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Note: In my opinion, the relationship between numbers of big game animals and the annual utilization of the available winter range forages should be determined on a yearly basis in spring. In order to properly balance big game populations with the forage resources available, these data are an essential component of big game management, management plans, and recommendations. Management plans consistently describe and require this animal-forage balance, but data are rarely collected to facilitate the necessary understanding and documentation. The range data collected on the Cache unit beginning in 1997 fulfilled this requirement. Most management systems collect intensive data on the populations dynamics, including sex ratios, fawn-to-adult ratios, age structure and antler characteristics of the harvested buck population, and physical condition indices, but most data collection systems simply forget or ignore the first half of the management prescription—the animal relationship with the forage resource. For example, in recommending hunting seasons and number of permits, knowing the number of big game animals available on a range is only important if the browsing impacts on the range are also known. When the range relationships are unknown, unsupported recommendations are submitted, which often lead to expanding populations in excess of range resources. Although the Utah big game range trend studies provide excellent data on a periodic, five-year cycle, these studies do not consider utilization...
on an annual basis, and therefore, do not address the causes of the trends. Both sets of data are essential.

Mule deer and big game in general have the unusual ability to destroy their habitat in a few short years of overpopulation. The first result of overpopulation is severe die-offs during a harsh or even moderate winter. The second result of overpopulation is excessive use of critical shrub species, especially during years of harsh winter weather. The consequence of excessive utilization of shrubs leads to the third result of reduced shrub productivity, increased shrub mortality, and decreased ability of the habitat to support mule deer. The fourth result is the logical and unfortunate decrease in the future carrying capacity of mule deer. Since about 1930 various units have experienced years of significant overpopulations and overused ranges, followed by severely decreased deer populations. Many of these significant die-offs and losses of range resources, due to the effects of deer populations in excess of carrying capacities on many or most of Utah's ranges, occurred during the winters of 1983–1984, 1988–1989, and 1992–1993.

The winter of 2001–2002 showed a significant increase in utilization of winter shrub forages compared to the three previous mild winters. Deer pellet group density increased while elk pellet group density slightly decreased. Temperatures were extremely cold, and snow depths on winter range were above average. Overwinter mortality was major. An estimated 50 percent of the Cache deer herd died during this harsh winter, including 80 to 90 percent of the fawns, 40 to 60 percent of the bucks, and 20 to 30 percent of the does. Minor losses were also observed for calf elk and moose.

The wintering period was long, fall regrowth was slight, snow cover was constant, and deer were forced onto critical winter ranges early into the winter. These factors caused deer to utilize winter range shrubs at an earlier and higher rate than under average winter conditions, despite the fact that deer numbers were considerably under the management goal of 25,000. In the spring, shrub utilization by subunit indicated that the Clarkston Mountains were under carrying capacity; the East Face, Garden City-Laketown, and Crawford Mountains were slightly under carrying capacity; the Blacksmith Fork drainage, Logan River drainage, East Bear Lake, and Woodruff Creek were about at carrying capacity; and the Wellsville Mountains in the Box Elder Canyon exceeded carrying capacity. Over the entire Cache unit the percent carrying capacity,
Mule Deer
determined by the utilization means of big sagebrush, antelope bitterbrush, and other palatable shrubs on deer winter ranges, was measured at 71 percent. These data indicated that big game populations on the Cache unit remained below carrying capacity.

Lesson Five. Redefining the Concept of Necessary Mule Deer Winter Range

All winter range is not equal in importance for sustaining mule deer populations. Also the importance of any habitat or subunit may change between years depending on the winter weather conditions of those years. Numerous titles describe various aspects of winter range and include transition range, upper, middle and lower winter ranges, critical winter range and important winter range. From my observations on the Cache unit during the extreme, and challenging for deer survival, winter of 2001–2002, I recommend using the term “vital mule deer winter range.”

“Vital mule deer winter ranges” are those areas where mule deer are found in significant numbers when weather conditions exceed the following parameters: nighttime temperatures are colder than zero degrees Fahrenheit and snow depth on winter ranges exceeds eight inches.

Under these conditions, deer seek the vital locations of winter range where plant cover, slope, and aspect maximize thermal cover and temperatures, and thereby maximize the opportunity for survival. Additional criteria for vital mule deer winter ranges include the area’s size and its ability to support mule deer through very cold and difficult winters. The area must first act as a gathering place for mule deer when the above two conditions are reached. Vital ranges always contain thermal cover, such as Utah juniper, or have steep south-southwest–facing slopes. The area must contain at least 500 acres and be capable of supporting at least 100 deer.

Numerous small areas of survival habitat are available, such as small protected draws of a few acres; well-landscaped backyards; small hillsides above roads, canals, or homes; and unimproved land within urbanized developments. Although deer may survive in such areas under severe weather, because of the limited numbers of deer that can be supported and the usually short-term or temporary availability of these habitats before development, they are not considered vital winter range.

On the Cache unit during the winter 2001–2002, the vital deer winter range was clearly defined by the locations of mule deer during the late
January to February period. The portion of the total winter range occupied by mule deer during this period was less than five percent of the defined winter range.

Vital mule deer winter range is simply restricted to only those areas where significant numbers of deer can survive during the harshest of winter conditions. These vital winter ranges must be defined and preserved to maintain deer populations on each of Utah’s 30 deer units. Vital deer winter ranges have been identified and mapped on the Cache unit. On ranges where winter range is the bottleneck, loss of these vital winter ranges, due to development, highways, or wildfires, will clearly lead to the demise of the deer herd during severe winters.

**Lesson Six. Triggers for Emergency Feeding of Mule Deer in Utah**

Generally, deer should not be fed due to numerous economic, disease, and range deterioration reasons. Feeding should only proceed under emergency winter conditions to control big game damage to agricultural crops, to promote public safety by attracting big game away from highways and urban areas, to maintain minimal big game populations, and to relieve stress on populations during severe winter weather. DWR feeding programs must be approved by the division’s director.

I believe that the experience gained during the winter of 2001–2002 on the Cache unit indicated certain considerations that should be evaluated before initiating a winter feeding program for mule deer. These criteria are similar to the DWR feeding policy, but were determined before that policy was approved. Feeding should only be initiated if all four of the following criteria are present:

1. Temperatures at night have decreased to zero degrees Fahrenheit or colder. Nighttime temperatures are forecasted to be subzero for one or more weeks.
2. Snow depth on the winter ranges generally exceeds eight inches. Snow depth in the adjacent valleys exceeds eight inches and is generally continuous.
3. Deer or elk have concentrated on vital deer winter ranges.
4. Native browse forages are expected to be insufficient to maintain big game throughout the winter.
If any of the above four conditions are marginal and the feeding decision remains debatable, the following criteria should be considered:

(1) Range forage conditions are poorer than normal due to reduced summer production. Fall regrowth of grasses is minor.

(2) Physical condition of deer at the beginning of winter, as determined by the xiphoid fat index, is rated in the poor to fair condition classes.

(3) Migration onto winter ranges occurred earlier in the winter compared to most years.

(4) Commercial feeds, including second and third-crop alfalfa hay, deer pellets, lamb grower pellets, rolled barley, and cracked corn, are readily available.

(5) Monies are available and have been designated for emergency feeding.

(6) Feeding sites have been previously selected and landowner permission obtained, and an emergency feeding plan has been written for the unit.

(7) To maintain deer numbers within carrying capacity of the winter range, sport harvest of antlerless and antlered deer can be accomplished.

(8) A reduction in mule deer–vehicle accidents is likely, resulting in a reduction of human safety concerns.

(9) Reduction of agricultural crop loss is probable, and a reduction of damage to landscaped residential properties is likely.

(10) Public opinion favors feeding of deer.

(11) Sportsman’s groups and other volunteers are organized to conduct the feeding. Leaders have volunteered to coordinate the program.

Feeding should be initiated between December 15 and January 31. Generally the most appropriate time to initiate feeding appears to be about January 1. Upon program initiation, feeding should continue through about the end of March, or until green-up. At this time, deer diets rapidly change in only a few days from the provided commercial feeds and available browse to the new spring growth of grasses, followed in a few more days by the availability of spring forbs.
Chapter 16

Defining Management Techniques

Every management question must deal not only with the question of how many deer, but what sex and age . . . . At present we do not even know how to tell the age of a deer!

Aldo Leopold, 1931

Game Survey of the North Central States

Age Determination

The age of mule deer cannot be determined by the number of antler tines or any other antler measurement. For example, although a high proportion, often 50 percent or more, of yearling bucks have 2x2 point antlers, yearling antlers can vary from 1x1 to an occasional 3x3 or even 4x4. Accurate age determination can only be made from dental examination or cementum annuli analysis (Severinghaus 1949; Robinette et al. 1957). Dental examination involves evaluating the teeth in the field, whereas in cementum annuli analysis the two front incisors are cut and removed from the jaw for laboratory inspection. In a laboratory, teeth are decalcified, thinly sliced, and stained, and the annual depository rings, similar to tree rings, are counted under a microscope for accurate age determination (Erickson et al. 1970).

Using tooth eruption, replacement, and wear criteria, most deer can be accurately aged in the field. Once the technique is learned, nearly 100 percent of yearlings, aged one-and-a-half years, 80 to 90 percent of twolings, aged two-and-a-half years, and 70 to 80 percent of mature deer aged three-and-a-half and four-and-a-half years can be aged accurately. Accuracy greatly declines for field determination of deer aged five-and-a-half years and older.
Using cementum annuli analysis, accuracy is often determined by the precision of the laboratory work. If done exactly correctly, cementum annuli analysis is nearly 100 percent accurate. However, because of the difficult techniques involved with the laboratory work, this analysis typically yields levels of accuracy between 80 and 95 percent. Generally, when deer age structure of a herd is important to determine, yearling and twoling deer should be aged in the field, and with much higher costs, cementum annuli analysis should be used only for older deer. Buck and doe deer have identical dental patterns.

Fawns are easily identified by their small body size, with a hog-dressed weight usually between 35 and 55 pounds, and small deciduous milk teeth. Yearling and older deer rarely have hog-dressed weights of less than 70 pounds.

To determine the field age of yearling and older deer, first cut the cheek between the upper and lower jaws and spread the jaws. In October, yearling deer are about 16 months of age and usually have new, large white incisor teeth at the center and front of the lower jaw. Often next to the incisor teeth are very small deciduous milk teeth. Sometimes next to the incisor teeth are empty spaces where the deciduous milk teeth have recently fallen out. The presence of milk teeth or empty spaces is an absolute indicator of a yearling. However, many yearlings have replaced all deciduous teeth with permanent incisors, and age must be determined using the third pre-molar. The third pre-molar is the third molar tooth counting back from the incisor teeth. The third pre-molar on all yearling deer in the fall is a deciduous tooth showing heavy wear and is tri-cuspid, or having three peaks. The tri-cuspid tooth always defines the deer as a yearling. The third premolar is replaced early the next summer when the deer is about 24 months of age. By the following fall at the age of about 28 months, all deciduous teeth have been replaced by the permanent teeth.

Twolings, or deer aged two-and-a-half years are identified by three dental examination criteria: the difference in staining between the lightly stained, new pre-molars toward the front of the jaw and the more darkly stained older molars toward the back of the jaw; sharp lingual crests, distinct lines along the outside upper teeth edges, of the first and second molars; and slight wear, if any, on the white-tipped posterior cups on the third molar, the tooth farthest from the incisors and often still emerging. Although sometimes difficult to deeply cut the jaw back and examine the
third molar, the condition of that tooth will almost always accurately age a twoling deer.

Prime deer aged three-and-a-half years and older are separated by evaluating the increasing wear on first and second molars. Most data collection and studies do not split prime age classes into years. However, experienced biologists can readily separate the three- and four-year age classes from older deer. The age classes five, six, seven, and eight become increasingly difficult to age accurately in the field due to the differences in dietary habits by individual deer over their lives. At about seven-and-a-half years deer begin to lose teeth and by nine-and-a-half years many or most teeth are missing from the jaw. Only rarely do mule deer live beyond 12 years.

**Classification Counts**

Determination of buck-to-doe-to-fawn and adult-to-fawn ratios are an essential part of big game management data collection. Classification counts are collected during three periods.

Pre-season counts are taken from about September 15 to October 15 when fawns and does stay mostly together in small groups. During this count bucks are more isolated and often fewer bucks are counted than are actually represented in the herd composition. The pre-season count yields data on the summer fawn rearing success and the expected number of deer available for the October general hunt. The pre-season count is most useful on units where the later counts are difficult to accomplish and cannot obtain adequate sample sizes. As expected, usually the pre-season fawn-to-doe ratio is extremely close to the fawn-to-doe ratio obtained during the post-season count, especially when the unit is closed to antlerless harvest. The pre-season count is not critical to deer management, especially when the other two classification counts are conducted. Furthermore, significant migration from a unit before the October hunt is rarely a concern, and harvest forecasts are not essential.

However, pre-season counts on private lands, especially Cooperative Wildlife Management Units, are highly recommended and contain several advantages for the landowner. First, because ranches are considerably smaller than wildlife management units, data on the herd composition on private lands may be considerably different than whole units. These data become extremely important on a year-to-year basis.
in establishing number of hunting permits. A reasonably limited number of hunting permits leads to the second reason why pre-season count data are important. Pre-season count data allow the private landowner to maintain the desired quality of the harvest over time, such as buck size and antler spread, since fewer hunters means more bucks can live longer and grow bigger. Third, due to the interests of hunting clientele, the landowner often needs to be able to present data from the current year. This provides the clientele hunter with information that may help refine selectivity in the harvest of a buck. Fourth, if deer tend to move off the private land before the post-season counts are conducted over entire units, the post-season data may not be reflective of the herd composition on the private land.

The post-season classification count is conducted from about mid-November through the end of December after most deer hunts have ended. The classification count should begin at least seven to ten days after most hunts have finished and bucks have settled into less hunter-wary breeding behaviors. When most big game hunts end about October 31, a good starting date for classification is November 10. Classification counts can continue until almost the end of December when buck deer begin to shed antlers. Although antlers are occasionally shed as early as December 15, a good ending date for the post-season classification count is December 23. The important ratios of bucks per 100 does, fawns per 100 does, and fawns per 100 adults are determined in the post-season counts.

The post-winter classification counts are conducted in late March, April, and sometimes into early May. During this count only the fawns-per-100-adults ratio is determined. However, this is the most important of the classification counts because it indicates the annual recruitment to the deer herd. The count is also compared to the post-season fawns-per-100-adults ratio for an estimate of potential overwinter losses. Spring counts must not begin until the earliest signs of spring green-up are evident. New growth of grasses must be visible on the winter ranges. At the end of winter mortality losses are accelerating, and counts taken before green-up often overestimate actual recruitment. However, within a week following initial green-up, and the consumption of highly palatable and nutritious forages, overwinter mortality has declined to almost zero, and deer begin recovering from winter stresses.

Interestingly, the post-winter count was not conducted for many years because it was thought that by spring fawns could not be accurately
Defining Management Techniques

separated from adults using visual field observations. However, my unpublished observations conducted in the Uinta Basin on Blue Mountain in the early to mid-1970s, using trapped deer marked with visible numbers, clearly showed that accurate separation of fawns and adults was very feasible. It is highly probable that reports by other Utah biologists reached the same conclusion. Post-winter classification counts were adopted in Utah as a regular management tool beginning statewide about 1980.

Because deer are crepuscular, that is, most active during twilight, classification data are collected using binoculars and spotting scopes only during early morning or late afternoon into evening. Good criteria for count times are to end two hours after sunrise and to begin two hours before sunset. Spotlight counts are inaccurate. Counts should be taken throughout the geographic range and elevation extent, and not just the “better areas” on each deer unit. For example, on the Cache unit, for an in-depth analysis, all counts were separated into 10 geographic areas during the 10-year period from 1994 to 2003. Consistent differences between some of the 10 areas became evident and management recommendations were made accordingly.

In my experience, on good deer ranges a wildlife biologist can usually classify between 25 and 100 deer per observation period. A classification of 50 deer per observation period is about average, and 50 is a good sample size per observation period to maximize and maintain the accuracy and precision of counts.

Some variation exists in the ability of biologists to separate fawns and adults during both post-season and post-winter classification counts. Especially difficult is the split between large male fawns and small yearling does during the post-winter count. However, most paired trials show a variation in ratios of less than 10 percent between experienced biologists classifying the same areas. Some, perhaps most, of that variation can be attributed to differences in the individual deer observed by each biologist.

The higher the number of deer classified on a unit, the greater the accuracy and reliability of the resulting ratios. Highly accurate ratios are obtained when 1,000 or more deer, or 400 or more does, are classified on a unit. A minimum count to retain reasonable accuracy is about 200 does per management unit.
Checking Stations

Utah operates about 12 deer checking stations on the opening weekend of the general deer hunt. One of those stations, Blacksmith Fork, has been run almost continually since 1945. Checking stations are primarily run to collect biological data, although they also serve many other functions. They give the wildlife manager and the sportsman the first indication of the hunt’s probable degree of success. They provide an opportunity to share ideas and concerns with hunters and distribute information to the media, aid in law enforcement, and act as a training and education site for students and occasionally sportsmen. Since about 2000, checking stations in Utah have become voluntary stops for hunters transporting deer. However, informal observations indicate that more than 95 percent of hunters who have harvested deer stop at the stations to have their deer examined. Law enforcement has a minor role at checking stations.

Data collected at checking stations usually includes: hunter success on a daily and trip basis by hunting unit and often by location of kill; composition of the harvest, that is the percentage of bucks, does and fawns in the harvest; data from individual deer including age, carcass or hog-dressed weight, fat depth at the xiphoid process as an index to pre-winter physical condition, antler spread and height, number of tines as related to age, parasite load, and often, samples for chronic wasting disease; and miscellaneous information meeting the specific needs of the unit or manager including blood and tissue samples, number of unretrieved deer observed, wildlife violations observed, hunter opinion questionnaires, other species of wildlife observed such as the number of bull, cow, and calf moose, and hunter recommendations.

Three essential pieces of data are collected at checking stations. The first is age composition of harvested bucks, which is used to determine the age structure of the buck population. Combined with the buck harvest and several other pieces of data collected in the field, and through simple computer models, the population size of the herd can be estimated. The second is the physical condition index of fat depth, which is used for later evaluation with winter severity, particularly in regard to supplemental feeding. The third essential data are disease testing. A recent example is the tissue samples collected to test for chronic wasting disease, which are very important for hunter safety and management concerns.
Defining Management Techniques

Trapping and Marking

Generally deer are trapped in late fall and early winter. Trapping efforts begin immediately following the end of the deer hunts. At that time of year physical condition of deer is near optimum. Bait is placed on winter ranges to attract deer to the trapping sites for usually five to ten days prior to setting of the traps. However, with good technique, the traps are in place at the beginning of the baiting period to allow deer to become accustomed to the presence of the traps. Invariably, the most successful trapping occurs immediately after the first major snowstorm when deer are adjusting their diet from fall grass regrowth, leaves, and dry forbs to winter browse. At this time tasty alfalfa hay is a strong food attraction to a deer. Because of declining deer physical condition, all trapping efforts should usually end by mid-January and extend no later than the first of February.

The box trap commonly used to trap individual deer, but may trap two or even three deer, consists of a collapsible half-inch diameter pipe frame, measuring about four by four by eight feet, and covered with nylon netting on all four sides and top. The trap, weighing 70 to 80 pounds, is secured to the ground by ropes tied to the bottoms of steel posts that are driven into the ground about four feet away from the midpoint of the long sides of the trap. Juniper trees are often used instead of steel posts where available. The single gate is string-tripped by deer entering the trap to feed on bait. Bait usually consists of second or third-crop dry alfalfa hay, but sometimes apples, apple mesh, rolled barley, or other feeds are used when available. Once deer are in the trap, biologists can either enter the trap directly and wrestle the deer to the ground, or collapse the trap by releasing the ropes tied to the posts. To reduce stress, trapped deer are handled as quickly as possible. Traps are checked at least daily by one or two biologists.

Few deer, only one or two percent, are killed from trapping efforts using box traps. Although biologists may receive many nicks and bruises, injuries are almost never serious. When a biologist enters the trap, the deer, in a frantic effort to escape, usually slam into the far end of the trap. The biologist rapidly crosses the trap, corners the deer, lifts and pulls the legs out from under of the deer, and both fall to the ground with the biologist on top. The take-down is similar to that in wrestling. Once on the ground, the biologist covers the deer’s head, particularly its eyes, with a
jacket or small blanket to keep it calm while the biologist attaches tags and collars and performs any other work.

Tangle-net traps are used to trap groups of deer and consist of a large net, suspended six to eight feet off the ground and secured by ropes and poles over a baited area. When the net is tripped, up to 20 deer may become tangled and trapped. Trapped deer are usually tranquilized with mild drugs to avoid injury to deer and biologists during untangling, marking, and release. Several biologists are needed to set up and operate large tangle-net traps.

The helicopter rocket tangle net is a relatively new application of the tangle net. Mounted at the base of a helicopter, four small rockets arranged in a square with the net between are fired from close range at selected big game individuals. This technique is very effective and highly selective, and big game injuries are few, but the technique is very costly.

In addition to trapping during winter, small fawns are simply captured by hand or by using long-handled nets when they are only a few days old. By attaching radio collars to captured fawns, this method is often utilized to determine causes of fawn mortality from birth to about six months.

The use of tranquilizing drugs, injected from darts shot from wildlife capture guns, is occasionally used in deer capture. This technique is usually employed in depredation situations when the deer would be translocated to a distant range.

Most captured deer are marked with numbered ear tags and radio telemetry collars. The radios emit signals for up to five years, while the location and movements are monitored. Radio signals can be monitored by fixed-wing aircraft and precisely located using GIS technology, or from ground crews using the same technology. With advances in radio telemetry not only are individual deer movements and locations monitored, but also mortality events, body temperatures, and even birthing dates and locations of fawns.

Previous to the technological development of radio telemetry, biologists relied on visual observations of ear streamers and colored neck collars. Since ear streamers, and color codes or numbers on neck collars were only discernible at distances of usually less than 200 yards, identifying and monitoring individual deer was very difficult and time consuming. Using this methodology, generally only annual migrations routes and major herd movements could be determined.
Defining Management Techniques

A Clover deer trap is used in winter to capture deer for research and migration studies.

Spring Range Rides, Pellet Group, Browse Utilization and Overwinter Mortality Transects

Overall impacts on the winter range are measured and determined in spring shortly following green-up. The relationship between numbers of big game animals and the annual utilization of available winter range forages should be determined on a yearly basis.

Annual range rides are an opportunity for biologists and sportsmen to look at the range in the western “cowboy” tradition. Although the popularity and number of range rides have greatly decreased in recent years, participants continue to look forward to the often first horseback ride of the year. Most spring range rides begin in early morning on saddle horses and cover many miles of winter range during the day. Range rides are an opportunity for riders to observe general range conditions, overwinter browse use by deer, and overwinter mortality. When used in conjunction with the recorded objective data, the range ride impressions and descriptive write-ups are an important input into management decisions.
Pellet group transects show deer population trends on winter ranges (Neff 1968). A transect usually consists of a minimum of 100 plots along a line and spaced at about 30 to 50-foot intervals. Plots are usually circular, contain 100 square feet, and are permanently marked at the center with an iron stake. Pellets are counted in the spring after deer have left winter ranges. All pellets are removed or swept from each plot to avoid counting pellets deposited from previous years. Pellet group transects are almost exclusively used on winter ranges because summer ranges usually contain large acreage, require numerous transects for accuracy, and have heavy vegetative growth that makes accurate counts very difficult. Because about 20 percent of pellet groups are not in a pile and are “strewn-out” or dropped while the deer is walking, usually a minimum of 25 pellets needs to be present on the plot for the group to be counted.

Browse utilization transects show the percentage of the current annual growth of key browse species that were eaten by deer during winter. The data are used as an index to deer herd numbers as well as range utilization. Browse utilization transects are usually located on important winter ranges or deer concentration areas. Randomly selected branches of shrubs, usually one branch per shrub, are marked with colored wires or numbered metal tags. Usually transects are run in a particular direction with each shrub along the direction sampled. At least 100 shrubs must be marked and sampled for browse utilization transects to begin to show accuracy. In fall before deer migrate to winter ranges, and in spring after they have left, browse transects are read by measuring the twig lengths of all annual growth above the tag on the branch. The differences in total twig lengths between the two measurements are used to calculate the percentage of overwinter utilization.

Browse transects can be an effective measure of range use by deer, however, they come with several problems. To be useful, many transects are needed within an area to yield an accurate data set. Separate transects must be established for each species and at several elevations. Big sagebrush, the key winter forage species in most areas, is very difficult to measure accurately. All transects require two readings each year and are very time consuming. Tagged branches are at times difficult to locate, and the need to periodically change branches within a shrub, due to branch mortality, reduces the accuracy of the technique. Consequently, except for special study areas, few browse transects are read.