 3.0 approximately a 63% ratio
  - 3.5 approximately a 67% ratio
  - 4.0 approximately a 71% ratio
  - 4.5 approximately a 75% ratio
  - This is a very significant return if you are selling direct to the customer

Grazing … Dr. Lee Manske

- When 25% of the grass tiller leaf area is removed during the first grazing period, 140% of the leaf weight removed is replaced by the compensatory growth processes.
- When 50% of the grass tillers leaf area is removed during the first grazing period, **only 70% of the leaf weight** removed grows back.
- When 25% of the grass tillers leaf area is removed during the first grazing period, the **quantity** of secondary tillers increases 40% during that same growing season **and increases 64% to 173% during the second growing season.**

What do those numbers mean

- **40% increase** in grass growth this year!!! versus 30% lower grass growth this year.
- **64%-173% increase in growth next year**!!! versus 63% to 144% **decrease in growth next year**
- This will allow for growth during lactation and post weaning for the calves, feeding less hay because of more grass production on your farm.
- The amount of Biology in the soil will increase or decrease based on which grazing practice we choose.

Developing Dairy heifers on Grass

- It costs $780 to develop on grass to first lactation
- It costs $1300 to develop on a TMR
- On the other end
  - Heifers developed on grass produced an average of 2000 **more** pounds of milk a year
  - Both groups were producing that milk on a TMR

University of Wisconsin

More milk for your beef calves out of the same cows

Dick Diven stuff

- Most technological solutions are expensive and hard to justify when the crop we produce (e.g. pasture) has a relatively low economic value.
- The first paradigm shift is to **change our focus from production to profit**. North American livestock producers are the most productive in the world. We are also the least profitable.
- The key to conception is **BCS** at the time of calving. Calving in an undesirably low BCS is the result of mismanagement or a natural disaster such as drought
- Anyone attending with a less than 90% conception rate, ask me for the Dick Diven Word Document

December 6-8, 2007

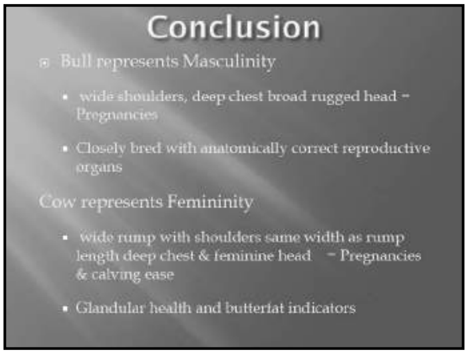
- Sorted through 1400 cows using "these" methods
- Linear measure and ultra sound "best" 275
- Rejected 50 of the 275
- Did not worm or feed hay 225 "keepers"

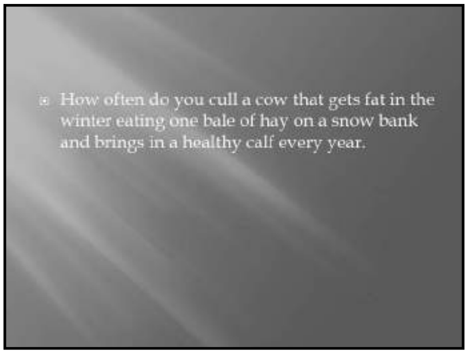
…AND…

- 3 ½ months later the rancher sold 900 of the cows in the other bunch
- How often do you cull a cow that gets fat in the winter eating one bale of hay on a snow bank and brings in a healthy calf every year.

2008-Single trait selecting

- Oregon – Rancher keeping every heifer and breeding for 21 days and then pulling the bull
- Kept every pregnant heifer
- This was his answer to calving troubles … shorten the period of time he had to pull calves
- Most rapid decline in the phenotype of the animals of any herd I have looked at.
- Some of the 11-15 years old cows his father had selected were very nice.
- The longer the son used his program the poorer the animals were.
- A better system would have been to choose **calving ease heifers.**


Conclusion
Bull represents Masculinity
wide shoulders, deep chest broad rugged head – Pregnancies
Closely bred with anatomically correct reproductive organs
Cow represents Femininity
wide rump with shoulders same width as rump length deep chest & feminine head – Pregnancies & calving ease
Glandular health and butterfat indicators


How often do you cull a cow that gets fat in the winter eating one bale of hay on a snow bank and brings in a healthy calf every year.


Tools to take home
We need to select functional cows.
We need to maximize the genetic potential and functionality of our herd when we breed.
We need to properly mineralize our animals and eliminate toxins for full genetic expression (Epigenetics)
We can create the finest grass in the world, but if we only have long/tall genetics w/o rumen development, we won't be able to efficiently harvest that grass.


Tailor Made Cattle:
"Have tape…Will Travel"
Steve Campbell
2365 Echo Avenue
Parma, Idaho 83660
Cell: 208-315-4726
Email: trianglec3@gmail.com
Web: tailormadecattle.com

RANCH SPONSORS

Our Ranch Proudly Supports the Range Livestock Workshop

50 Mile Cattle Co. Fredonia, AZ

Owners: Shane and Sonny Stottlar and Caleb Miller

With pride we brand our livestock with

"AN"

Our Ranch Proudly Supports the Range Livestock Workshop

7 D Ranch Mt. Trumbull, AZ

Owners: Larry and Kole Iverson

With pride we brand our livestock with

"Seven D"

Our Ranch Proudly Supports the Range Livestock Workshop

Antelope Ranch Hurricane, UT

Owners: Devin and Bonnie Ruesch

Employee(s): Family

With pride we brand our livestock with

"Slash-One"

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Brinkerhoff Livestock Glendale, UT

Owner: Eric Brinkerhoff

Employee(s): Raymond Brinkerhoff

With pride we brand our livestock with

"Two Bars B"

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Bundy Ranch Mt. Trumbull, AZ

Owners: Orvel and Sally Bundy

With pride we brand our livestock with

"Lazy SO"

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Carroll Ranch Orderville, UT

Owners: Norman Carroll/ Merlin Esplin

Employee(s): Kim Cox

With pride we brand our livestock with

"E Lazy V"

Our Ranch Proudly Supports the Range Livestock Workshop

DHC Agriculture Alton, UT

Owners: Dustin and Harmony Cox

Employee(s): Esther, Ruth, Rachel, Emma & Elisabeth

With pride we brand our livestock with

"C 7"

Our Ranch Proudly Supports the Range Livestock Workshop

Dodds Cattle Co. Panguitch, UT

Owners: Maloy and Wally Dodds

With pride we brand our livestock with

"Double 5"

Our Ranch Proudly Supports the Range Livestock Workshop

Ed Bundy Ranch Mt. Trumbull, AZ

Owners: Ed and Connie Bundy

Employee(s): Family

With pride we brand our livestock with

"X O"

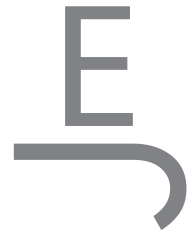
Our Ranch Proudly Supports the Range Livestock Workshop

E Lazy J Ranch North Black Rock MT, AZ

Owners: Allen M. Jones and Ron Leavitt

With pride we brand our livestock with

"E Lazy J"



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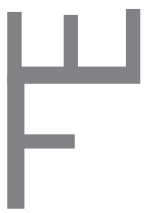
Elden Frandsen Livestock Panguitch, UT

Owner: Elden Frandsen

Employee(s): Pam Frandsen

With pride we brand our livestock with

"Lazy E with a Hanging F"



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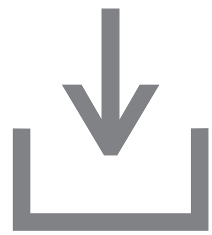
Esplin Livestock, LLC Mt. Carmel, UT

Owners: Eric and Kline Esplin

With pride we brand our livestock with

"Dart Box"



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Fenton Bowler Ranch Veyo, UT

Owners: Fenton and Margie Bowler and Family

With pride we brand our livestock with

"L B"

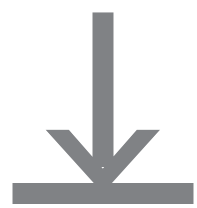
Our Ranch Proudly Supports the Range Livestock Workshop

Fincum Land and Livestock/Coyote Buttes Ranch South of the Utah Border

Owners: Ron Henderson and Sherre Finicum-H

With pride we brand our livestock with

"Aqave (Cactus)"



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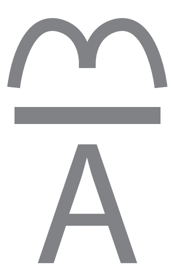
Finicum Ranch Cane Beds, AZ

Owners: Finicum Trust: David/Don Finicum

With pride we brand our livestock with

"(Oxbow) Three Bar A"



Our Ranch Proudly Supports the Range Livestock Workshop

Gardner's DeMar Ranch St. George, UT

Owners: Larry, Allen, Janice Gardner and Louise Zeenati

Employee(s): Ryon Gardner

With pride we brand our livestock with

"Lazy RU"

Our Ranch Proudly Supports the Range Livestock Workshop

Gubler Ranch, LLC Wolfhole, AZ

Owners: Bill and Zach Gubler

With pride we brand our livestock with

"711"

Our Ranch Proudly Supports the Range Livestock Workshop

Heaton Cattle Company, LLC
St. George, UT

Owners: Tony Heaton Family

With pride we brand our livestock with

"Bar 10"

Our Ranch Proudly Supports the Range Livestock Workshop

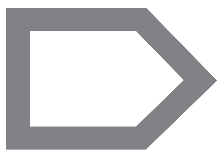
Heaton Livestock, LLC Alton, UT

Owners: Karl, Raymond and Charles Heaton

Employee(s): Kale & Chad Heaton

With pride we brand our livestock with

"Flat Iron/House"



Our Ranch Proudly Supports the Range Livestock Workshop

JW Farms Hurricane, UT

Owners: John and Colette Wadsworth

With pride we brand our livestock with

"JW Combined"

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K Diamond Ranch Panguitch, UT

Owners: Allen and Jeannie Henrie and Sons

Employee(s): Grandkids

With pride we brand our livestock with

"K Diamond"

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Layton Cattle Co. Beaver Dam, AZ

Owners: Steve and Larene Layton

Employee(s): Kolter Layton/ Rokelle Reeve

With pride we brand our livestock with

"L K"

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Little Livestock Kanab, UT

Owners: Lane and Susan Little

Employee(s): Family

With pride we brand our livestock with

"X Bar"

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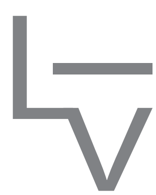
L V Bar Ranch Cane Beds, AZ

Owner: LaVoy Finicum

With pride we brand our livestock with

"L V Bar"



Our Ranch Proudly Supports the Range Livestock Workshop

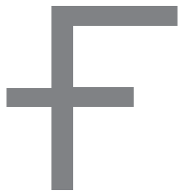
Mackelprang Ranch Bean Hole, House /Rock Valley

Owners: Mackelprang Family Trust

Employee(s): Family

With pride we brand our livestock with

"Cross F"



Our Ranch Proudly Supports the Range Livestock Workshop

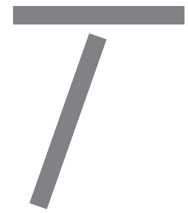
Mackelprang Ranch Bean Hole, House /Rock Valley

Owners: Mackelprang Family Trust

Employee(s): Family

With pride we brand our livestock with

"Bar Stripe"



Our Ranch Proudly Supports the Range Livestock Workshop

Milton and Helen Hall Ranch Hurricane, UT

Owners: Milton and Helen Hall

With pride we brand our livestock with

"Quarter Circle 2"

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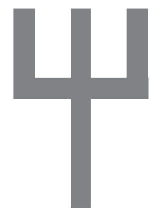
Paul O. Mangum Ranch Tropic, UT

Owner: Paul Mangum

With pride we brand our livestock with

"Pitch Fork"



Our Ranch Proudly Supports the Range Livestock Workshop

R.C. Atkin Inc. St. George, UT

Owners: R.C. Atkin Family

With pride we brand our livestock with

"Top Hat"

Our Ranch Proudly Supports the Range Livestock Workshop

Reeve Livestock Hurricane, UT

Owners: Reeve Livestock

With pride we brand our livestock with

"N 7"

Our Ranch Proudly Supports the Range Livestock Workshop

Roger Pugh Ranch Kanab, UT

Owner: Roger Pugh

Employee(s): Arkay Pugh

With pride we brand our livestock with

"Three Quarter Box Box"

Our Ranch Proudly Supports the Range Livestock Workshop

Rockin h Ranch Kanab, UT

Owner: Hal Hamblin

With pride we brand our livestock with

"Rockin h"

Our Ranch Proudly Supports the Range Livestock Workshop

SC Esplin Inc Yellowstone, AZ Strip/ St. George, UT

Owners: Stan and Diane Esplin

Employee(s): Doug, Jeff, and Justin Esplin

With pride we brand our livestock with

"74 and L Lazy E"

Our Ranch Proudly Supports the Range Livestock Workshop

Shakespear Ranch Tropic, UT

Owners: Carl and Kay Shakespear

With pride we brand our livestock with

"Bar Triangle Gar"

Our Ranch Proudly Supports the Range Livestock Workshop

Western Legacy Farm & Ranch/S Lazy B Cattle Hurricane, UT

Owners: Kelby and Kathy Iverson

With pride we brand our livestock with

"S Lazy B"

BREED ASSOCIATION SPONSORS

Utah & Idaho Gelbvieh Association
Utah Horned and Polled Herford
American Maine-Anjou Association

This bull produces better mamas, not headaches

There's no mama like a Hereford-sired mama. Net income of $51 more per cow per year and a 7% advantage in conception rate, compared to straight Angus females.* All this from a bull that is known for its fertility and easy-going nature. Hereford bulls — better mamas and no headaches.

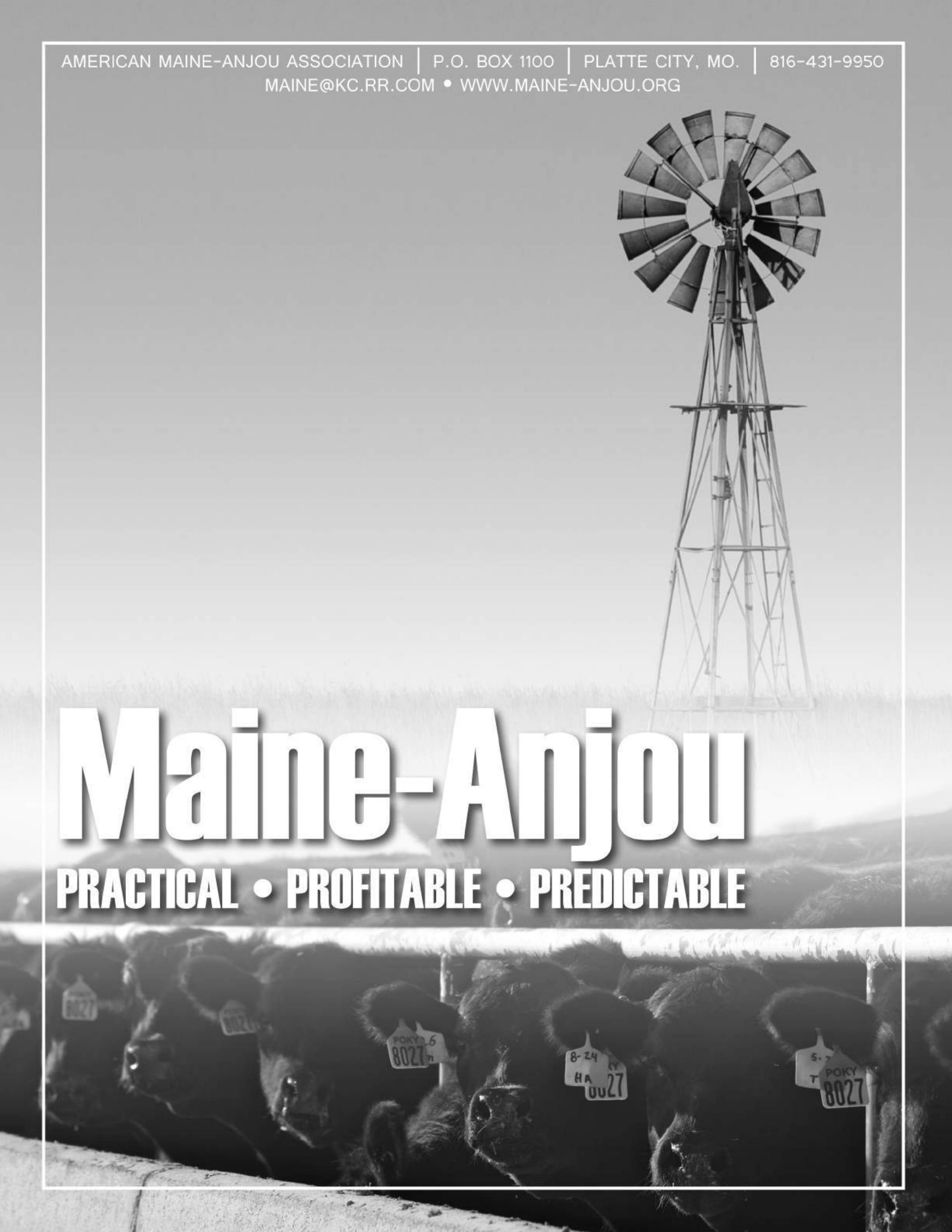
Hereford — *gentle bulls* **making black better.**

* Data from the Circle A Ranch Heterosis Project

American HEREFORD ASSOCIATION

P.O. Box 014059 ■ Kansas City, MO 64101
816.842.3757 ■ www.hereford.org

Utah Polled and Horned Hereford Association
Shannon Allen, President
(435) 624-3285
sjallen@color-country.net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PRACTICAL • PROFITABLE • PREDICTABLE

36TH ANNUAL AZ/UT RANGE LIVESTOCK TOUR AGENDA

Thursday, April 10, 2014

Tour starts at 8:00 AM Utah time (Mountain Daylight Time) from the BLM parking lot
345 E. Riverside Drive, St. George, UT.

9:00 AM Stop #1	**Wolfhole Valley/Whiterock-Soapstone:** Pinyon-Juniper Maintenance Treatment with Agro Ax **Bill Gubler:** Whit Bunting
9:30 AM	**Diamond Mowers:** Discussion of Product **TJ Honke** (Lunch Sponsor)
10:00 AM	Depart for Mt. Trumbull School
10:45 AM Stop #2	**DuPont:** Product Overview **Nevin Dupesis** (Lunch Sponsor)
11:15 AM	History and Stories of life on the Ed Bundy Ranch, Mt. Trumbull, AZ Ed Bundy
12:30 PM	Remain at Mt. Trumbull School House, Lunch Provided
1:15 PM	Tour Wrap-Up and Return Home

Directions from BLM Office to BLM Road 1069 on the Arizona Strip

- Turn right out of BLM parking lot and get onto I-15 south bound.
- Travel south on I-15 to Southern Parkway (Exit 2), Exit I-15 here
- Turn left onto Southern Parkway (SR 7) and continue east to River Road Off-Ramp
- Exit Southern Parkway on River Road Off-Ramp
- Turn right onto gravel road, you are now on BLM Road 1069 which will take you onto the Arizona Strip

A special "Thank You" to Utah State University Extension marketing, especially Olivia Yeip, for design and careful editing of this proceeding.

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