



## Chapter 1—

# Understanding Horses and Mules

In addition to the usual planning considerations, equestrian recreation trails and facilities require attention to the behavior and physical characteristics of horses and mules. The success of horse trails and recreation sites depends on how well planners and designers understand these animals.

## An Evolutionary Perspective

Essentially, horses and their kin are prey animals. They developed behavior patterns and physical characteristics over millions of years spent in wide open spaces. Flight is their primary defense. They use their strength, stamina, agility, and speed to escape predators, notably large cats—such as cougars—and wild dogs—such as dingos. Horses and mules constantly monitor their surroundings and are always aware of available escape routes. They may become nervous when routes are narrow or blocked. Horses and mules also prefer to see what they hear or smell.



### Horses and Their Kin

What is the difference between a *horse* and a *mule* (figure 1–1)? A mule is half horse and half donkey. When a female horse—a *mare*—mates with a male donkey—a *jack*—the resulting offspring is a mule. Mules are sterile and are generally unable to reproduce. Their adult size depends on the breeds of their parents. A rarely seen variation is a *hinny*—the offspring of a male horse and a female donkey.



Figure 1–1—The mule on the left and the horse on the right are closely related. The mule is a unique animal with a blend of characteristics inherited from its horse mother and donkey father.

### Lingo Lasso

What is the difference between a *donkey* and a *burro*? Burro is Spanish for donkey. Many people in the Southwest use the term to refer to feral donkeys on public lands. Burros (figure 1–2) are usually smaller than horses and mules. When this guide refers to horses, stock, or trail animals, it includes mules and donkeys as well.



Figure 1–2—Burros—also called donkeys—generally are smaller than horses and mules. These two are hard-working members of a trail crew.





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## The Startle Factor

What frightens horses and mules is not always obvious. Anything that moves suddenly or makes an unexpected noise can rouse an animal's survival instincts and prime it to bolt. This natural reaction—often referred to as a startle reflex—is the result of remarkably acute senses.



### Lingo Lasso

#### Startling News

A horse or mule can be said to *startle*, to *shy*, to *spook*, or to be *skittish*. The terms have similar meanings—a horse is instinctively on alert, assessing the situation for danger. Horses and mules have much faster reflexes than humans and other domesticated animals (Miller 1999). When a horse or mule startles, its response varies according to the stimulus and the animal's personality.

*Startle* is a generic description for any aroused behavior. *Shy* and *spook* are often used interchangeably with *startle*, but they are not exactly the same. An animal that shies moves swiftly away from the disturbance—sometimes quickly enough to unseat the rider. *Spook* is a colloquial term for frighten. A *skittish* horse is one that is nervous or easily alarmed.

Horses and mules have excellent vision, hearing, and tactile senses. They are even capable of feeling vibrations through their hoofs, which often alert them to others long before the rider becomes aware. Horses and mules need a comfortable operating space. When they can see something suspicious from afar, they can more easily evaluate the danger and react accordingly. There is a fine line between what is comfortable for horses and mules and what seems dangerous.

In addition to confined spaces and predators, things that can startle a horse or mule include:

- ★ Loud or unexpected noises—Buzzing model airplanes, exploding firecrackers, batting practice, or a falling tree
- ★ Quick or unexpected movements—Fast-moving bicycles, inquisitive children, running animals, or birds rustling in the underbrush
- ★ Things in unusual combinations—Hikers with large backpacks or vehicles with strange loads
- ★ Highly contrasting or reflective surfaces—A light-colored tread near dark soil, freshly cut logs, black or white rocks, or a manmade object in a natural setting
- ★ Unfamiliar situations—Activity at a golf driving range or a train nearby
- ★ Wild or unfamiliar domestic animals—Mountain lions, moose, emus, pigs, or llamas (figure 1–3)
- ★ Narrow or constricted spaces—Bridges, gates, or tight passages
- ★ Unexpected trail obstacles—Litter, fallen trees, or boulders



Figure 1–3—Anything that appears suddenly, makes an unexpected noise, or is unfamiliar engages a horse's survival instincts. On the trail, horses and mules are particularly wary of llamas, hikers with bulky backpacks, and bicycles.



### Equine View

### Trail Talk

*Designing Shared-use Trails to Include*

*Equestrians* (O'Dell 2004) offers the following interpretations of scary things from a trail animal's perspective:

- ★ Fishing rods look suspiciously like buggy whips.
- ★ The ticking of bicycle gears sounds like an electric fence charger.
- ★ Boisterous dogs look like wolves.
- ★ People carrying canoes overhead may be horse-eating monsters!



So, what happens when horses and mules are startled? They have a range of responses, from remaining calm to becoming severely frightened. The more conditioned the animal is to uncomfortable situations, the more likely its response will be subdued. When something makes it nervous, an animal may dance around, inadvertently step on things, or balk. Horses or mules that are severely unnerved may run, jump, spin, or do a creative combination of all these things. When horses and mules feel the need to protect themselves, they may kick, bite, or strike. Experienced riders can hold a well-trained animal in check under most circumstances. There is a point, though, where a stimulus becomes so great that even the best conditioning will not override the animal's innate fight-or-flight instincts.



### Trail Manners

### Trail Talk

Trail etiquette varies in different parts of the country and in different situations. According to IMBA, the International Mountain Bicycling Association (2007), "All animals are startled by unannounced approach, a sudden movement, or loud noise. This can be dangerous for you, others, and the animals. Give animals extra room and time to adjust to you. When passing horses always use special care and follow directions from the horseback riders (ask if uncertain). Running cattle and disturbing wildlife is a serious offense. Leave gates as you found them, or as marked."

Horses and mules are often uncomfortable around moving bicycles and may startle if they spot a bicyclist nearby. It is a good idea for bicyclists to make sure the stock have seen them from a distance. Hiding is not a good strategy, as the animal will probably sense the presence of something unknown and become agitated.

Trail stock—especially mules—have highly developed memories for pleasure, pain, fear, people, and places. Many trail animals recognize a previously visited location or trail route (figure 1–4). Once a horse or mule has had a particularly unpleasant or painful experience, the animal will try to avoid that location, condition, or object forever. Recreationists in many areas minimize potential conflicts by practicing trail etiquette that favors needs of horses and mules. *Chapter 12—Providing Signs and Public Information* lists ways to communicate a trail animal's needs to other trail users.



Figure 1–4—Horses and mules have excellent memories and can easily retrace routes they have traveled in the past. They avoid areas they associate with unpleasant experiences.



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## Physical Characteristics

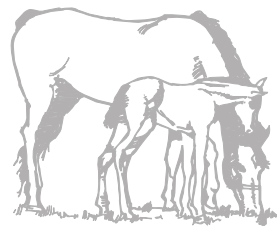
On nonmotorized recreation trails, the heaviest, widest, and tallest recreationists are riders on their mounts. Not only do designers need to take the dimensions of mounts and their riders into consideration, they have to provide for the needs, abilities, and heightened sensitivities of horses and mules.

### Size and Strength

Horses and mules come in all different sizes. For example, quarterhorses, used extensively in the American West, are generally shorter than thoroughbreds, commonly used in other areas. A horse or mule's height is measured in *hands*—or 4-inch (102-millimeter) increments. Measurements start at the bottom of the front hoof and end at the *withers*—the highest point on an animal's shoulder near its mane. The saddle rests just behind the withers, in a slight depression on the animal's back.

The size of horses and mules depends on their breed and age. Miniature breeds are about the size of a large dog. Small horses, such as ponies, are frequently about 14 and one-half hands—also referred to as 14.2 hands—or about 58 inches (1,473 millimeters) tall. Draft horses are often about 19 hands—76 inches (1,930 millimeters) tall. Many trail stock are about 15 to 16 hands—60 to 64 inches (1,524 to 1,626 millimeters) tall.

Trail stock usually weigh between 800 to 1,500 pounds (454 to 680 kilograms). They have exceptionally strong muscles that help them maintain their balance and allow them to carry heavy loads for long distances. The rule of thumb is that healthy, well-conditioned horses and mules can carry as much as 20 percent of their body weight.



### Horses by Design

#### Horse Sense

Design measurements give recreation designers some guidance when they are designing and constructing recreation facilities and amenities. The American Institute of Architects (2000) considers a design horse as 16 hands—64 inches (1,626 millimeters) at the withers (figure 1–5), 92 inches (2,337 millimeters) from tail to nose, and 81 inches (2,057 millimeters) at the top of the ears. When a rider is seated in the saddle, the top of the rider's head is about 93 inches (2,362 millimeters) above the ground. Viewed from behind, the rider and horse span about 4 feet (1.2 meters) at the widest point. These measurements don't include maneuvering space.

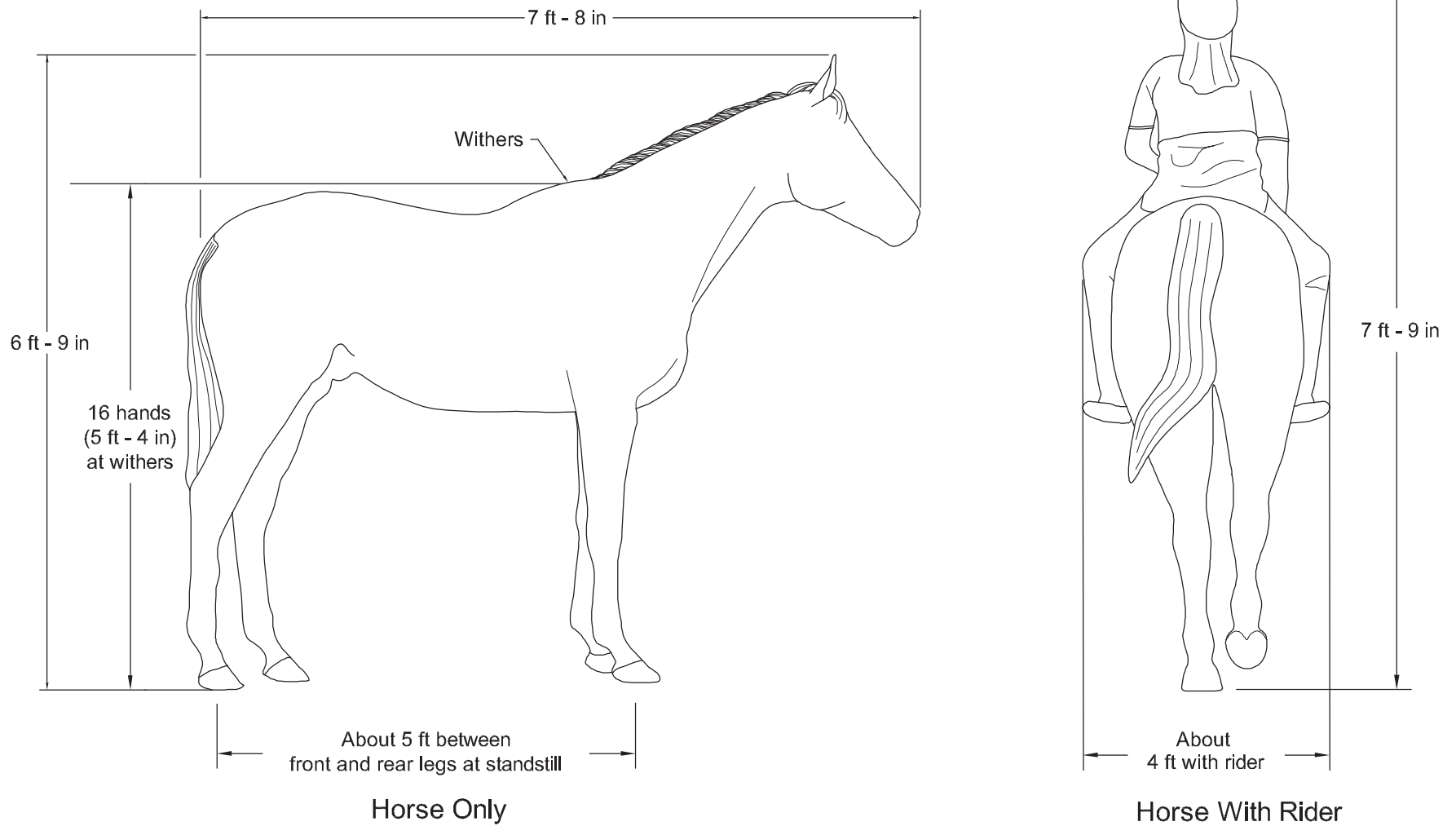


Figure 1-5—Industry standard design dimensions for a horse and rider from *Architectural Graphics Standards*. Standard design dimensions are representative dimensions for planning purposes. —Courtesy of Wiley Publishing. The original figure was edited for clarity.



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### Hoofs

With their well-adapted hoofs, horses and mules are sure-footed in many environments. Hoofs have a hard material outside—the *hoof wall*—and a triangular-shaped area of living tissue on the underside (figure 1–6). This tissue—the *frog*—is susceptible to injury from sharp objects, such as broken glass or sharp crushed gravel, and by very hot surfaces, such as melted asphalt. Horses and mules can bruise their hoofs with repeated exposure to hard surfaces. Mule hoofs are generally more elongated than those of horses.

Both horses and mules are particularly careful where they place their hoofs. Many stock avoid stepping

on slippery shale, smooth boulders, mud puddles, boggy areas, railroad crossings, bridge decks, or other unfamiliar surfaces, until they become more confident with their footing. They sometimes are reluctant to use human-sized steps on trails or in urban environments. Many riders also are uncomfortable negotiating steps while on horseback.

Because an animal’s hoof wall can crack, chip, or break, horseshoes are used to enhance the hoof wall’s strength. Special nails are tapped through the hoof wall and clinched over to hold the horseshoes in place. Horseshoes are made in different sizes and styles (figure 1–7). Some are smooth on the bottom, some have grooves, and others have raised heels

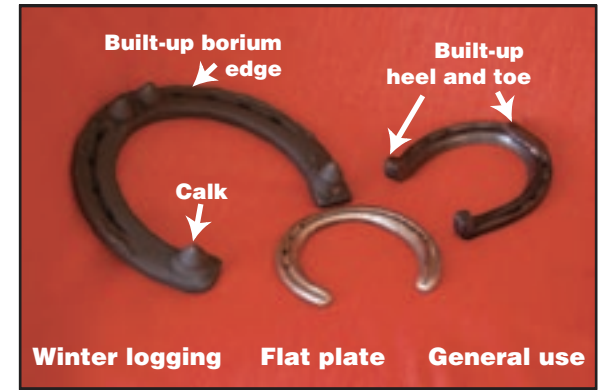


Figure 1–7—As far as horses and mules are concerned, one horseshoe doesn’t fit all. A draft horse wears the large, specialized horseshoe during winter logging operations. Its sizeable calks and built-up borium edges improve footing on ice. Saddle horses commonly use flat-plate horseshoes. The general-use shoe has built-up heels and toes for added traction.

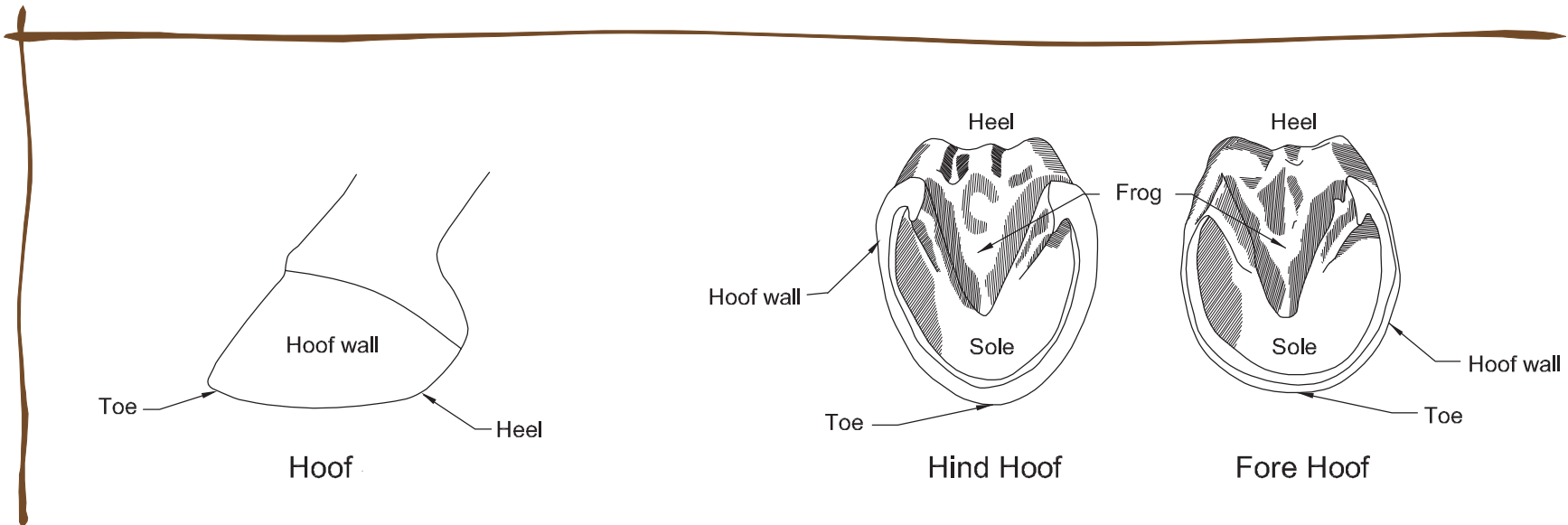


Figure 1–6—A horse hoof.



and toes for better wear and traction. A hoof that is protected by a horseshoe withstands rugged terrain and extended periods of use better than the natural hoof alone. However, horseshoes can be loosened or pulled off when they catch in wire, between boulders, in underground holes, under roots and waterbars, and in cattle guards. If this happens, stock may trip or suffer pain or injury.

Paved or hard surfaces— asphalt, concrete, metal, and stone— offer little or no traction and are quite dangerous for stock. The smooth face of horseshoes exacerbates the danger of slipping. While there are some horseshoe styles that increase traction in certain circumstances, they are not appropriate for all surfaces. Slick surfaces that compromise an animal's footing include shale, submerged rocks, wet wood surfaces, moist vegetation, and ice. Snow-packed hoofs, especially shod hoofs, also limit an animal's mobility.

Hard surfaces become much more dangerous on a slope. Once an animal has started to slip or skid, it has difficulty regaining its balance. In most cases, both animal and rider fall to the ground. Hard surfaces with slopes steeper than 5 percent need to be treated to increase traction. Consult *Chapter 6—Choosing Horse-Friendly Surface Materials* for more information regarding suggested surface treatments.

## Mouth and Teeth

Horses and mules use their flexible lips and strong teeth much like people use their hands. They can untie a rope or release a pressure snap on a gate. Mules are especially adept escape artists. Even experienced riders have been surprised to return to a mount they thought was securely tied, only to find it wandering loose. Horses and mules also can lift or pull heavy objects by using their teeth and their body weight.

## Basic Needs

Horses and mules have the same basic needs as most living beings— healthy air, water, and food. They also have some specific and unique requirements.

Healthy horses and mules have excellent lung capacity and a high level of endurance. Smoke, dust, toxic fumes, and pollutants affect their ability to breathe. Many people are surprised to learn that horses and mules breathe air only through their nostrils. Some stock even hold their breath when they are listening intently or greatly stressed or alarmed. When this happens, they can become dizzy or faint from lack of oxygen. Horses and mules also hold their breath for short periods while eating underwater vegetation. They must be able to keep their nostrils above water when swimming. If *tack*— or riding equipment— restricts movement and forces a horse's nostrils underwater, the horse may drown. Horses and mules with canvas feedbags on their heads can drown if the bag fills with water when they try to drink.

According to the Cummings School of Veterinary Medicine at Tufts University (2006), an average horse needs at least a gallon of water daily for each 100 pounds of body weight. The amount of water a horse needs depends on many factors, including its physical size, how active it is, whether it is pregnant, how much it has eaten, and how long it's been since it last had a drink. A horse exercising in hot weather may need two to four times the minimum amount. Make sure that horses have frequent access to drinking water. On trails, provide horses and mules with access to drinking water at least every 10 miles (16.1 kilometers). Riders often take advantage of every watering opportunity. On the other hand, riders leading a long string of stock may not water stock as frequently to avoid the complications of stopping a string. The mules in figure 1–8 are taking advantage



Figure 1–8—Trail stock, such as these saddle mules, need regular access to clean water.



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of access to water during a work trek. In hot climates or when traveling through difficult terrain, additional watering may be advisable. During freezing weather, inexperienced horses and mules or stock from warm climates may not know how to break the ice that has formed on top of water containers. Dehydration can cause serious health complications that require immediate medical attention.

Horses and mules thrive when they have access to grazing 24 hours a day. Eating regularly keeps an animal's digestive action healthy. At a minimum, stock need to feed twice daily—usually 12 hours apart, morning and evening. Food requirements vary with the amount of work an animal has done, as well as its physical attributes, age, and condition.

The *Manitoba Agriculture, Food and Rural Initiative* (2006) lists a horse's daily feed requirement as between 1.5 and 3.5 percent of its body weight. That means a 1,000-pound (454-kilogram) horse will eat 15 to 35 pounds of hay, grass, or other feed each day.

The digestive system of horses and mules becomes accustomed to the particular food they're eating. If the type or quantity of food changes suddenly, horses are vulnerable to digestive disorders or serious health problems. In addition to food, stock require salt in

their diet to replace lost electrolytes. As outdoor temperature, sweating, and the horse's activity level increase, so does the required amount of salt. When an animal is dehydrated enough to have a low salt concentration in its blood, its thinking may be clouded.

At feeding time, horses and mules frequently become very nervous, aggressive, and display dominating behavior toward other horses. The horses in figure 1–9 display typical aggressive body language as they keep an eye on their neighbors and show their impatience for food. If facilities don't have adequate space to allow horses and mules to get away from a dominant animal, stock can injure themselves, their stablemates, people, and property. In such cases, stock may need to be separated from one other.



Figure 1–9—Aggressive behavior often emerges during feeding time. These horses are extremely wary of each other.

## Senses and Behavior

A key to understanding the instinctive behavior of horses and mules is to know how they see, hear, smell, and feel things. As prey animals, horses and mules are very perceptive—they had to be to survive in the wild. However, along with that acuity comes some limitations.

### Vision

Horses and mules move their eyes independently, allowing them to see objects in two different directions at once. Their eyes protrude slightly from the sides of the head, allowing panoramic vision with a visual field that measures about 350 degrees. This visual field is predominantly *monocular*—or seen with one eye at a time. The monocular portion of the field measures about 285 degrees. Monocular vision is relatively flat and is used for detecting distant motion. Horses and mules also have a *binocular* visual field—an area of about 65 degrees that is seen with both eyes at once. In contrast, the human field of vision, which measures less than 180 degrees, is mostly binocular. Binocular vision is three dimensional and contributes to depth perception.





Because their eyes are on the sides of their heads, horses and mules have blind spots in their binocular vision (figure 1–10). They cannot see the tips of their own noses or anything directly beneath their heads, limiting the ability to see anything directly in front. They cannot see objects closer than 4 feet (1.2 meters) with binocular vision. They also don't automatically see something behind that is narrower than their body. Horses and mules can't see forward and sideways at the same time.

In order to focus their vision, horses and mules must move their heads, and they can do so with amazing speed. They can focus their vision more quickly than

can humans. Usually when stock lift their heads, they are looking at something in the distance. They lower their heads to focus on low, close objects. This visual arrangement allows horses and mules to graze and watch for danger at the same time, but may affect their depth perception. Occasionally stock run into, fall over, or step on low-lying objects that they did not see or recognize as a hazard, such as posts, wires, holes, signs, rocks, and waterbars. Stepping into an animal's burrow can cause a horse or mule to trip, fall down, or break a leg. Common burrow dwellers include ground squirrels, badgers, and prairie dogs (figure 1–11).



Figure 1–11—The burrows of ground animals, such as prairie dogs, present tripping hazards for horses and mules.

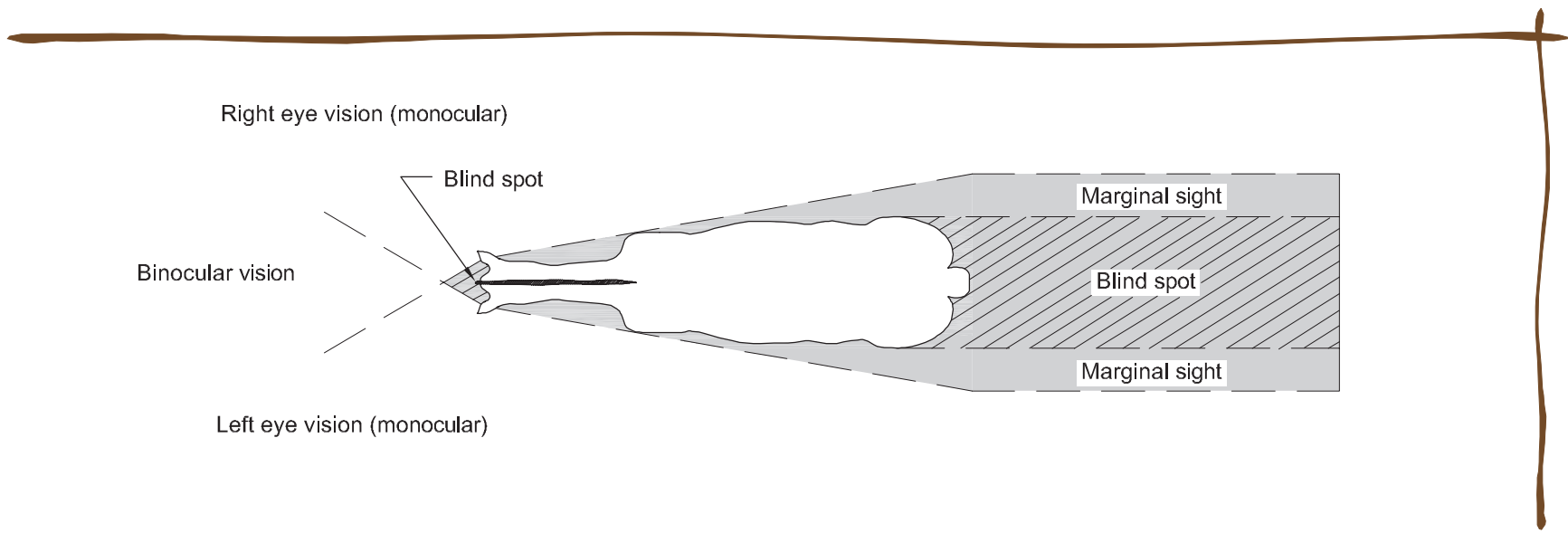


Figure 1–10—A horse's fields of vision. —*Courtesy of American Youth Horse Council. The original figure was edited for clarity.*



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Unfamiliar objects in the distance are suspect to horses and mules. For instance, a trail animal sometimes has trouble identifying a hiker with a bulky backpack (figures 1–12 and 1–13) as a person, unless the hiker speaks. The animal will be on alert until satisfied that a threat is not imminent. Because they are prey animals, horses and mules can become disoriented and nervous when they hear



Figure 1–12—Horses and people may have trouble identifying unusual objects they encounter on trails. What first appeared strange and possibly threatening...



Figure 1–13—...turned out to be a hiker with a plastic-covered backpack.

something, but are unable to see it. Hidden sources of activity—such as those behind solid walls or fences—cause some stock to become fearful. Horses and mules frequently rely on their wide peripheral vision to navigate in tightly restricted spaces and to pass through narrow areas, such as gates, trails, or bridges. In these situations, some stock feel trapped. In response, they may bolt quickly through the offending space, creating a potential safety hazard to themselves, riders, and others. Because of their exceptional sensitivity to side and rear movements, horses and mules that are harnessed to pull a cart often wear side blinders. The blinders reduce peripheral vision and reduce the chance that the animal might see something that alarms it, such as the motion of the cart’s wheels.

Research by J. Carroll and others (2001) suggests horses—mules were not studied—have *dichromatic* vision—they distinguish two main colors—while humans have *trichromatic* vision—they distinguish three main colors. Many of the colors horses do see are *desaturated*—or less intense. Colors that contrast with more subtle natural hues attract the animal’s attention. Examples include a large white rock against a dark background, a red shirt, or dappled shadows. Many experienced stock stop to make certain such objects are not potential hazards or predators. Similarly, when horses or mules see a surface change, such as shadows or roadway markings painted on asphalt, they hesitate or stop.

Reflective materials may confuse stock, especially if the material is used on signs that move in the wind or if lights ripple across reflective backgrounds. Any lighting that distorts natural colors, including some night lighting, affects an animal’s comfort, vision, and ability to function well.

Horses and mules see very well at night, probably a survival mechanism to escape nocturnal predators. Their large eyes admit substantial light, which is amplified by internal reflectors. The low-light vision of horses and mules is better than that of humans. However, their eyes adjust more slowly to light changes than human eyes. Lighting contrasts when entering or leaving enclosures, such as tunnels or horse trailers, can cause horses and mules to hesitate until their eyes can adjust to conditions.

### Hearing

Riding animals have excellent hearing, better than that of humans. Horse and mule ears rotate 180 degrees and generally face the direction the animal is looking. They can focus one eye and ear on the rider and one eye and ear on something else. When they hear something, horses and mules want to see the cause. Noise created by traffic, wind, and other distractions can greatly interfere with hearing, and cause many stock to become skittish. Stock ridden in more developed environments become accustomed to unsettling noises after repeated exposure to them. Vehicles backfiring, sonic booms, gunfire,



firecrackers, sirens, helicopters, public address systems, hot air balloons, trains, marching bands, mechanical equipment, echoes, and bridge or tunnel sounds are tolerated by stock that are accustomed to them. Horses and mules that spend time in rural areas get used to noises there, such as the sounds of farm animals or forest activities. However, all these sounds and many others can startle stock unfamiliar with them, making it difficult for riders to maintain control.

### Smell

Horses and mules also have an excellent sense of smell, much better than that of humans. Trail stock may use smell to find their way back. They readily smell other animals, and they can discern differences in the smell of water. Most horses and mules are happy to drink muddy water from a puddle because it has a natural odor, but they may refuse to drink from an unfamiliar source. Many riders travel with a familiar water bucket so their stock will welcome water in recreation sites.

### Touch

Horses and mules are so sensitive to touch that they can feel a fly land on a single hair. Slight pressure from a rider's legs can guide a horse or mule forward and anything touching its whiskers or body hair can alert the animal to trouble. If an animal brushes up against a narrow passage and feels trapped, its survival instincts kick in.

Sharp objects, such as barbed wire, easily cut or damage the relatively tender skin of a horse or mule. Painful or sharp impacts trigger the animal's instinct to run away from the offending object or lunge through it, potentially injuring itself or others. A frightened animal also can damage things nearby.

Horses and mules enjoy rubbing against protruding objects because they are handy scratching devices. Given the sensitivity of their skin, stock can easily injure themselves while scratching. Remove or flatten any sharp corners, nails, posts, curbing, or protruding objects that can catch an animal, rider, or equipment. Wire fences should be completely smooth and free from projections or barbs.

### Curiosity

Some horses—and many mules—are exceptionally bold. Their curiosity leads them to explore anything new in their environment. They smell, push, move, pick up, or play with new objects within their reach. They may pull things into a corral with their teeth or kneel to reach underneath fences for something they want. Depending on the design of the fence or barrier and the size of the animal, horses and mules may be able to reach 6 feet (1.9 meters) beyond its edge.

### The Herding Instinct

Horses and mules prefer being around others of their kind, where they find comfort and safety. In the wild, horses survived by staying with the herd. This innate

herding instinct strongly affects domesticated horses and mules today. If one animal becomes startled, many nearby animals also will become alarmed. When one horse runs, the others want to run as well.

The herding instinct can pose problems when new horses or mules are introduced to a group that has an established *herd structure*—or pecking order. Stock establish the herd structure by kicking and biting (figure 1–14). Horses usually dominate mules. The pecking order influences which stock have ready access to food, water, or space in a shared enclosure. Some equestrian facilities address this behavior by blocking views from one animal area to another, but not all riders agree with this approach. Until stock are familiar with each other, they should not be turned loose together in open, common enclosures.



Figure 1–14—Horses and mules kick and bite to establish herd structure—or pecking order. Herd structure determines who has first access to food.



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When unacquainted horses and mules are tied side by side or placed in shared areas, they need close supervision.

Kicking and biting are natural defense mechanisms for horses and mules. Their kick is amazingly quick, powerful, and potentially life threatening. An average animal can kick 6 feet (1.8 meters) backward without moving its front feet. They also strike and stomp with their front legs and can aim sideways. Mules in particular are adept at kicking forward with their hind feet, a practice sometimes described as a *cow kick*. Stock confined in relatively small enclosures often repeatedly kick the offending barriers. Horses and mules also may bite people, animals, vegetation, or other objects within range.

### Responses to Weather Conditions

Horses and mules sometimes respond to changes in weather more than humans. Why a weather change affects them is not fully understood. How they respond in different conditions is relatively well known.

Horses and mules can adjust to relatively high outdoor temperatures, although the combination of high heat and high humidity exhausts them and makes them quite uncomfortable. They frequently seek shelter—or *shade up*—by standing under

trees or overhead structures. However, if irritating insects invade the shaded areas, horses and mules may choose to stand in the sun. Horses and mules withstand cold weather and snow quite easily if they are conditioned. In cold weather, stock with shorn hair or stock accustomed to being stabled or blanketed may become chilled and susceptible to respiratory illnesses.

Rain, whether it is a light shower or a torrential downpour, does not noticeably affect stock. Most horses and mules turn their backsides into the rain during heavy showers and wait them out. Stock that stand in accumulations of rainwater or mud for 3 to 4 days may get *hoof thrush*—an ailment caused by an anaerobic bacterium that eats away at the frog.

Horses and mules are unusually sensitive to electrical current and highly susceptible to injury. Some horses and mules may tense up near high-voltage electrical lines.

Lightning is very hazardous. Some stock become nervous and difficult to control when lightning is flashing and thunder is cracking. Taking shelter under trees can be dangerous during electrical storms. An enclosed horse trailer with rubber tires may be one of the safest locations for stock. The riders probably will be safe inside the tow vehicle.

Horses and mules don't like wind in their faces. Whenever possible they turn their hindquarters upwind (figure 1–15). When the wind is blowing and much of the outdoors is moving, horses and mules may shy while mentally preparing to evade perceived threats, even the moving shadow of a billowing flag.



Figure 1–15—Horses turn their backsides to the wind.