# Conservation and Management of the White-tailed Deer: An East Texas Perspective

***Billy Higginbotham***
***Extension Wildlife and Fisheries Specialist***
***Texas Agricultural Extension Service***

## History and Current Status

The white-tailed deer is found in every East Texas county; however this has not always been the case. During the late 1800s and early 1900s, extensive land clearing, market hunting and lack of game laws reduced East Texas deer populations to remnant herds found in isolated pockets of habitat. More recently, favorable forestry management practices, law enforcement, public awareness and support and restocking of suitable habitat have resulted in the steady range expansion with current deer populations at an all time high throughout East Texas (Halls 1978).

### Life History

East Texas whitetails mate during the fall, with the peak of breeding season occurring in November. However, breeding may occur from October through January, depending on climatic conditions, age structure and condition of the deer population (Kroll, SFASU, personal communication).

Does are in estrus for approximately 24 hours and cycle at 28-day intervals as many as three to six times unless breeding occurs. Most does conceive for the first time at 1.5 years of age, but Forbes et al. (1971) reported that yearling does may cycle and conceive if adequate nutrition is available. Bucks are 1.5 years old at the time of their first participation in the rut.

Although doe fawns are capable of breeding at 6 or 7 months of age, this capability is directly related to the quality of nutrition available. Doe fawns capable of breeding may vary from 10 to 40 percent of a population (Tomlinson 1988).

Reproductive rates of older does are also directly related to the nutritional plane available. In East Texas the reproductive rates of adult does may be as low as 35 percent if the population has exceeded the carrying capacity of the range, or as high as 90 to 100 percent on high quality range that has not been overbrowsed. Does 1.5 years of age usually have a single fawn, while older does typically bear twin fawns if range conditions are adequate.

Theoretically, one mature buck and doe could increase to 22 animals in 5 years and 189 in 10 years in the absence of limiting factors (Halls, 1978). Production seldom reaches this level in East Texas because population levels are near or above carrying capacity throughout most available deer habitat (Kroll 1986).

Fawns are normally born in a 1:1 sex ratio; however, there is some evidence that a higher percentage of males are produced when the population has exceeded the carrying capacity of the habitat. In expanding populations a slightly higher percentage of females are produced (Verme 1969).

Life expectancy varies greatly with the degree of harvest pressure. In areas where antlerless harvest is limited, does may live to be 10 years old. Bucks suffer a much higher degree of natural mortality (often 25 percent annually). In hunted populations where bucks are heavily exploited (i.e., Leon County, Texas), approximately 70 percent of the bucks present are harvested at 1.5 years of age. The combination of natural mortality and heavy hunting pressure on bucks severely limits the number that ever reach full maturity (Kroll, SFASU, personal communication).

### Behavior

Daily movement of deer are closely associated with feeding routines and rutting activities. The home range sizes of deer in Texas vary from 60 to 340 acres for does and 240 to 880 acres for bucks (Halls 1978).

During early spring (February and March), deer are active most the day. Movement occurs every 2 to 4 hours, usually in search of food supplies that are typically scarce prior to spring greenup.

During the summer, deer movement occurs at sunrise, sunset and night, when temperatures are cooler. Does separate during this time and become territorial as fawning season approaches. After fawning (usually in May), does stay away from the fawns as much as possible except at 2- to 4-hour intervals for care and feeding. The fawns are generally weaned at 60 days of age, but they remain with their mothers and rejoin other does and fawns (Halls 1978).

Prior to the time of fawning, yearling bucks are driven away by dominant does and disperse at distances of 1 to 2 miles. Bucks typically form bachelor groups during the summer that may number five or more per group.

During the fall, decreasing day length (photoperiod) triggers the estrus cycles in does. Exact cycling periods are genetically coded and may be population

specific in order to meet varying environmental conditions. The first estrus cycle usually occurs in September, but the primary estrus period occurs in late October and early November throughout most of East Texas. The decrease in day length also triggers behavioral responses in bucks. Bachelor groups break up in early fall as bucks shed their velvet and begin preparation for the rut by rubbing trees to build up their forward body musculature. Increasing levels of testosterone in response to decreasing day length stimulates gonadal development.

Within 5 to 7 days of peak estrus in does, the bucks initiate rutting activity due to increased testosterone levels. Rutting behavior may be intensified by changes in weather conditions (i.e., cold fronts). The peak of the rut in East Texas normally occurs between October 15 and November 1. However, the rut may be very erratic if the deer population is in poor condition. Typically, poor nutrition brought on by drought, etc., may cause the rut to be delayed and/or undefined as was the case throughout most of East Texas during the fall of 1988.

Individual bucks rub small trees and saplings to create visual cues to attract does. This behavior usually occurs in open understory areas in or near foraging areas frequented by does. Bucks become increasingly aggressive and territorial and often defend their rutting areas from other bucks.

The formation of scrapes is an important part of rutting behavior. Bucks paw out areas in sandy loam soils under bushes and overhanging tree limbs. The limbs of the overhanging vegetation are often bitten off or rubbed with the nose and forehead to deposit scents (Tomlinson 1988). The buck also marks the scrape by urinating on his tarsal glands to leave further identification. Bucks may return to the scrapes, rework them and defend them against other bucks. Does frequently approach the scrapes and also urinate in them to increase the incidence of mating. Bucks often stay in attendance of receptive does for several days. Breeding normally occurs several times during the estrus period. In populations that have sex ratios heavily skewed toward females (i.e., buck:doe ratios of 1:6 or more), the use of rubs and scrapes as a means of communication may be less prevalent.

Following the breeding season, inclement weather and decreased body condition due to rutting activity takes its toll on a deer population. Bucks may have lost 30 to 40 percent of their pre-rut body weight and mortality increases substantially because of poor body condition, inclement weather and increased susceptibility to predation.

## Antler Development

Deer, as all other members of the family Cervidae, grow antlers that are shed annually. Except in rare instances, only male whitetails grow antlers.

Antlers develop from two permanent bones called pedicels. This developmental process is programmed to occur in boreal whitetails at certain prescribed times of the year (Goss 1983). Buck fawns develop small bumps the first year that do not break through the skin (Ullrey 1983). Antler growth is initiated by the pituitary gland which is stimulated by increasing hours of daylight.

During the growth process, antlers are covered by a soft membrane ("velvet") interlaced with numerous blood vessels that transport and deposit minerals (primarily calcium and phosphorus) needed to build the antler. The "rack" attains full size in August when decreasing day length triggers the release of testosterone into the blood stream, inhibiting further antler growth (Bubenik et al. 1986). The velvet drys up and is normally shed within a 24-hour period. Bucks often accelerate velvet shedding by rubbing their antlers on small trees.

Coloration of antlers is primarily determined by the amount of blood left in the velvet. If a buck begins to rub off the velvet before it has completely dried, the resulting blood stain gives the antlers a dark or "chocolate" color. Antlers generally lighten in coloration over time due to the bleaching effects of sun and rain.

Once velvet is shed and the antlers are hardened, whitetail bucks are in breeding condition. Testosterone levels of East Texas bucks peak in October and November, which corresponds to the primary breeding period. Testosterone levels decrease as winter progresses and once below a critical level, the antler base dissolves and antlers are cast (Calhoun and Loomis 1974, Jacobson and Griffin 1983). In East Texas this usually occurs during January and February.

The antler cycle is initiated once again during March when a temporary surge of testosterone is released in response to increasing day length (Brown et al. 1983).

## Factors Affecting Antler Development

Antler size and shape are reflections of age, heredity and nutrition (Davis 1973, Calhoun and Inomis, 1974). Since antler quality is of utmost importance to many hunters, manipulation of these controlling factors may greatly affect buck quality. Of these factors, the two that can be influenced most through management are age and nutrition (Tomlinson 1988).

Research has shown that antler size depends on the age of a buck. Therefore, hunters desiring bucks with large antlers should protect younger deer to increase the age structure of the bucks present. Unfortunately, many hunting leases in East Texas are buck-exploited, with as many as 70 percent of the bucks harvested when they produce their first set of hardened antlers (1 1/2 years of age). Bucks produce their largest racks at 4 1/2 to 6 1/2 years of age. However, few bucks ever have an opportunity to reach the age of maximum antler growth in heavily hunted areas.

Nutrition is the second factor that landowners/hunters can influence in order to enhance antler development. If minerals or other nutrients are lacking for the first 18 months of life, body growth takes precedence over antler development (Ullrey 1983). Therefore, the nutritional plane present plays an especially important role in determining the development of a buck's first set of antlers.

Adult bucks consuming high quality forage of at least 17 percent crude protein (McEwen 1975, Ullrey et al. 1971) from March to August receive adequate nutrition for antler production. McEwen (1975) also reported that optimum antler growth occurs when diets contain 0.64 percent calcium and 0.56 percent phosphorous by weight. Unfortunately, in overpopulated herds where quality forage is lacking, a higher percentage of spike antlers is produced by 1 1/2 year-old bucks. Many hunters mistakenly interpret this as a sign of poor genetics and develop a "kill all spikes" philosophy to improve the gene pool of the herd. As a result, almost the entire age class of 1 1/2-year-old bucks may be eliminated during poor nutrition (drought) years and are prevented from reaching their antler potential. Numerous hunting clubs have documented that most spikes harvested are young (1 1/2) rather than inferior deer, and if protected, will develop a more desirable set of antlers in subsequent years (Jacobson, MSU, personal communication).

# Habitat Needs: Cover, Food and Water

East Texas enjoys the highest precipitation rates and most diverse vegetation in the state. These factors result in a rapid response of plant succession to land disturbance activities.

This same rapid response allows the deer manager and landowner to manipulate the vegetative growth to the benefit of deer populations. For instance, forage availability can be enhanced by land disturbances such as timber stand improvements, etc. Escape cover can develop from bare ground in just a few short years if there is adequate protection from livestock grazing, etc. The relatively high annual rainfall in the region also allows managers, landowners and hunters to use supplemental food plots as a viable intensive management tool.

The basic requirements of food, cover and water are necessary for survival and propagation of deer as well as all wildlife (Short 1986). East Texas is well suited to provide for all of these requirements if appropriate management is applied.

## Cover

In East Texas, adequate cover is not a limiting factor for whitetails except where large acreages of forestland have been cleared or converted to permanent pastureland. Nevertheless, landowners should be aware that adequate escape cover is necessary to provide safety and connect food and water supplies.

A pine/hardwood mix is considered to be optimum habitat for East Texas whitetails. This mosaic of vegetation types at various stages of succession provides quality whitetail habitat, especially if a combination of uplands and bottomlands is present to further increase diversity of the vegetative community.

## Food

This diversity of vegetation also enhances the production and availability of deer forage (Short 1986). Deer rely on browse and herbage, but will also feed on grasses, hard and soft mast and mushrooms. The inconsistency in mast production, especially hard mast such as acorns, makes this source of forage unreliable. However, when mast is available, deer often feed on it to the exclusion of most other forage sources. The consistency of mast production can be enhanced by managing for a wide variety of mast producing species (i.e., red and white oaks) to reduced the likelihood of total mast crop failure (Kroll, SFASU, personal communication).

In general, deer rely primarily on browse and herbage as food sources. Browse is considered a mainstay in deer diets because of its year-round availability (Halls 1973). Deer use browse most in the fall and winter and it may become especially important during years of low mast production (Harlow et al. 1975). Although browse quality changes with season and species, its quality is usually adequate for deer during the cooler months.

Herbage is the preferred food source during the spring or whenever it is succulent and green (Short 1971). When available, herbage may constitute 50 percent or more of the diet. Native grasses usually contribute less than 10 percent of the total diet. Most grass consumption consists of young, tender grass shoots available in the late winter and early spring (Halls 1978).

Mushrooms are relished by deer and contain high levels of calcium and phosphorus (Miller and Halls 1969). However, mushroom availability is limited and, therefore, does not constitute a large portion of the overall diet.

Nixon et al. (1970) noted that agronomic crops (i.e., soybeans and winter pastures of annual grasses and legumes) are readily eaten by deer, provided that adequate cover exists nearby. Supplemental feeding using food plots of agronomic crops is becoming an increasingly popular method of increasing the nutritional plane available for deer (Crawford 1984). The production of these forages during seasons when native forage is unavailable or lacking in quality can greatly increase the productive capacity of a tract of land (Higginbotham and Kroll 1989).

Properly designed food plots can concentrate deer (i.e., for harvest), increase the nutritional plane avail-

able and inject needed minerals (especially calcium and phosphorous) into the diet. Both warm- and cool-season plants have produced in excess of 4 and 6 tons of forage per acre per year, respectively, at costs of less than $0.02 per pound.

Another form of supplemental feeding includes free choice, or creep feeding (Perkins 1979). This technique is more commonly practiced in West and South Texas where precipitation patterns prevent the consistent production of supplemental forages. One drawback to this technique is cost. Creep feeding with a commercial ration containing 16 percent crude protein that supplies adequate levels of calcium and phosphorous may cost five to ten times as much as supplemental feeding via food plots (Higginbotham and Kroll 1989).

The use of supplemental feeding is one of the best techniques available for improving the nutritional plane of a deer population, especially when their establishment is used in conjunction with techniques that enhance the production and quality of native forage (i.e., timber thinnings, prescribed burns). However, this technique should not be viewed as a management cure-all. Supplemental feeding is only one piece of the overall deer management puzzle and usually proves ineffective without adequate population control measures.

Ozoga and Verme (1982) concluded in a study of a supplementally fed deer herd "that the individual must decide whether the goal of a moderately large, healthy herd justifies the cost of its husbandry. However, this practice is not a logical substitute for habitat restoration nor a panacea for unpopular herd management measures. Traditional principles aside, perhaps biologists should stop viewing artificial feeding as professional heresy and realize that when properly administered, it can serve as a valuable tool in the current status of the art." It appears that in East Texas, the advantages of supplemental feeding can at least in part be obtained through forage production without the cost of creep feeding.

Mineral supplements also have been used to provide critical minerals (primarily calcium and phosphorous) to a deer herd. Preliminary information has indicated that mineral stations may improve antler development. However, these supplements are only recommended where soils are deficient in these minerals. Mineral supplements should contain no more than 30 percent salt and consist of a 2:1 or 1:1 ratio of calcium to phosphorous by weight. Some deer managers recommend one mineral station for every 150 acres of habitat, with 25 to 50 pounds of mineral poured into a shallow depression in the ground and replenished as needed.

### Water

Deer usually drink water from ponds, creeks, etc., but can go long periods without water if succulent forage is available (Short 1986). Water availability in East Texas is seldom a limiting factor. However, landowners should strive to maintain escape cover near watering sites to provide adequate protection.

## Management Considerations

The need for more intensive management strategies was recognized previously by Leopold (1933), who noted increases in human population required a more intensive system of game management to maintain the same proportion of hunting opportunities. McEwen et al. (1957) suggested that as human populations increased and land use intensified, measures beyond law enforcement and manipulation of regulations would become necessary to maintain species (deer) in sufficient numbers for sport. Schrader (1963) elaborated that mushrooming numbers of hunters necessitate that wildlife management personnel maximize wildlife production in order to maximize recreational potential.

## Deer Management: The Essential Elements

### Population Dynamics

The white-tailed deer is a K-adapted species, which means their population growth is habitat controlled. Whitetails are highly adaptable to land use changes (land disturbance and sub-climax conditions) and are capable of population growth from near zero to saturation (carrying capacity) of the habitat in a period of only 6 or 7 years (Kroll 1987). As a result, many Pineywoods and Post Oak Savannah deer herds are too large for their habitat. Kroll et al. (1986) noted that when herds are larger than carrying capacity for an extended time, forage availability and carrying capacity decrease over time.

Deer populations seldom remain low for more than just a few years because of the high reproductive capability of the species (Halls 1978, Kroll 1987). Where these rapidly expanding deer herds do occur (in the absence of limiting factors), a unique opportunity exists to study their population dynamics. For example, the extremes of the whitetail's range (Canada to the north and Mexico to the south) offers a glimpse at the mechanics of population expansion. In these unique situations, r max (intrinsic rate of increase achieved in the absence of crowding and shortage of resources) proceeds at an exponential rate. In the rare instances of poached-out populations, the same situation occurs. In both cases, r (observed rate of increase) approximates r max. Seldom are biologists presented with a more opportune occasion to monitor herd expansion (Kroll, SFASU, personal communication).

The maximum carrying capacity of most of the East Texas deer habitat is estimated at 8 acres per deer. Theoretically, a deer population of one-half of carrying capacity is considered to maximize production (McCollough 1979, Caughley 1980). At this level, hunters can harvest the most deer and still have the most deer present. Unfortunately, deer at population levels of one-half of carrying capacity are difficult to efficiently harvest. Therefore, managers generally compromise by maintaining populations at approximately two-thirds of carrying capacity (approximately 12 acres per deer) to achieve management strategies.

## Habitat Considerations

### *An Integrated Approach*

While most deer managers think, discuss and write in terms of carrying capacity, numerous deer management "success stories" have generated the term "productive capacity." Productive capacity invokes intensive management strategies and considers the questions: How many deer is this site capable of producing? and How many deer can be harvested on a sustained basis? (Kroll 1987). An intensive deer management program mandates that productive capacity of the site (as opposed to carrying capacity) be considered.

How is productive capacity achieved? The answer is through deer population control and habitat manipulation. However, many complex issues are involved. From a habitat standpoint (especially in the Pineywoods), this usually entails integrated management with timber stands. More specifically, the management of timber will need to meet forage, edge and cover requirements of whitetails. Timber harvest strategies, timber stand improvements (including prescribed burning), maintenance of streamside management zones, protection of mast producing hardwoods and supplemental forage production are several techniques utilized for improving deer habitat and productive capacity (Kroll 1987).

To maintain high quality habitat, a balance must be struck between a clearcut and a monoculture of pure, even-aged pine stands (Halls 1973, Hurst and Warren 1981, Short 1986 and others). Habitat diversity, not dominance of any one vegetation type, is the key to maintaining quality habitat for white-tailed deer (Table 1).

The whitetail responds well to disturbances and has proven to be highly adaptable to changes in land

**Table 1. Habitat Manipulation Techniques for Deer Management**

| Technique | Treatment |
|---|---|
| Clear cut harvest | Harvest in blocks of 15 to 35 acres whenever possible. Replant adjacent to stands that are at least 7 years older than new plantation. |
| Seed tree harvest | Reduce basal area to 15-25 square feet. Seed trees naturally regenerate stands. |
| Plantation establishment | Use an 8' x l0', l0' x l0' or 12' x 12' spacing on seedlings following clearcutting to delay canopy closure and maintain forage availability. |
| Streamside management zones (SMZs) | Maintain stands along creek drainages from crest of hill to crest of hill (300 feet minimum width if possible) to serve as travel corridors. Protect from prescribed burns using fire lanes. |
| Hardwood stand maintenance | Protect clumps of hardwood mast producers from harvest, prescribed burning, etc. |
| Prescribed burning | Divide tract into stands based on site index, stand age, geographic boundaries, etc. Prepare fire lanes around each stand. Burn 20 percent of stand total every year (5 year schedule) to stimulate forage production in the understory. Adjust prescribed burning schedule as necessary to maintain forage availability for deer (sites with a high site index may require a 3 year rotation). |
| Forage plots | Cool season – shred and disk food plot sites. Soil test and amend as required. Plant 1 to 3 percent of total area in 100 pounds elbow rye and 8 pounds inoculated arrowleaf clover per acre in late September and early October. Top dress with 60 pounds nitrogen in December and again in February.<br><br>Warm season – prepare 1 to 3 percent of total area as above and separately plant 50 pounds cowpeas (iron and clay or catjang) per acre and 20 pounds alyceclover per acre. Plant in May whenever adequate soil moisture is available.<br><br>Take advantage of existing areas available for planting such as right of ways, roads, permanent clearings, etc. |

use. One example of disturbance that occurs frequently throughout the Pineywoods is timber harvest. Even-aged timber management has resulted in clear-cuts of various sizes, many of which are too large to be useful to deer.

The best clearcuts (in terms of deer habitat) are small (15 to 35 acres), irregularly shaped and well distributed throughout the tract (Kroll 1987). This creates a mosaic of habitat types that are well suited for deer. Re-establishment of stands with at least 7 years age difference between adjacent stands provides additional habitat diversity. For the first 5 to 7 years following the clearcut, herbage and browse production provides excellent forage for deer, then forage quantity begins to decline with increasing canopy closure of the growing pines. Plantation establishment using a wider spacing (8 x 10 feet, 10 x 10 feet or even 12 x 12 feet) also helps to maintain forage availability by delaying canopy closure. Appropriately timed thinnings serve to increase sunlight to the forest floor and restimulate forage production (Halls 1973).

Other harvest strategies include seed tree cuts that reduce basal area to 15 to 25 square feet. This strategy keeps the cost of timber stand re-establishment low, yet provides sufficient sunlight to the forest floor to stimulate forage production.

Another important consideration in timber management involves the maintenance of adequate stream-side management zones (SMZs) and hardwood islands within timber stands. SMZs serve as travel corridors and should be maintained "crest to crest" if possible. Hardwoods (especially mast producers) should be preserved in clumps throughout all pine stands to provide food and habitat diversity (Halls 1978, Kroll 1987).

Supplemental forage plots have been used to concentrate deer for increased harvest, improve the nutritional plane available and provide critical nutrients (primarily phosphorous and calcium) for the herd. Well-planned food plots can satisfy all of these objectives.

Food plots should be planted on 1 to 3 percent of the total acres in the management unit. The sizes of individual plots may vary from 1/4 to 2 acres. Plots should be irregular in shape and, whenever possible, be long and narrow (Short 1986). Road, pipeline and highline rights-of-way are excellent sites for planting supplemental forages. Cereal grains (elbon rye, oats, wheat) and arrowleaf clover will attract deer for harvest (especially if doe harvest is necessary) and also provide high quality nutrition during the winter stress period and through the spring for antler and fetal development. Demonstrations have shown that production of more than 6 tons of forage per acre per year is possible from cool-season combination plantings (Higginbotham and Kroll 1989). Warm-season food plots of cowpeas and alyceclover provide high quality forage during the summer months. However, the availability of any warm-season supplemental forage is highly dependent on rainfall patterns and the ability of the forage to successfully compete with native vegetation.

Regardless of the supplemental forage program used, control of the deer population is necessary in order to achieve maximum benefits. Supplemental forage should not be viewed as a cure-all mechanism to correct over-population.

In addition to the integrated management of deer and timber, many landowners in East Texas also manage at least a portion of their land resource for cattle. Unfortunately, competition from cattle often limits food for white-tailed deer (Spencer 1983). The livestock manager interested in maintaining productive, healthy herds of deer and cattle must consider the needs of both to reduce competition whenever possible.

Moderate grazing by cattle during the spring and summer has little impact on deer, especially if well-managed pastures are available. However, if cattle are permitted to graze in deer habitat during the fall and winter, severe competition may result. This competition occurs mainly for available browse, a staple food source for deer during the cool months. Cattle should be excluded from woodlands during the fall and winter in order to decrease competition.

If cattle are grazed on native pasture, a rotation grazing program is necessary to prevent elimination of valuable herbage species (Yantis et al. 1983). Much of the native pastureland in East Texas has been over-grazed. As a result, the carrying capacity of these areas has decreased over time.

Pasture forage selection by the cattleman also can have a positive impact on a deer herd. Including legumes such as clover in permanent pastures can benefit both cattle and deer. Likewise, the use of winter pastures comprised of small grains provides high quality forage during a major stress period when native forage is low in quality or unavailable. However, to be effective, these combination plantings should be established adjacent to suitable deer habitat.

Another consideration when integrating deer into cattle management includes deer cover requirements. Obviously, deer won't be found on areas consisting of only cleared land or permanent pastures. The need for adequate cover may limit deer numbers on some ranches where too much woodland has been converted to pastureland. The optimum pasture-land/woodland ratio necessary to provide adequate habitat for deer will depend on landowner goals, soil types, terrain and vegetation types. However, deer requirements usually can be met if at least 30 to 50 percent of the land is maintained in woody cover (Spencer 1983, Yantis et al. 1983).

The integration of deer management with timber and/or beef cattle is the rule, rather than the exception, in East Texas. Ecologically speaking, farms and ranches have one common product for sale: sunlight

energy. How this product is utilized is entirely up to the landowner. It can be converted into pine timber, grasses in permanent pasture that are eventually converted to beef or perhaps a more diverse strategy involving forage and cover that will also benefit deer populations.

Landowners faced with trying economic times are frequently opting to move away from monocultural forms of agriculture towards diversification and integration of their operations into numerous enterprises. The ability to manage various land resources (i.e. timber, cattle, wildlife) will play an important role in improving cash flows and profitability in the future.

## Genetic Considerations

The final consideration concerning management of deer populations involves genetics. Genetic manipulation catches the fancy of many landowners and hunters who express a desire to improve their deer herd by stocking big-bodied, northern whitetails or large-antlered, South Texas bucks. This is, almost without exception, a mistake. Genetics is the most poorly understood of the three factors influencing deer management, yet it is often looked upon as a "quick fix."

An example of misinformed genetic management of a deer population is the war waged on spikes by many East Texas hunters under the auspices of improving the herd genetics. Unfortunately, the end product of this harvest strategy is usually a loss of bucks that are spikes due to poor nutrition instead of genetics. As a result, heavy spike harvests may eliminate most of the 1.5-year-old bucks in drought years when adequate nutrition is lacking. Research has clearly shown that the antler size and configuration of a buck at 1.5 years of age are not good indications of future antler characteristics (Jacobson, MSU, personal communication).

While there is considerable debate among deer researchers regarding the genetic influences on antler development, we know less about the effects of genetics on deer populations than the effects of habitat manipulation (nutrition) and population dynamics. For most hunters and landowners, greater efforts towards improving the nutritional plane, population control and increasing the age of bucks are the best methods of producing more desirable animals. The practice of culling certain animals because of genetic inferiority should only become a consideration when all other facets of management have been adequately addressed.

# Defining Goals – A Management Necessity

A landowner should not attempt to initiate a deer management program without first identifying a feasible set of goals. An integral part of this process involves a clear understanding of the cost (both ecological and financial) of each management strategy.

Basically, the East Texas landowner has three deer management strategies available: (1) trophy management; (2) high quality buck management; and (3) numbers management (Kroll 1987). A review of each strategy and its individual requirements should be an important part of the landowner's decision-making process.

## Trophy Management

Given a choice, most deer hunters would prefer to harvest a trophy buck (150 plus Boone and Crockett score), but few of them are willing to make the sacrifices necessary to achieve this management option. Likewise, many landowners desiring to manage for trophies fail to realize that the land base requirements are considerable (3,000 acres minimum, 10,000 acres preferred). Smaller tracts may be used, but deer-proof fencing becomes a necessity to achieve population control (to keep deer out, not to keep deer in!). Conventional deer-proof fencing costs $12,000 per mile; however, recent improvements in electric fence technology may cut that cost in half (Kroll 1987).

As previously discussed, maximum fawn production occurs at population densities of one-half carrying capacity. However, hunting becomes difficult at such low deer densities. As a result, trophy management dictates that deer populations be controlled at approximately 60 percent carrying capacity (approximately 12 acres per deer in East Texas).

In order to achieve such a drastic decrease in population levels in most East Texas habitat, harvest emphasis should be placed on antlerless deer while bucks receive increased protection. Once population control is achieved, fawn production will increase accordingly. The deer population will quickly expand back to or beyond carrying capacity because of increased fawn production, unless antlerless deer are controlled (three does harvested for every buck). Furthermore, antlerless harvest should be geared to produce a buck:doe ratio of 1:2.

How many trophy bucks are produced by this strategy? The answer is very few (1 per 1,000 acres of deer habitat). The reason so few are produced is a result of high natural buck mortality that may reach 25 percent per year. Since bucks must be protected until they are 4.5 to 6.5 years of age to reach trophy status, very few from any given year class ever reach full maturity.

In addition to increasing the age structure of bucks to meet the goal of trophy management, the nutritional plane available also affects antler development. While population control and habitat manipulation enhance native forage production, supplemental food plots should be established at the rate of 2 percent of the habitat base (2 acres planted for every 100 acres of deer habitat) to further improve the nutritional plane.

## Quality Management

Quality management refers to striving for high quality bucks in high quality habitat, resulting in a high quality hunting experience. Although strategies of managing for high quality bucks and trophy bucks are similar, ecological costs of producing high quality bucks are somewhat lower (Kroll, SFASU, personal communication).

The main difference between these strategies is the land base necessary (1,000 acres minimum for high quality management) and the age structure of bucks harvested. In a high quality program bucks become eligible for harvest at 3.5 years of age, resulting in a greater buck abundance and more opportunities for buck harvest.

A high quality buck can be defined as a 3.5-year-old eight pointer with a 15-inch inside spread. Most hunters will agree that this indeed is an animal most would be proud to harvest.

In order to initiate a high quality management program, population control at a level of 60 to 70 percent of carrying capacity is necessary. As with trophy management, most of the harvest should come from the antlerless segment of the deer population. The manager should strive to achieve a 1:2 or 1:3 buck:doe ratio, which will require the harvest of at least two does for every buck. By following this strategy, one quality buck (3.5+ years old) may be harvested for every 100 to 150 acres of deer habitat. With at least two does harvested for every buck, a harvest rate of one deer per 35 to 50 acres is possible.

As in trophy management, the productive capacity of the habitat should be increased through the establishment of supplemental food plots. Again, 2 percent of the land base (2 acres for every 100 acres of deer habitat) should be established in forages that meet the deer's nutritional requirements.

## Numbers Management

Numbers management is a strategy geared toward producing the maximum number of deer possible for harvest without much regard for the quality of bucks produced. This technique may be the only feasible alternative if the landowner does not have a large land base or cannot otherwise control harvest rates. In order to produce large numbers of deer, fawn production must be stimulated by reducing the population level to 60 to 80 percent of carrying capacity.

This approach differs from high quality management mainly in the age of bucks harvested (1.5 and 2.5 years of age instead of 3.5 years plus for a high quality program). In addition, a buck:doe ratio of 1:3 or 4 is acceptable. Supplemental food plots also should be an integral part of this management option. In most cases, establishment of 1 to 2 percent of the habitat base (1 to 2 acres planted for every 100 acres of deer habitat) in high quality supplemental forages is sufficient to increase the productive capacity of the land.

Using this strategy, sustained harvests of one deer to 35 to 50 acres are possible. However, efforts should be made to harvest more does than bucks.

## Deer Population Status/Diagnosis

Up to this point, a tremendous amount of information has been presented to outline population dynamics and habitat manipulation for the establishment and maintenance of a deer management program according to landowner goals. Yet there must be a standardized set of criteria available to determine the status of any given population (Kroll 1987). Fortunately, several tools are available to the manager, landowner and/or hunter for assessing population status in order to make necessary adjustments.

1. **Browse surveys** – inventory of the utilization rates of first, second and third choice browse species to determine relative deer density (Lay 1967). Typically conducted in late winter but also useful in late summer.
2. **Incidental observations** – records of deer classified by sex provide useful information from midsummer to the opening of gun season. This technique helps to determine buck:doe ratio and fawn survival.
3. **Population census** – useful at providing trend data on acres per deer from year to year as well as sex ratio and fawn survival. A combination of drag (track) counts and spotlight surveys are recommended in late summer.
4. **Harvest data** – normally collected by hunters as required by the landowner. This will be the most important data for making future management decisions. For the first year of a management program these records are especially essential in documenting the current population status. All future year's data will be compared to this benchmark data for making recommendations. These data include: dressed weights by sex; lactation rate; antler measurements (spread, beam length, basal circumference); age by sex; and percentage of spike bucks in the harvest.

Once a deer population has been assessed using these tools, adjustments can be made to achieve the desired goal. Collected data are compared to "standards" to determine the status of the population. Deer density determined census techniques and browse surveys, lactation rates, field dressed weights of yearling bucks and sex ratios will indicate whether a herd is expanding or over-populated (Table 2). Harvest characteristics (i.e., factors influenced by the hunter) that also serve as useful measures of population status include proportion of bucks harvested that are spikes and average age of bucks and does harvested (Table 3).

| Table 2. Deer Population Characteristics Summary. | | |
|---|---|---|
| **Herd Status** | **Expanding** | **Over-populated** |
| Deer Density: | over 15 acres per deer | less than 8 acres per deer |
| Browse survey: | low use of second and third choice browse | high use of second choice browse and moderate to high use of third choice browse |
| Lactation rate: | 75 percent minimum for does 1 1/2 years of age and older | below 75 percent (typically 35 to 40 percent) for does 1 1/2 years of age and older |
| Field dressed weights of yearling bucks: | 80 pounds or more | less than 80 pounds |
| Sex ratio (buck:doe): | 1:3 based on incidental and spotlight observations | 1:4 or more based on incidental and spotlight observations |

| Table 3. Deer Harvest Characteristics far a Goal of Quality Management. | | |
|---|---|---|
| **Herd Status** | **Expanding** | **Over-populated** |
| Average age of bucks harvested: | 2.5 years or older | less than 2.5 (buck-exploited herd) |
| Average age of does harvested: | less than 2.5 years | more than 2.5 years |
| Proportion of bucks harvested that are spikes: | less than 15 percent | more than 15 percent |

Data collected by these methods will provide sufficient information to determine population and harvest characteristics necessary for the development of the desired management strategy (i.e., trophy, quality or numbers management).

## Application of Management Strategies/Recommendations

Following the diagnosis of a deer population, the landowner and hunter should have gained valuable insight as to its status (i.e., expanding, over-populated). At this point, goals should be reviewed to determine which management strategies (i.e., trophy, quality, numbers management) are feasible.

Regardless of the option chosen, many managers believe that an expanding population is the easiest to manage, and for the short term, that is true. Remember, however, that an expanding deer population grows at a rate that will saturate most East Texas habitat in only 6 or 7 years. To prevent saturation, managers manipulate habitat in order to maintain an abundance of high quality forage throughout the year (increase productive capacity) and to remove surplus animals. In a management program, a population reduction strategy targets the removal of older does, while younger does and most bucks are left. The rate of removal to decrease the population to the desired level below carrying capacity requires a close watch on browse use, lactation rates, dressed rates by year, class by sex and sex ratios (from incidental and census observations). If an expanding population is left unchecked for just a few years, it may quickly become too large and be difficult to restore to the proper level.

A herd that is too large is much more difficult to manage for three reasons. First, more deer must be harvested to reduce deer density into an "expanding" mode. This may be difficult to achieve through normal hunting pressure. Secondly, grossly overpopulated areas in East Texas (i.e., 6 acres/deer) may have permanently deteriorated habitat from overbrowsing. Recovery of the habitat may require exhaustive manipulation, or at the very least a great number of years. Lastly (and probably the most difficult to overcome), the manager must work against the psychological common among many hunters and landowners who believe "the more deer you have the more deer you can produce." Few are convinced (until they see for themselves) that in an expanding herd, fewer does can actually produce more fawns than a greater number of does in a herd that is too large for the area. The more fawns produced, the more bucks become available. Since most hunters want bucks, maximum fawn production should be given high priority. These three facets of deer management apply whether a trophy, high quality or numbers management strategy is applied.

Once the fawn crop and sex ratio are improved, the protection of younger age class bucks (particularly for trophy or high quality management strategies) will lead to more high quality and/or trophy bucks available for harvest. The more of these animals produced, the more hunters enjoy the hunting experience.

The final puzzle piece in deer management (independent of deer density) should be attainable, yet often becomes the most frustrating for managers. How do we get the hunters and deer (particularly bucks) together? Research has shown that the success rate of hunters pulling bucks (especially mature bucks) out of their preferred habitat is quite low. The answer lies in the ability to find the bucks, learn their habits and then hunt them on those terms.

While some hunters look at "patterning" bucks as an important part of their recreational experience, managers must often step in and assist in hunter education. Placing stands near travel corridors, buck corridors, sanctuaries, active rub lines and scrapes will enhance the odds of harvesting a buck. This may be a totally new experience for those hunters used to sitting on an "oat patch" and lamenting about the lack of good bucks on the lease.

## Literature Cited


Brown, R..D, C.C. Chao and L.W. Faulkner. 1983. "The endocrine control of the initiation of growth of antlers in white-tailed deer." Acta Endocrinologica. Vol. 103, p. 138.

Bubenik, G.A., P.S. Smith and D. Schams. 1986. "The effect of orally administered melatonin on the seasonality of deer pelage exchange, antler development, LH, FSH, prolactin, testosterone, T-3, T-4, cortisol and alkaline phosphate." J. of Pineal Research. Vol. 3, p. 331.

Burger, G.B. and J.G. Teer. 1981. "Economic and socioeconomic issues influencing wildlife management on private lands." In T.T. Dumke, G.V. Burger and J.R. March, eds. Proc. Wildl. Manage. on Private Lands. Wisc. Chapt., The Wildl. Soc., Madison, Wisconsin. p. 352.

Calhoun, J. and F. Loomis. 1974. "Prairie whitetails." Illinois Dept. Cons., Springfield.

Caughley, G. 1980. "Analysis of vertebrate populations." John Wiley and Sons, New York.

Crawford, H.S. 1984. "Habitat management." In L.K. Halls, ed., White-tailed Deer. Ecology and Management. Stackpole Books, Harrisburg, PA. p. 629.

Davis, F.S. 1973. "Racks, rations and heredity." La. Conservationist. 25 (5 and 6):10:15.

Fambrough, J., and J.C. Stribling. 1988. "The Texas deer lease." TAEX fact sheet no. L-2334. Texas Agricultural Extension Service. College Station.

Forbes, S.E., L.M. Lang, S.A. Liscinsky and H.A. Roberts. 1971. "The white-tailed deer in Pennsylvania." Pennsylvania Game Comm., Harrisburg.

Gore, H.G. and J.M. Reagan. 1988. "White-tailed deer populations and trends." Texas Parks and Wildlife Department. Fed. Aid Proj. No. W-lO9-R-11. Job No. 1.

Gould, F.W., G.O. Hoffman and C.A. Rechenthin. 1960. "Vegetational areas of Texas." Tex. Agri. Exp. Sta. bull. no L-492.

Goss, R.J. 1983. "Control of deer antler cycles by the photo period." In Antler Development in Cer-vidae. R.D. Brown, ed., Caesar KlebergWildl. Res. Inst., Kingsville, TX

Halls, L.K. 1973. "Managing deer habitat in loblolly - shortleaf pine forest." J. For. Vol. 71, p. 742.

Halls, L.D. 1978. "White-tailed deer." In J.L Schmidt and D.L. Gilbert, eds. Big Game of North America. Stackpole Books, Harrisburg, PA. p. 43.

Haney, R.L. 1983. "Our wildlife in Texas is a great and growing resource." TAES res. rept. no. 389. Tex. Agri. Exp. Stat., College Station.

Harlow, R.F., J.B. Whelan, H.S. Crawford and J.E. Skeen. 1975. "Deer foods during years of oak mast abundance and scarcity." J. Wildl. Manage. Vol. 39, No. 2, p. 330.

Higginbotham, B.J. and J.C. Kroll. 1989. "Warm and cool season food plot strategies for southern whitetails: a 2-year progress report." Southeast Deer Study Group Meeting. Oklahoma City, Oklahoma.

Hurst, G.A. and R.C. Warren. 1981. "Enhancing white-tailed deer habitat of pine plantations by intensive management." MAFES tech. bull. no. 107. Miss. Agri. and For. Exp. Sta. Mississippi.

Jacobson, H.A. and R.N. Griffin. 1983. "Antler cycles of white-tailed deer in Mississippi." In Antler Development in Cervidae. R.D. Brown, ed., Caesar Kleberg Wild. Res. Inst., Kingsville, TX. p. 15.

Kroll, J.C. (1981, April). "Hunting–An American Tradition." In The American Hunter. p. 12.

Kroll, J.C., W.D. Goodrum and P.J. Behrman. 1986. "Twenty-seven years of over-browsing: Implications to white-tailed deer management on wilderness areas." In D.L. Kulhavy and R.N. Conner, eds. Wilderness and natural areas in the eastern United States: A management challenge. Center for Applied Studies, School of Forestry, Stephen F. Austin State University. Nacogdoches, TX. p. 294.

Kroll, J.C. 1987. "The white-tailed deer in the mixed pine-hardwood forest: A practical approach to management." White-tailed Deer Management and Research Institute, School of Forestry, SFASU. Nacogdoches, TX.

Kroll, J.C. 1989. "How much is a white-tailed buck worth?" Texas Forestry. Vol. 30, No. 1, p. 14.

Lay, D.W. 1966. "Recovery of a southern forest from excessive utilization, an example of good deer management." In The White-tailed Deer: Its Problems and Potentials (a symposium). Texas A&M University, College Station. p. 73

Lay, D.W. 1967. "Deer range appraisal in eastern Texas." J. Wildl. Manage. Vol. 31, p. 426.

McCollough, D.R. 1979. "The George Reserve deer herd: population ecology of a K-selected species." Univ. Mich. Press. Ann Arbor, Mich.

McEwen, L.S., C.E. French, N.D. Magruder, R.W. Swift and R.H. Ingram. 1957. "Nutrient requirements of the white-tailed deer." Trans. North Amer. Wildl. Conf. Vol. 22, p. 119.

Miller, H.A. and L.K. Halls. 1969. "Fleshy fungi commonly eaten by southern wildlife." USDA For. Serv Res. Pap. p. 49.

Nixon, C.M., M.W. McClain and K.R. Russell. 1970. "Deer food habits and range characteristics in Ohio." J. Wildl. Manage. Vol. 34, No. 4, p. 870.

Ozogy, J.J. and L.J. Verme. 1982. "Physical and reproductive characteristics of a supplementally-fed white-tailed deer herd." J. Wildl. Manage. Vol. 46, No. 2, p. 281.

Payne, J.M., 1988. "Wildlife enterprise opportunities on a limited land base." Proc. First Int. Wildl. Ranch Symp. Las Cruces, New Mexico. p. 82.

Perkins, J.R., 1983. "Supplemental feeding." TPWD bull. no. 7000-33. Texas Parks and Wildlife Department.

Ramsey, C.W. 1968. "Leases for hunting." TAEX fact sheet no. L-761. Texas Agricultural Extension Service. College Station.

Short, H.L. 1971. "Forage digestibility and diet of deer on southern upland range." J. Wildl. Manage. Vol. 35, No. 4, p. 698.

Short, H.L. 1986. "Habitat suitability index models: white-tailed deer in the Gulf of Mexico and South Atlantic Coastal Plains." U.S. Fish Wildl. Serv. Biol. Rept. Vol. 82, No. 20, p. 123.

Spencer, G.E. 1981. "Pineywoods deer management." TPWD bull. no. 7000-88. Texas Parks and Wildlife Department. Austin.

Steinbach, D.W. 1987. "Wildlife as a ranching enterprise." Landowner Relations Conference. Denver, Colo.

Teer, J.G. and N.K. Forrest. 1968. "Bionomic and ethical implications of commercial game harvest programs." Trans. N. Amer. Wildl. and Nat. Res. Cong. Vol. 33, p. 192.

Tomlison, B. 1988. "The white-tailed deer: Life history and management." Anderson-Tully Company. The Habitat. Vol 5, p. 2.

Ullrey, D.E. 1983. "Nutrition and antler development in white-tailed deer." In: Antler Development in Cervidae. R.D. Brown, ed., Caesar Kleberg Wildl. Res. Inst., Kingsville, TX. p. 19.

Ullrey, D.E., H.E. Johnson, N.G. Youatt, L.D. Fay, B.L. Schoepke and W.T. Magee. 1971. "A basal diet for deer nutrition research." J. Wildl. Manage. Vol. 35, No. 1, p. 57.

Verme. L.J. 1969. "Reproductive patterns of white-tailed deer related to nutritional plane." J. Wildl. Manage. Vol. 33, No. 4, p. 881.

Yantis, J.H., C.D. Frentress, W.S. Daniel and G.H. Veteto. 1983. "Deer management in the Post Oak belt." Texas Parks and Wildlife Department. TPWD bull. no. 7000-96. Austin.