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UNDERSTANDING WORKING RANGELANDS

Cattle, Sheep, Goats, and Horses: What's the Difference for Working Rangelands?

INTRODUCTION

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Domestic livestock commonly raised in California include cattle (bovines), sheep (ovines), goats (caprines), and horses (equines). Cattle, sheep, and goats can be used for the production of meat or dairy products, depending on their breed and management. Horses are kept primarily for recreation and for use in ranch work. Each livestock species has dissimilar feed and husbandry needs, interacts with humans differently, and has varying effects on the land and vegetation.

Livestock affect land and vegetation in several interrelated ways, including removal of leaves, stems, and other plant parts; removal or redistribution of nutrients; and mechanical impacts on soil and plants through trampling (Vallentine 1990). All of these factors vary by animal species, depending on dietary preference, digestive system, mouth anatomy, and

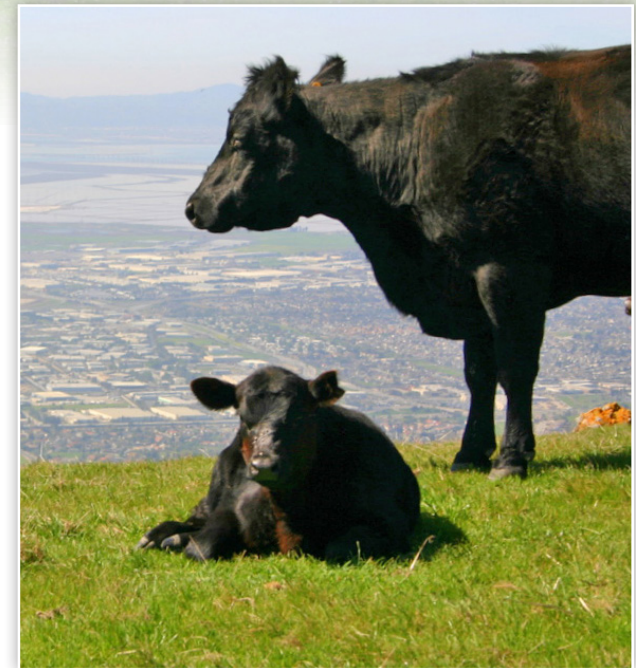


Photo: Josh Mazgelis/Flickr

Working rangelands are public or privately owned open space lands that are managed with livestock grazing and rancher stewardship. Their management contributes to the production of a variety of ecosystem services, including food, clean water, weed control, wildlife habitat, fire fuel reduction, carbon sequestration, pollination, aesthetic views, cultural heritage, recreational and educational opportunities, and open space conservation.



animal size and weight. Livestock behaviors such as herding ability, use of terrain, and willingness to travel also vary between species, breeds, and individual herds. These behaviors can affect land and vegetation. Within a species of livestock, certain breeds may have unique attributes that make them especially suitable for grazing a particular site. Examples include Babydoll Southdown sheep, which are so short in stature they cannot eat grapevines, and Scottish Highland cattle, a small breed of cattle adapted to high rainfall and strong winds. While rare or unusual breeds may fill a specific niche, they may not be very practical. Ranchers with unusual breeds can experience difficulty in marketing livestock and livestock products that do not conform to the standard sizes of conventional breeds. Also, characteristics attributed to some breeds may not be present in some individuals. Practical considerations that may determine the species and/or breed of livestock best suited for grazing a particular site include infrastructure requirements, local availability, and potential for predation.

On California's rangelands, grazing is typically dominated by a single species, most often beef cattle; however, some ranchers may graze multiple species. Tradition, rancher experience and knowledge, fewer management requirements, available infrastructure, grass-dominated rangelands, and low risk for predation are reasons why grazing cattle dominate California's working rangelands.

SPECIES DIFFERENCES

Dietary Preferences and Digestive Systems

Livestock species are described as grazers, browsers, or intermediate feeders according to the types of plants they eat (Hoffman 1989). Grazers, including cattle and horses, eat mostly herbaceous plants such as grasses and forbs (broadleaf weeds) and have a digestive system that can handle large quantities of low-quality forage. Browsers, such as goats, can select the highest-quality leaves and stems from woody plants such as shrubs and trees. Intermediate feeders, such as sheep, graze selectively but can consume both herbaceous and woody vegetation. These categories are not absolute, as diet is also driven in part by the availability of different types of vegetation, nutritional needs, experiences, and inherited and learned behaviors, which can affect where and what a given animal eats. Table 1 shows the dietary preferences of cattle, sheep, goats, and horses.

Because of these differences in dietary preference, livestock species can have a significant impact on achieving conservation objectives, especially those related to vegetation management. For example, controlling broadleaf weedy plants may best be achieved using sheep or goats. Alternatively, controlling annual grass to enhance native forbs, including wildflowers, may be best achieved by cattle grazing, especially since sheep and goats may prefer forbs over grasses.

Differences in how much and what is consumed by each animal species depend on each species’ digestive system, the composition of rumen microbes, forage quality, and the animals’ ability to handle tannins and other secondary compounds. These compounds can reduce plant palatability by causing negative digestive impacts and

Table 1. Dietary preferences, digestive systems, mouth parts, and adaptations for grazing and browsing of selected livestock species

Species	Dietary preferences	Digestive system	Mouth parts and adaptations for grazing or browsing
cattle	Grazers. Prefer grass to a greater extent than do sheep or goats. Some seasonal use of forbs and woody plants, but cannot thrive on strictly woody plants. Coarse and dried tall grass is best grazed by cattle.	ruminant	Large muzzle and relatively immobile upper lip limits their ability to select among plants and plant parts. Large rumen allows them to consume and digest low-quality forage. Use mobile tongue to grasp taller grass clumps then pull them off, usually not closer than 2 inches from ground unless forced to do so to obtain forage. Back molars shred vegetation into small, digestible pieces.
sheep	Intermediate feeders. Readily graze forbs but also graze grass and browse woody plants.	ruminant	Cleft upper lip permits close grazing. Small mouthparts and narrow muzzle permit them to be more selective of plant species and plant parts and allow them to graze prostrate plants. Large rumen relative to body mass allows them to utilize low-quality forage. Will consume a grass-dominated diet, especially if grasses are succulent, but consume more forbs when forbs are available.
goats	Browser to intermediate feeders. Readily graze forbs, but also graze large amounts of woody plants and grass; highly versatile.	ruminant	Narrow muzzle, strong mouth, mobile upper lips and prehensile tongue are designed for eating tiny leaves off of shrubs, avoiding spines, and chewing woody plants. Large liver relative to body weight and special saliva enables them to more effectively process plants that contain secondary compounds like tannins.
horses	Grazers: Mostly graze grass, with some grazing on forbs and browsing on woody plants.	pseudo-ruminant (Cecum)	Upper and lower incisors allow them to bite close to the ground; they crop grass with incisors (foreteeth) and grind with back teeth.

Source: Adapted from Vallentine 1990, Launchbaugh 2006, Krysl et al. 1984, and Ménard et al. 2002.

may be poisonous. Although livestock digestive systems vary by species, all depend on fermentation, which is driven by microbes that live in the animals’ rumen or cecum. Cattle, sheep, and goats are ruminants, or foregut fermenters; horses are pseudoruminants, or hindgut fermenters, and have a cecum (see below). Cattle, and to a lesser extent sheep, have large rumens that allow them to consume and digest fibrous, low-quality forage. Goats, on the other hand, are adapted to consuming woody plants. Their mouth structure allows them to select the high-quality parts of woody plants, and they can also effectively detoxify secondary compounds, such as tannins and terpenes.

Ruminants

Cattle, sheep and goats have a four-chambered stomach consisting of the rumen, reticulum, omasum, and abomasum (fig. 1). The rumen, the first chamber of the stomach, comes before the gut. When ruminants eat, they ingest large amounts of vegetation that is initially softened and broken down in the rumen by microbes, mostly bacteria. They regurgitate the semidigested plant matter, chew (called “chewing the cud”), and swallow it again. This fermentation and regurgitation process efficiently extracts nutrients such as cellulose from plant materials.

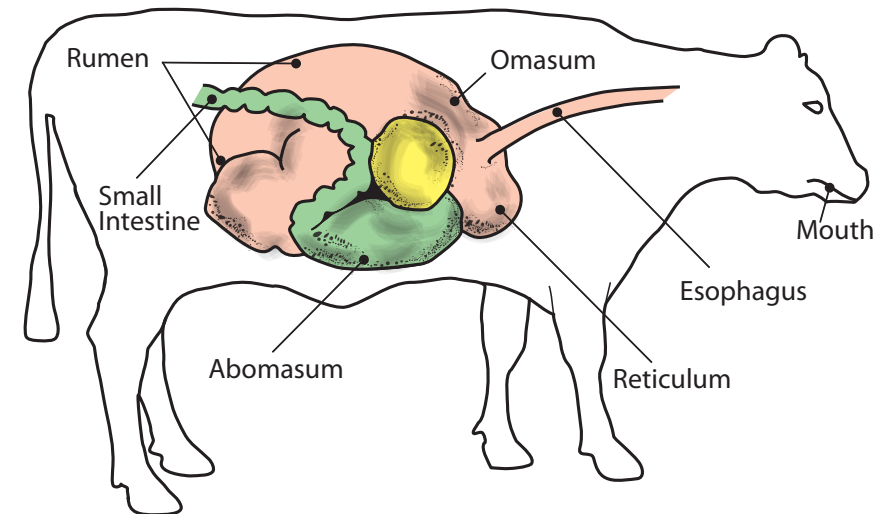


Figure 1. Digestive system of a ruminant.

Pseudoruminants

Horses, rabbits, and certain other herbivores are classified as hindgut fermenters. They have a fermentation chamber called a cecum just before their large intestines. The cecum performs the same function as the rumen does in ruminants, although its position is after the main stomach and it is less efficient than a rumen.

Nonruminants

Ruminants and pseudoruminants are in contrast to nonruminants such as pigs. Nonruminants have a simple stomach and cannot ferment feed or eat large amounts of vegetation. This difference is why ruminants are so well adapted to the feed available on rangelands.

Size and Weight

Cows, sheep, goats, and horses vary widely in size and weight, depending on age, sex, and breed. Their size and weight is directly related to forage consumption and is important to consider when estimating a site's carrying capacity (the number of animals that can graze a site without harming resources). Table 2 summarizes typical weights by species and estimates their daily dry matter consumption.

Although one may think that larger animals compact the soil more than smaller animals, different species of livestock actually produce similar hoof pressure per unit area because their hoof area is proportional to weight (Cumming and Cumming 2003). Rangeland

scientists have determined that stock density and livestock activity may have greater trampling affect than an animal's weight. Higher stock densities (more animals per unit of land at any given time) and more-active livestock increase trampling impacts (Betteridge et al. 1999; Mandema et al. 2013; Nolte et al. 2015). For example, horses, which are generally more active than cattle and spend more time grazing, were found to cause more compaction (Nolte et al. 2015) and trampled more bird nests (Mandema et al. 2013) than cattle. Animal trampling not only affects compaction of fine-textured soils (those with a high proportion of small particles, such as clay, compared with coarse-textured soils that have a high proportion of large particles, such as sand), their trampling can also shear off new plants and cause stream banks to slough off, especially when the soil is wet. It should be noted, however, that these impacts are not always necessarily negative. For example, cattle can improve the soil's water retention through trampling and can help to maintain inundation periods in ponds and wetlands (Pyke and Marty 2005). Trampling has also been used to prepare a seedbed by incorporating seeds into the soil and by damaging undesirable seedlings of weedy plant species.

EFFECT OF TOPOGRAPHY ON GRAZING AND BROWSING

Generally, cattle and horses prefer level to gently rolling ground and have more difficulty traversing steep slopes. Sheep and goats, which are smaller, more agile, and sure-footed, readily graze on steep slopes (Holechek et al. 2011). The result of this behavior is that cattle tend to graze less than sheep or goats on steep slopes if both steep and gentle topography is available. However, sheep and goats also have a strong tendency to graze into the wind, which can result in overuse on the side of a pasture from which the prevailing winds blow (Launchbaugh 2006).

Livestock selection and breeding may also affect how animals use terrain, whether they tend to be solitary or stay in groups, and how tightly they herd (George et al. 2007). For example, breeds of cattle developed in mountainous terrain may distribute better across rugged rangeland than do cattle breeds developed on flatter land (Bailey et al. 2004).

Table 2. Typical weight and daily dry matter intake for select livestock species grazing rangeland

Species	Typical weight	Dry matter intake
beef cattle (cows)	1,000–1,300 lb	20–26 lb/day
sheep (ewes)	150 lb	3 lb/day
goat (does)	100 lb	2 lb/day
horse (mares and geldings)	1,000–1,200 lb	30–36 lb/day



INFRASTRUCTURE REQUIREMENTS

Grazing infrastructure requirements such as handling facilities, fencing, predator protection, and water sources vary by livestock species and type (see the UC ANR publication *Fences, Gates, and Corrals* in the “*Understanding Working Rangelands*” series).

Handling Facilities

Handling facilities include a delivery or gathering area accessible to livestock vehicles, sturdy wooden or pipe pens and corrals for processing and shipping animals, stock water, and perhaps a loading chute or ramp. Ranches that have been recently divided or sold in parcels may not have adequate infrastructure and may be lacking handling facilities. In some cases, portable facilities can be used, but the lack of handling facilities can make it difficult for cattle ranchers to access and use a site. Alternatively, sheep and goat ranchers are more likely to have portable infrastructure such as stock water on trailers and portable pens and may not need loading chutes.

Fencing

Cattle can be managed with barbed wire, and horses can be managed with barbed and/or smooth wire fencing. Sheep and goats require mesh-style fencing. Electric fencing, which can be made of electrified ribbon, cord, smooth wire, or mesh such as field fencing, can be used for all livestock species. Due to the fact that they can easily climb under or over fencing and trees, goats tend to be especially difficult to contain.

Predator Protection

Sheep and goats are highly susceptible to predation by coyotes, mountain lions, domestic dogs, and even people, whereas cattle and horses are less susceptible due to their larger size. Electrified mesh or electric wire and use of guard dogs that intimidate predators by barking and aggressive behavior are essential techniques for protecting sheep and goats. In settings where barking dogs are considered a nuisance, other guarding methods such as donkeys and llamas (llamas can effectively guard against coyotes but not against mountain lions), night pastures (where animals are gathered together into a confined area for the night), or herding must be used. If economically viable, sheep and goat flocks have herders living with them. When predation risk is too high, cattle or horses are a better choice.

Water Sources

All livestock need access to clean, fresh drinking water daily. Their daily water requirement may vary greatly with forage moisture, temperature, workload, stress, and disease. In general, adult cattle and horses consume 5 to 20 gallons per day. Sheep and goats consume 1 to 2 gallons per day, but they may get by with much less when consuming high-moisture forage. Watering troughs should be appropriately sized for the livestock species that use them.

Animal Management

Ranchers in California, including those in the San Francisco and North Bay Areas, still use horses for rangeland and livestock

monitoring and management. Some ranchers may have a *remuda*, an equine herd that is grazed like other livestock. Horses, like sheep and goats, prefer to graze together in a herd, unlike cattle, which graze in smaller groups.

Multi-species Grazing

Grazing more than one livestock species in the same pasture, at the same or different times, makes efficient use of forage because of differences in dietary preference and needs. For example, in a mixed herd of cattle and goats, the cattle can make good use of grasses, while the goats would eat more forbs and woody plants. The species combination should be carefully selected, based on land management objectives.

SUMMARY

When it comes to grazing effects on vegetation and land, all herbivores are not created equal. The inherent differences between livestock species, including their dietary preferences, digestive system, mouth anatomy, size and weight, and behavior, influence their effects on vegetation and other rangeland resources. Practical considerations such as availability of livestock, rangeland vegetation type, rancher knowledge and experience, potential for predation, and available infrastructure have led to California's working rangelands being grazed predominantly by cattle.

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