Understanding and Using Livestock Behavior

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Anyone who raises livestock, especially on rangelands, knows the interactions between weather, soils, plants, animals, and people are extremely complex. Not surprisingly, the behavior of animals is also complex but understanding what motivates livestock can help you manage your livestock more effectively. The examples presented in this handout demonstrate how understanding behavior can: 1) help you change the behavior of your livestock; 2) use animal learning to your advantage; or 3) anticipate problems with livestock due to management decisions.

Training Livestock to Eat the Best and Leave the Rest

Typically, livestock are removed from pastures when key plant species are grazed to a specified height. This management practice may have unintentionally trained our livestock, especially cattle, to eat the best plants and leave the rest by not encouraging them to increase the number of different plants they eat. High stock density, timing of grazing, supplements, and positive experiences can increase intake of "so called" unpalatable plants, improve biodiversity, and cut feed costs.

1. Changing Palatability: Eating Sagebrush

Grazing sagebrush in the fall and winter reduces its abundance, improves biodiversity and wildlife habitat. So what's the best way to get livestock to eat sagebrush? Supplement them! In this case, we're using the idea of using nutrients to increase intake of plants with toxins. Research shows sheep eat more sagebrush despite its high terpene content when they're supplemented with protein and energy. Supplements help livestock detoxify terpenes in sagebrush and eliminate them from the body.

One study found grazing reduced dense stands of sagebrush by 66% while increasing the amount of grass 43%, forbs 60%, and other shrubs 14%. Livestock can learn to mix their diets with plants low and high in nutrients and toxins without reducing performance. Below are three examples of using supplements to help livestock eat sagebrush.

a. Eating sagebrush to save it: Creating and improving resilience

Chuck Petersen is teaching cows to eat sagebrush to improve the land. If effective, this approach to habitat renovation will be an alternative to chemicals, mechanical treatments, and fire. Chuck is conducting his project on Agee Smith's Cottonwood Ranch near Wells, NV. Pastures are a mix of Wyoming and basin big sagebrush with an understory of grasses and forbs. Each fall as cattle are turned onto the pastures, they are supplemented with meadow hay and pellets high in protein and energy to help cattle detoxify terpenes in sagebrush.

When cattle first go onto the pastures, they eat the understory and leave the sagebrush. By the end of the adaptation phase (10 days to two weeks), they're eating sagebrush and are moved to new pastures that contain sagebrush. When cattle enter the new pastures, they mix sagebrush with the understory. The change in behavior maybe due to experience alone but some studies suggest that rumen microbes need time to adapt to the terpenes in sagebrush.

Fall grazing increased grasses and forbs in the understory during the next growing season, encouraged new sagebrush

seedlings and caused the death of old, nonproductive sagebrush plants. Calves tended to gain weight while on sagebrush pastures and smaller framed cows generally maintained their weight or gained, larger framed cattle tended to lose weight. Chuck and Agee are hoping to change the culture of the cattle on the ranch by getting them to include sagebrush as part of their diet to reduce hay costs in fall and winter and improve biodiversity on rangelands.

b. Rancher Saves Money by Teaching His Cows to Eat Sagebrush
Mat Carter, an Oregon rancher, taught his cattle to use sagebrush as winter feed and as a way to grow more grass for his cows. The first winter, he corralled 150 cow-calf pairs with electric fence on 5 to10 acres for 3 days and fed them 15 to 20 lbs/hd/d of meadow hay. His pastures were a mix of low and big sagebrush, gray and green rabbitbrush, and bitterbrush with an understory of grasses. Grazing decreased the amount of brush and increased grasses and new shrub seedlings.

The following winter, snow cover was light so Mat fed 3 to 10 lbs/hd/d of meadow hay to 400 pregnant cows and moved them about every 3 days. The amount of hay fed depended on weather and available forage. Matt noted that as he turned his cattle onto a new strip of pasture some ate grass, others bitterbrush and others sagebrush.

In 2007-08, he grazed rangeland where the canopy cover of big sagebrush was 50 to 70%. Some of the shrubs stood 4 to 6 feet tall. Snow was deep that year, 2 to 4 feet. For nearly a month cattle were fed 10 to 15 lbs/hd/d of hay. The rest of their diet was sagebrush.

In 2008, he leased some cattle and trained them to eat sagebrush. Snow was deep so only sagebrush was available. He started feeding 20 lbs of hay and over a 2-week period he reduced hay to 6 lbs/hd/d. Cattle were in good body condition when they came to the ranch and remained in good condition throughout the winter.

Besides saving on hay and increasing the amount of grasses and forbs on his rangeland, Matt has noted several other benefits to using sagebrush as winter forage. His cattle eat sagebrush even when other forage is available. They also started eating plants Mat had never seen them eat before like stinging nettle, whitetop, lupine and various wild flowers. Finally, when cattle graze sagebrush rather than hay alone, they require less water.

One important point is Mat calves in June. In the middle of winter his cows have fairly low nutrient requirements. Browsing sagebrush has no adverse effect on his calf crop and his cattle breed back just fine. He's found no downside to his cattle to eating sagebrush.

c. Grazing to improve wildlife habitat
In a demonstration project, 2200 sheep were supplemented to heavily browse sagebrush in fall and early winter. Sheep were supplemented daily with a mix alfalfa, beet pulp, corn and soybean meal. According to one sheep producer working on the project, his replacement ewes continued to eat sagebrush even without supplement.

After fall grazing that following spring, sagebrush cover decreased from 27% to 9% in grazed plots while sagebrush in the ungrazed plots remained unchanged. Forb and grass cover were slightly higher in grazed versus ungrazed plots and increased more the following year. Forbs and grasses are vitality important for sage-grouse and their chicks.

Grouse used grazed areas more than areas not grazed by sheep. Biologists can track use of an area by counting bird pellets. Grazed plots contained five times as many pellets as ungrazed plots. Also, three times as many grouse were flushed from grazed plots as ungrazed plots.

There was good news for the producer too. The project is increasing available forage for sheep. Supplementing ewes

to eat sagebrush also flushed ewes to improve lambing. Sheep used in the study maintained their body condition while browsing sagebrush.

d. How can you use this idea?
Unfortunately, increasing use of sagebrush can be difficult. How effective supplements are in changing palatability of sagebrush depends on the experience of the animal, the terpene and nutrient content of the sagebrush, and what's growing in the understory. The examples above have several things in common: 1) high stock densities; 2) animals were moved often; 3) animals browsed sagebrush in fall or winter when terpene levels are low and forbs and grasses are dormant; 4) supplemental feed helped animals eat and detoxify sagebrush; 5) animals were not starved into eating sagebrush; and 6) animals maintained body condition while eating sagebrush.

2. Changing Palatability: Eating Weeds
Why don't livestock eat weeds? Many weeds contain toxins but as long as livestock have a variety of plants to eat, the majority of weeds are not toxic enough to cause health problems or death. Novelty may be a better answer because when weeds invade a pasture, they are likely a novel food to livestock grazing the pasture. Since the animals already have a preferred diet of familiar foods, they simply won't eat the new food. In no time, weeds take over because ungrazed plants have a competitive advantage over grazed plants. How do we get livestock to change their minds about weeds? Teach them.

a. The steps to training
1) Know your weed. Make sure your plant is not high in toxins and likely cause health problems or death. Check out your weed's nutritional value. Most weeds are nutritious. The more nutritious the weed, the more likely your animals will learn to eat the weed and keep eating it.
2) Train young females because young animals are more likely to try new foods and they will teach their offspring to eat the weed.
3) Decrease the fear of eating new foods by giving your animals small amounts of a variety of nutritious, new foods in familiar feeders.
4) Reduce food novelty by mixing weeds with familiar foods for a day or two. You can also use a flavor like molasses provided your animals are familiar with molasses. If you simply spray molasses on the weed, there's a good chance your cows won't eat the weed. It's the training process that works not the molasses!!
5) Use competition to your advantage. A group of animals will encourage each other to eat both the new foods and weed. They don't want to miss out on a good food.
6) If the weed is hard to eat because it's prickly or thorny, give your animals time to learn how to eat it by putting them in a small pasture with the target weed and a variety of other plants

b. How can you use this idea?
The method for training cows to eat weeds is much more straightforward than getting livestock to eat sagebrush. It was developed by Kathy Voth and based on research from the BEHAVE Project at Utah State University. The steps are briefly listed above. For more information on training your animals to eat weeds, visit Kathy's website or order her book Cows Eat Weeds at www.livestockforlandscapes.com.

Livestock Learn to Use Medicines
Why do livestock eat soil or chew bones? Are they just bored or are they lacking some nutrient in their diet? Many researchers don't believe that livestock select foods to meet mineral requirements because research has shown that animals don't "instinctively" recognize specific minerals. However, livestock can learn to prefer foods that rectify nutritional imbalances including mineral deficiencies. They can also learn to prefer medicines that alleviate illness. Below are several research examples of how livestock learn to remedy nutritional imbalances and illnesses.

1. Calcium and Phosphorus

Lambs fed diets either too high or adequate in phosphorus learn to avoid a flavor paired with phosphorus. Conversely, when they were deficient in phosphorus, they learn to prefer a flavor paired with phosphorus. In another study, lambs deficient in calcium had a higher preference for foods that contained calcium carbonate than lambs adequate in calcium. Lambs deficient in phosphorus had a higher preference for foods that contained sodium phosphate compared with lambs adequate in phosphorus. The results suggest animals can self-regulate intake of these minerals and may explain why animals deficient in minerals eat "foods" they normally wouldn't eat.

2. Bloat

Bloat is a big problem for producers. Lambs form strong aversions to foods associated bloat. They also formed strong preferences for foods that cause relief from bloat.

Now that we know animals can learn about foods based on the effects of bloat, the next step is to translate this to the field. Soon we may know if animals can learn to mix birdsfoot trefoil (which contains tannins) with their alfalfa (which contains saponins) to prevent bloat. Tannins are believed to interact with saponins to prevent bloat.

3. Reducing Parasites

Tannins are secondary compounds produced by plants. At high doses, they reduce intake and protein digestibility but at lower doses they benefit ruminants by reducing internal parasites. Most shrubs contain tannins as well as sudangrass, birdsfoot and big trefoil, sorghum, sulla, sainfoin, and sericea lespedeza.

Studies show lambs infested with parasites had higher preferences for foods containing tannins, and ate more of a tannin-containing food than lambs with low levels of parasites. Consuming high-tannin foods also reduced fecal egg counts - a measure of parasite infestation. There was a direct relationship between the amount of tannin eaten and the decline in fecal egg counts. However, intake and preference for tannin food were not different between groups when parasites levels were similar. These studies suggest: 1) lambs can detect internal parasite infestations, 2) they can learn about the relationship between the flavor of tannin and relief from internal parasites and 3) tannins can reduce parasite levels.

4. Relieving Heartburn

Sodium bicarbonate helps relieve grain acidosis. Lambs prefer foods that contain sodium bicarbonate after eating large quantity of grains. They also drank more water containing sodium bicarbonate when they were on high versus low-grain diets.

5. Choosing the Right Medicine

Juan Villalba and Ryan Shaw conducted a difficult study where sheep were familiar with three diets: 1) high grain, 2) high tannin and 3) high oxalate; and three medicines 1) PEG 2) bentonite, and 3) dicalcium phosphate. One group was fed the diets and medicines at different times of the day (control). The other group received the correct medicine right after eating a diet that caused illness (treatment). Bentonite alleviates grain acidosis, PEG for tannin, and dical for oxalate.

Animals were then put in one of the above physiological states (grain acidosis, too much tannin, too much oxalate) and then offered a choice of three medicines. Control animals ate the same proportion of medicines regardless of which diet they ate. The medicine preferred by the treatment group depended on their physiological state. Sheep with training chose the correct medicine; meaning sheep can learn to use medicines.

6. How to Use This Information

Animals do not eat substances to prevent deficiencies. When they suffer a deficiency or illness, they seek out novel

substances to eat. If they eat a substance that rectifies the problem, animals form a preference for it. If your animals are eating soil, bones, or other odd substances, it is likely they have a deficiency or illness.

Minerals: I'm often asked about free-choice mineral systems. My recommendation is to offer trace mineral salt mixtures or blocks along with free-choice minerals that are known to be deficient in your area.

Bloat: Bloat blocks work because they are high in nutrients and contain compounds to counteract bloat. With bloating legumes planting another forage that contains tannin in the pasture may alleviate problems with bloat.

High grain diets: Livestock on high grain diets should be offered sodium bicarbonate or bentonite to alleviate acidosis and keep intake high.

Parasites: Offering variety, which is normally not a problem on rangeland, gives animals a variety of plants to eat to rectify problems. Rangeland plants, especially woody plants, contain a variety of secondary compounds that may reduce parasite loads or counteract toxins in other plants. In dry climates livestock rarely have high infestations of parasites, you may want to send in a fecal analysis to check your animal's parasite load. If it's low, regularly worming livestock may be a waste of money.

Habitat Preference

Below are a several examples of how experience affects habitat selection. They profile: 1) how strongly animals prefer their home range; 2) point out that you're changing more than location when moving animals to uplands; 3) discuss the possible downside to buying replacement heifers; and 4) the dangers of moving livestock to new locations.

1. Home, Home on the Range

In the 1960s, white-tailed deer were a problem in the Adirondacks. They are especially fond sugar maple, yellow birch, and other commercially valuable species. Deer browsing inhibits growth of trees seedlings and competes with people who depended on harvesting and growing timber for a living.

The plan was to reduce the deer population by 50% to allow maple and birch seedlings to regrow but biologists disagreed on how to achieve that goal. A young biologist proposed a solution. Hunt on a 5,000-acre test area to reduce the estimated deer population from 300 to 150. Other biologists immediately questioned the idea. They maintained that much like gas molecules that migrate from an area of dense concentration to a lower one, deer from the surrounding areas would move to a less populated area. If their goal were to regenerate trees on 5,000 acres, deer would need to be removed from a much larger area. Since some of the biologists were betting men, the experiment became the subject of a wager with the stakes set at a case of beer. Did the deer behave as gas molecules?

Over five years, the population was reduced by 50%. Deer from the surrounding areas did not behave like gas molecules. The wager lost and the beer handed over. So why didn't the deer fill the void? The biologists concluded that deer outside the removal area were too strongly attached to their home range to be drawn to any other area. Genetic analyses suggest that each summer range is shared by a group of related individuals, probably the daughters, granddaughters and great-granddaughters of a single female. Deer from adjacent areas did not move into the area over a 10-year period.

2. Grazing Uplands Changes Diet and Habitat Preferences

Herders, who understand and practice low-stress livestock handling (LSLH), can move and place livestock on uplands and away from riparian areas. There are many benefits of LSLH but one possible benefit is a change in cattle behavior. Over time, consistently moving cattle to uplands will likely require less time and effort as cows

learn new places to forage and they are not bothered by herders as long as they're in the uplands. Their daughters (replacement heifers) will learn to forage in the uplands. They will acquire preferences for upland forage because dietary experiences early in life have a huge effect on food preferences later in life. Early dietary experiences can improve feed efficiency and intake, change the physiology, neurology and/or structure of the body and may even change gene expression. Which means cattle are less likely to return to loitering in riparian areas if favorite foods are in the uplands.

3. Replacement Heifers: To Buy or Not to Buy

Economists often recommend buying replacement females because it's cheaper. Unfortunately, they rarely take into account that replacements are not created equal. One rancher referred to the time he bought in replacements as the "year from hell." New animals often walk the fences, gain poorly, suffer more from predation and illness, and are sometimes hard to find on the range.

Ranches with harsh conditions (poor-quality or sparse feed, rough terrain, few watering points, etc.) should look hard at the economics of raising replacement heifers. Buying replacements may be a viable option if heifers are coming from a ranch similar to yours, and they perform nearly as well as cattle raised on your ranch. However, we've heard stories of cattle doing poorly when moved from relatively harsh conditions to good rangelands and cattle still perform poorly.

If you raise your own replacements but supplement them heavily until they are yearling, you may want to consider the way one ranch in Nevada raises its replacement heifers. On the Zimmerman Ranch replacement heifers are not weaned with the steers. Heifers are left with their mothers to learn how to survive on the desert. They must learn where to go when it storms and there's a shortage of water or forage. They need to know how to use a country that is long on feed but short on water and to eat snow so they will not have to travel long distances to water. A heifer must learn these things so she will know how to care for herself and her calf. Her mother weans her at the proper time.

Zimmerman says "If we did wean her by keeping her in the fields to put on weight and then sent her back to the desert the following winter as a bred heifer, we would be signing her death warrant."

4. The Hazards of New Environments.

Ignorance of behavior can be devastating. Mick Holder, an Arizona rancher, writes: "Gila County is mercifully deficient in poisonous plants, but we have lupine and loco in small or moderate stands. In 30 years of ranching, I never had a problem with either. I leased rangeland in Apache County and moved part of my cattle to that location during a drought and suffered severe losses to poisonous plants, while the sister cattle left in Gila County on equally poor rangeland didn't have one case of loco or lupine poisoning. Did they not recognize the plants because they had been relocated 100 miles east?"

It may seem strange, but animals prefer familiar to unfamiliar foods, even if familiar foods are toxic, especially in unfamiliar environments. Cattle moved to Apache County preferred familiar, toxic foods to unfamiliar foods. Holder summed it up: "The only plausible explanation I would make after reading your paper is that moving cattle to Apache County suspended their aversions to familiar plants - loco and lupine - due to the unfamiliar settings or the lack of diversity of browse found in the Pinyon-Juniper habitat.... painful lesson for us both."

There also is evidence that the same dose of a toxin has a much greater effect in an unfamiliar environment compared to a familiar one. The added stress increases the toxin's effect on the animal. Thus, cattle may have eaten amounts of toxic plants that were not lethal in the familiar environment but lethal in the unfamiliar environment.

Feeding animals familiar, nutritious foods while they adapt to unfamiliar environments can mean the difference

between life and death.

One last point, if you're moving animals to a new location to forage during drought, winter, etc., your cattle to may not gain as well as the cattle raised in that area. I'm not suggesting moving them to a new area is always a bad idea. It can make economic sense. However, you may overestimate cost per pound of gain if you count on your cattle gaining at the same rate as cattle reared in the area.

Recommendations for Offering a Choice of Foods to Finish Livestock

What are the advantages of letting animals select their own diets?

1. Lower feed costs as much as 20% due to improved feed efficiency and animals tend to eat more of the less expensive foods but gain at the same rate as animals eating a total mixed ration.
2. Don't need a nutritionist to balance the ration
3. No need to mix feed
4. Animals can meet individual needs
5. Animals of different sizes and ages can be fed together
6. Take advantage of cheaper feeds when available
7. Less illness especially acidosis
8. May not need to feed everyday

What should I feed my animals when offering a choice?

1. An energy source. Examples: corn, barley, oats, beet pulp. 2. A source of protein. Examples: wheat-midds, distillers' grains, soybean meal, cottonseed meal. 3. Roughage. Examples: alfalfa, grass hay, oat hay, corn silage, haylage.

Mark Kossler, Turner Enterprises, feeds his bison wheat midds, whole corn, grass, alfalfa and oat hay. Kent Fullerton, Iron Mountain Bison Ranch, used corn, dried brewer's grain and alfalfa hay. In our study, we used alfalfa hay, corn silage, corn and barley.

For more feed options see Nutritional value of feeds.xls on the BEHAVE Website. You may also want to look at Understanding feed analysis.pdf.

How do I determine which feed is the best value?

The following resources are on the BEHAVE website: 1) Feed costs calculator helps you estimate the cost of a feed or nutrient including: feed, waste, transportation, storage, and feeding costs; 2) What does that nutrient cost? Helps you compare the cost of a nutrient in different feeds but without the additional costs listed in the worksheet above. You can get the nutritional content of feed from the feed tag or use Nutritional value of feeds.xls.

When comparing the cost of nutrients in a feed, remember to compare the cost of protein (CP) in high-protein feeds and energy (TDN, DE, ME) in high-energy feeds. Roughages can fall into either category.

How many choices should I offer?

At a minimum three, an energy source, a protein source and a roughage. If you're feeding good-quality alfalfa as your roughage, I suggest you offer a poor quality roughage as well. Good-quality alfalfa is too high in protein for cattle and bison to have as their only roughage source. It actually makes a better protein source. Bison are excellent at utilizing poor quality roughage; use that to your advantage.

Most (and there aren't that many) feeding studies with bison offer them a choice between one hay and one concentrate ration but offering a choice of at least three foods may improve results. Offering even more choices may further improve performance. In a study with dairy goats, offering goats a choice of six foods rather than four resulted in higher milk yields and better feed efficiency. Researchers speculated that giving animals more choices in grains and high-protein feed sources might overcome any possible imbalances in nutrients supplied to the animal and/or rumen microorganisms. While the amount of nutrient supplied to the animal by the diet is important, how quickly or slowly a nutrient is released by digestion in different feeds also matters. Nutrient utilization is most efficient when nutrients are released at the same rate. Adding another choice will likely increase costs which needs to be considered before adding another feed.

How do I get my animals eating concentrates and avoid health problems?
For cattle or bison (and most herbivores), mixing grain with chopped roughage and slowly reducing the amount of roughage will also work. Just watch for scours, animals off-feed, etc., as you're putting them onto concentrates.

Can I change feeds to take advantage of lower prices?
Changing feeds is no problem. Just mix the new food with the old one for a week or two to help animals accept the new food and avoid any possible digestive problems. They'll rebalance their ration as needed.

For more information: extension.usu.edu/behave or contact Beth Burritt at beth.burritt@usu.edu or phone (435) 797-3576.