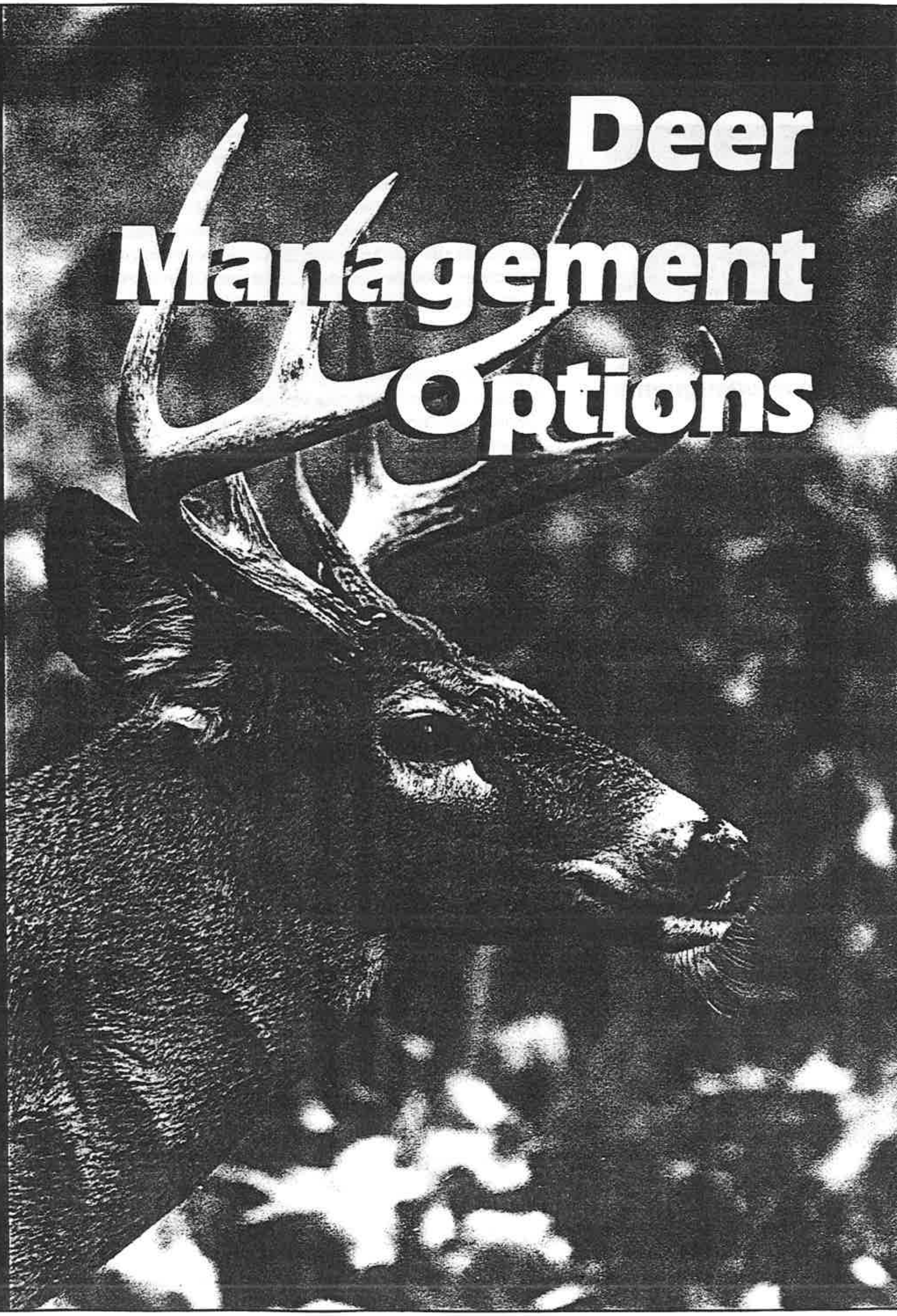
An Evaluation of Deer Management Options



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The New England Chapter of The Wildlife Society is an association of professional wildlife biologists from Connecticut, Massachusetts, New Hampshire, Rhode Island and Vermont devoted to stewardship and enlightened appreciation of wildlife and its environments.

The Northeast Deer Technical Committee is a group comprised of professional deer biologists from the northeastern United States and eastern Canadian Provinces, is committed to the study and wise management of our deer resources.

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Introduction

The white-tailed deer *(Odocoileus virginianus)* is the most abundant and best-known large herbivore in the United States. Whitetails are valued and appreciated by large segments of society. State and provincial wildlife agencies are responsible for the management of this invaluable resource.

Considerable confusion and controversy exists concerning white-tailed deer management. The objective of this booklet is to explain the rationale behind deer management and to discuss the utility of various management options.

A Brief History of Deer Management in the Northeast

During colonial times, the Northeast was dominated by extensive tracts of mature forest. Early records suggest that white-tailed deer were present in moderate numbers at the time. Deer populations were small and scattered by the turn of the 20th century, primarily as a result of habitat loss due to extensive forest clearing and unregulated market hunting. In the early 1900s, deer were so scarce in much of the Northeast that sightings were often reported in local newspapers.

Passage of the Federal Aid in Wildlife Restoration Act (better known as the Pittman-Robertson Program) in 1937 marked the beginning of modern-day wildlife management in the United States. This act earmarked income from an already existing excise tax on sporting arms and ammunition for use in wildlife development, research and land acquisition.

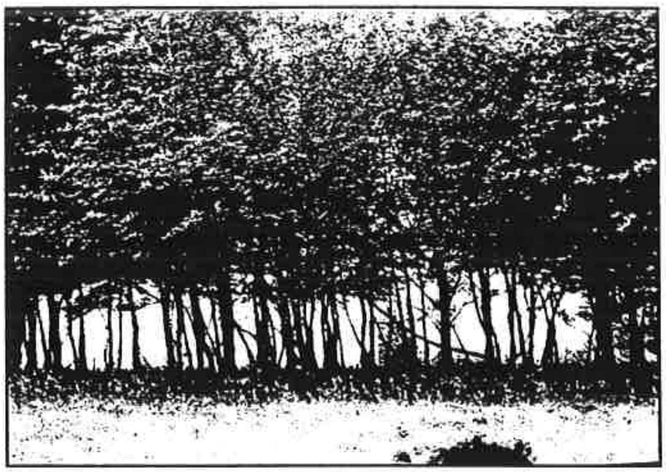
Early deer management efforts featured protection from unregulated exploitation. Today, efforts are directed toward the maintenance of deer populations at levels intended to: (1) ensure the present and future well-being of the species and its habitat, (2) provide a sustained yield of deer for use by licensed hunters, and (3) allow for compatibility between deer populations and human land-use practices, as well as with other plant and animal communities.

Components of Deer Habitat

White-tailed deer require adequate food, water, cover, and living space in a suitable arrangement in order to ensure their healthy survival. Deer eat a wide variety of herbaceous and woody plants, in accordance with their nutritional value and their local and seasonal availability. Water requirements are met through the drinking of water and from the consumption of succulent vegetation. Good habitat provides shelter from extreme temperatures and precipitation, as well as protection and concealment from predators.

Population Growth and the Concept of Carrying Capacity

Deer populations have the potential for rapid growth. Under normal circumstances, does two years old or older produce twins annually, while yearling does typically produce single fawns. On excellent range, adult does can produce triplets, yearlings can produce twins and fawns can be bred and give birth during their first year of life. In the absence of predation or hunting, this kind of reproduction can result in a deer herd doubling its size in one year. This fact was illustrated on the 1,146-acre George Reserve in southern Michigan when the deer herd grew from six to 162 individuals in six years (1928-1933) [23]. More recently, the George Reserve herd grew from 10 deer in 1975 to 212 deer in 1980 [24].



When deer have eaten (browsed) all the vegetation available to them, a distinct "browse line", such as the one above, can be seen; it indicates that the local deer population has exceeded Biological Carrying Capacity.

There are natural limits to the number of deer that a given parcel of habitat can support. These limits are a function of the quantity and quality of deer forage and/or the availability of good winter habitat. The number of deer that a given parcel can support in good physical condition over an extended period of time is referred to as "Biological Carrying Capacity" (BCC). Deer productivity causes populations to exceed BCC, unless productivity is balanced by mortality. When BCC is exceeded, habitat quality decreases and herd physical condition declines. Biologists use herd health indices and population density indices to assess the status of a herd relative to BCC.

The importance of compatibility between land-use practices and deer populations in urban areas justifies consideration of another aspect of carrying capacity. "Cultural Carrying Capacity" (CCC) can be defined as the maximum number of deer that can coexist compatibly with local human populations [10]. Cultural carrying capacity is a function of the sensitivity of local human populations to the presence of deer.

This sensitivity is dependent on local land-use practices, local deer density and the attitudes and priorities of local human populations. Excessive deer/vehicle collisions, agricultural damage and home/gardener complaints all suggest that CCC has been exceeded. It is important to note that even low deer densities can exceed CCC; a single deer residing in an airport landing zone is too many deer. As development continues in many areas of North America, the importance of CCC as a management consideration will increase.

Consequences of Deer Overpopulation

As previously indicated, deer populations have the ability to grow beyond BCC. When BCC is exceeded, competition for limited food resources results in overbrowsing [6,7]. Severe overbrowsing alters plant species composition, distribution, and abundance, and reduces understory structural diversity (due to the inability of seedlings to establish themselves). These changes may have a deleterious impact on local animal communities, which depend on healthy vegetative systems for food and cover. In time, overbrowsing results in reduced habitat quality and a long-term reduction in BCC. Coincident with overbrowsing is a decline in heard health. This decline is manifest in decreased body weights, lowered reproductive rates, lowered winter survival, increased parasitism, and increased disease prevalence [11]. In the absence of a marked herd reduction, neither herd health nor habitat quality will improve, as each constrains the other. Such circumstances enhance the likelihood of die-offs due to disease and starvation.

Deer overabundance often leads to a high frequency of deer/vehicle collisions, as well as excessive damage to commercial forests, agricultural crops, nursery stock and landscape plantings [17, 21]. In addition, studies suggest that a correlation exists between high deer densities and the incidence of Lyme disease, an arthritic disease that can be contracted by humans [1].

A Justification for Deer Population Management

The potential for deer populations to exceed carrying capacity, to impinge on the well-being of other plant and animal species, and to conflict with land-use practices as well as human safety and health necessitates effective herd management. Financial and logistical constraints require that deer management be practical and fiscally responsible.

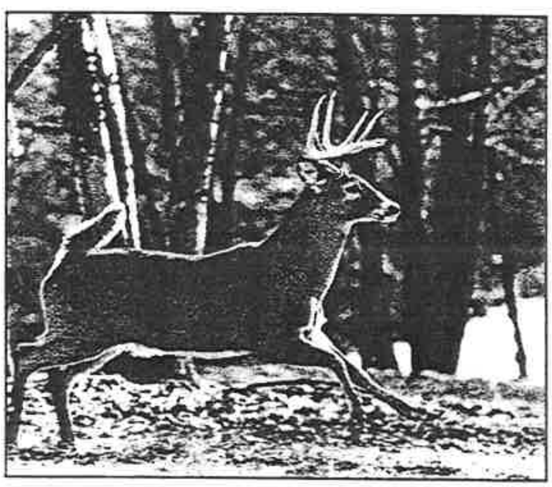
Deer Management Options

Option 1

USE REGULATED HUNTING AS A DEER MANAGEMENT TOOL.

Regulated hunting has been proven to be an effective deer population management tool [13, 23]. In addition, it has been shown to be the most efficient and least expensive technique for removing deer [28]. Wildlife management agencies recognize deer hunting as the only effective, practical and flexible method available for regional deer population management and therefore rely on it as their primary management tool. Through the use of regulated hunting, biologists strive to maintain deer populations at desirable levels or to adjust them in accordance with local biological and/or social needs. They do this by manipulating the size and sex composition of the harvest, season type, season timing, season length, number of permits and land-access policies.

Values associated with white-tailed deer management are diverse and extensive [16]. Ecological benefits derived from regulated hunting include protection of our environment from overbrowsing [2,4], protection of flora and fauna that may be negatively impacted by deer overpopulation and the maintenance of healthy, viable deer populations [13, 23] for our benefit and that of future generations. Social benefits which result from regulated hunting include: increased land-use compatibility stemming from fewer land-use/deer conflicts, human safety benefits resulting from reduced deer/vehicle incidents, diverse educational and recreational opportunities, and emotional benefits associated with a continued presence of healthy deer herds. Regulated hunting provides economic benefits in the form of hunting-related expenditures. Researchers estimated nationwide deer hunter expenditures during 1991 at $4.5 billion. Estimated values received by hunters and nonhunters was $12.3 billion and $18.1 billion, respectively[34]. An economic evaluation of regulated deer hunting should also include costs that would be incurred in the absence of population management. As an example, the cost of agricultural commodities, forest products, and automobile insurance would likely increase if deer populations were left unchecked.

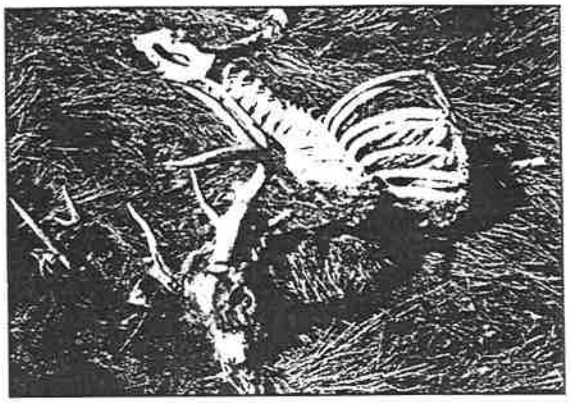


ALLOW NATURE TO TAKE ITS COURSE.

Option 2

In the absence of regulated hunting, deer herds would grow until they reached the upper limit at which they could be sustained by local habitat. Herds at this "upper density limit" consist of deer in relatively poor health [7]. High density herds such as these are prone to cyclic population fluctuations and catastrophic losses [23]. Such herds would be incompatible with local human interests and land-use practices. Disease and starvation problems in the Great Swamp National Wildlife Refuge, New Jersey [31]; damage to ornamentals on Block Island, Rhode Island; vegetation destruction at Crane Beach, Massachusetts; roadkill problems in Princeton, New Jersey; and forest regeneration difficulties on Connecticut's Yale Forest, are but a few examples of the deleterious impacts of a "hands off" deer management policy. Allowing nature to take its course could result in a significant negative impact on other plant and animal species as well as local deer herds. In extreme cases, the balance achieved by "hands off" management may be local herd extinction [32].

It is important to note that humans have had a dramatic impact on the ecology of North America. Among other things, they have altered landscapes, changed and manipulated plant communities, displaced large predators, eliminated a variety of native species, and introduced numerous exotics. Natural systems and regulatory processes have changed as a result of these impacts. Adopting a "hands off" policy will not restore North American ecosystems to a pristine state.

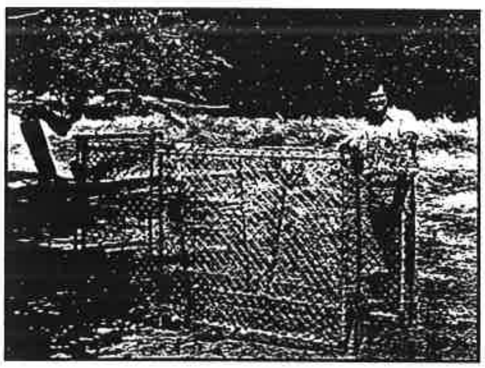


Deer evolved under intense predation and hunting pressure. In precolonial times many Native American tribes hunted deer year-round and depended on them as their primary food source [22]. Mountain lions, wolves, bobcats, and bears all utilized the precolonial deer resource. The high reproductive capability of present-day herds likely reflects intense predation and hunting in the past. As a consequence, it would seem inaccurate to describe a deer herd in today's environment, with few if any predators and no hunters, as "natural". In fact, active management in the form of regulated hunting seems to be a more natural option than the "hands off" approach. Active deer population management offers distinct ecological, social, and economic benefits to society. Few such claims can be made for the "hands off" option. In fact, there are significant costs associated with the "hands off" approach to deer management.

Option 3

TRAP AND TRANSFER EXCESS DEER TO OTHER LOCATIONS.

This option would include the use of trapping, netting and/or immobilization for the purpose of capturing and relocating deer. Trap-and-transfer efforts have proven to be labor intensive and prohibitively expensive. Research conducted with an urban deer herd in Wisconsin (14) resulted in capture costs ranging from $113 to $570 per deer ($412 per deer for all capture methods combined). Similar work conducted on Long Island, New Hampshire, and Angel Island, California (26) resulted in costs of $800 and $431 per deer, respectively.



Deer are attracted into live traps, such as the one above, using apples, corn, salt, or some other desirable food bait. Trapping is most successfully conducted during the winter months, a time when natural foods are relatively scarce. Deer traps are sometimes used in wildlife research, but they have limited value in managing free-ranging herds due to the relative inefficiency of trapping, manpower and logistical constraints, and the lack of suitable release sites.

Aside from problems of cost and logistics, large scale trap-and-transfer programs would require release sites capable of absorbing large numbers of relocated deer. Such areas are often lacking. The potential negative impact that translocated deer could have on local BCC and/or CCC is an additional concern. Land-use conflicts and disease concerns caused by translocated deer could lead to questions of liability.

Deer are susceptible to traumatic injury during handling. Trauma losses average approximately four percent during trap-and-transfer efforts. Capture myopathy, a stress-related disease that results in delayed mortality of captured deer, is thought to be an important (and often overlooked) mortality factor. Delayed mortality as high as 26 percent has been reported (29).

Survival rates of relocated deer are frequently low. Trap-and-transfer efforts in California, New Mexico and Florida resulted in losses of 85, 55 and 58 percent, respectively, from four to 15 months following relocation (26).

The poor physical condition of deer from an overpopulated range, and the behavior of some deer from overpopulated urban settings, predispose them to starvation, accidents and dog predation following relocation into new surroundings.

An additional concern associated with relocation of deer, especially from an overpopulated range, is the potential for spreading disease. The presence of Lyme disease in some areas of North America makes this a timely consideration.

In conclusion, trap-and-transfer options are generally impractical and prohibitively expensive. As a consequence, they have limited value in the management of free-ranging herds. They may have more value in the control of small, insular herds where deer are tame and/or hunting is not applicable.

USE FENCING AND REPELLENTS TO MANAGE CONFLICTS WITH DEER POPULATIONS.

Option 4

To the extent that fencing and repellents are practicable, wildlife agencies regularly recommend them to address site-specific problems. Application of repellents and/or fencing can only be justified economically when the financial gain yielded by protection is equal to or greater than the cost of implementation. Research conducted in New York's Hudson Valley revealed that it costs approximately $70/acre/year to implement an orchard repellent spray program [8]. Similar work conducted in Connecticut nurseries indicated that repellent costs (equipment and labor excluded) ranged from $10 to $396 per acre for a single application [5]. In New York, it was determined that it cost approximately $18/acre/year (when pro-rated over a 10-year period) to protect a 25-acre parcel with a moderately priced, high-tensile electric fence. Under the same circumstances, it would cost $60/acre/year to use a eight-foot woven-wire fence [9]. Economic, personal, and aesthetic considerations typically restrict the use of these techniques to cost effective applications.

There are constraints that limit the applicability of various damage abatement techniques. High-tensile electric fencing requires regular maintenance and is best suited to areas of good soil depth and moderate terrain. Electric fences suffer from seasonal problems associated with poor grounding due to heavy snows and dry soil conditions. In addition, electric fences are inappropriate for use in areas where frequent human contact is likely. Effective repellent programs require frequent applications because rapidly growing shoots quickly outgrow protection and repellents weather rapidly. Spray repellents can only be applied effectively during mild weather, so their value during winter months is restricted. Additional limits on repellent use stem from plant damage concerns, labeling restrictions, equipment problems (heavy binding agents and repellent slurries clog equipment), and difficulties resulting from noxious and/or unaesthetic product residues.


A biologist uses a backpack sprayer to apply deer repellent to test plots in order to evaluate their relative effectiveness.

Repellent performance is highly variable and seems to be negatively correlated with deer density. Work conducted in New York and Connecticut indicates that repellent performance is highly variable. This seems to result from the fact that repellents are behavior modifiers; they perform well under moderate pressure but may be ignored when alternative deer foods are scarce. Electric fence performance is variable as well, apparently due to differences in deer pressure and fence quality.

There are distinct limitations on the applicability of fencing and repellent options. As an example, neither technique has value in addressing concerns relating to wide-scale deer impacts on plant and animal communities. These techniques were designed to supplement, not replace, deer population management. As a consequence, they are best employed within the context of a comprehensive deer management program. In the absence of population regulation, deer damage will increase in severity and the efficacy of abatement techniques will decline.

Option 5

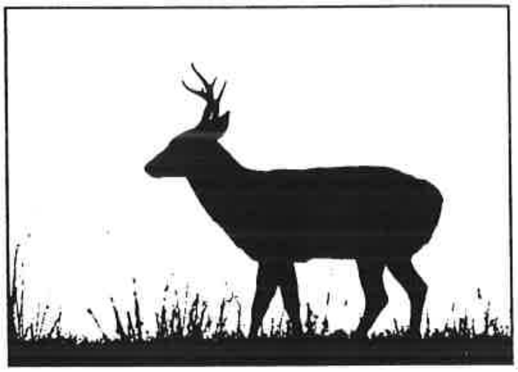
USE FERTILITY CONTROL AGENTS TO REGULATE DEER POPULATIONS.

Steroidal fertility control agents (i.e., synthetic progestins and estrogens) have been evaluated for use in deer reproduction control. Research conducted on a captive deer herd in Ohio indicated that oral and intramuscular doses of diethystilbestrol (DES) significantly reduced deer productivity. However, the reduction was insufficient to contain local herd growth [12]. In Kentucky, oral doses of microencapsulated DES successfully interrupted deer pregnancies, but high dose requirements, aversion to treated bait, and post-treatment breeding, precluded effective herd control [18]. Additional research revealed that oral doses of melengestrol acetate (MGA) effectively inhibited deer reproduction, but daily treatment requirements made the technique impractical for use on free-ranging deer herds [30].

Concerns pertaining to oral contraception in deer include: cost and logistics of bait distribution, dosage control, and ingestion of bait by non-target wildlife. Based on these concerns, and past research, oral contraception programs, to date, would be impractical and ill-advised.

Several studies have shown subcutaneous implants of some fertility control agents to be effective in preventing deer pregnancies [19, 20]. Recent advances in the delivery and efficacy of implants allows for the remote delivery of intramuscular treatments using biodegradable projectiles, with one year of effective treatment. Remote delivery reduces the probability of direct consumption of fertility control agents by nontarget species. Nonetheless, the limited life expectancy of implants, the expense involved in treatment and the difficulty of treating an adequate portion of the herd, suggest that large-scale implant programs would be impractical. However, this technique may have value in controlling small insular herds. Unresolved questions relating to the use of implants include the effect of long-term steroid exposure on deer and the impact of steroid treated carcasses on consumers in the food chain.

Recent advances in wildlife contraception have facilitated remote delivery of antifertility agents to feral horses via dart guns [33]. More recently, immunofertility agents have been successfully employed to control deer reproduction in penned applications. Field research in areas where deer are habituated to humans, has also resulted in various degrees of successful reproductive inhibition. Advances in delivery systems, coupled with improvement in the efficacy of antifertility vaccines, improve the prospect for limited applications of wildlife contraception in the future. The cost of manpower and materials, and the practicality of treating an adequate number of deer, will likely limit the use of immunocontraceptives to small insular herds habituated to humans.



Since fertility control has no short-term effect on population size, pre-treatment culling will be an essential part of the timely resolution of deer problems with fertility control agents. In addition, questions regarding the potential negative impacts of fertility control agents on deer energetics and genetics remain largely unresolved.

In conclusion, fertility control in deer is a rapidly advancing technology that continues to require additional research. Fertility control may have value for use on small insular deer populations under carefully regulated conditions, but will not provide an alternative to hunting for the control of free-ranging herds [15]. While effective fertility control agents have been identified, their use on free-ranging herds would be impractical.

Option 6

PROVIDE SUPPLEMENTAL FOOD TO ALLEVIATE CONFLICTS WITH BCC AND CCC.

Implementation of a supplemental feeding program would be counterproductive to control efforts directed at free-ranging herds because it would encourage additional population growth [6]. In addition, supplemental feeding on a regionwide basis would be logistically and economically impractical. Work conducted in Michigan and Colorado indicates that it costs from $37 to $53 per deer to run an ad libitum winter feeding program [3, 27]. In Colorado, supplemental feeding of mule deer cost $183 per animal saved. While the program did reduce winter deer mortality, it failed to eliminate substantial losses. Colorado researchers concluded that supplemental feeding can be justified for use during emergency circumstances (e.g., exceptionally severe winter weather) but not as a routine method for boosting local BCC. In addition, the researchers believed that such a program was only practical when deer were densely concentrated on readily accessible range. Researchers in

Michigan concluded that "nutritional supplementation" had potential value as a management tool, but that it would only work within the context of "strict herd control" [27]. In many areas of North America, supplemental feeding would lead to conflicts with CCC. In addition, it would enhance the likelihood of disease transmission between deer and predation of deer by dogs.

Supplemental feeding fails to address the cause of overpopulation. In fact, it actually compounds future deer population problems. As a result, it would seem reasonable to reject supplemental feeding as an alternative to active deer population management.

Option 7

CONTROL DEER HERDS WITH SHARPSHOOTERS.

The use of sharpshooters would concede the need for population regulation. Such a task would likely require shooting throughout the year, in order to control regional population growth. Even on a small scale, this option would be expensive relative to hunting. According to the results of an urban deer removal program conducted in Wisconsin [14] the cost averaged $74 per animal shot over bait. This cost included 13.5 hours of labor for each deer removed, at a cost of $3.65 per hour. An evaluation of techniques employed to control an enclosed deer herd in Ohio revealed that sharpshooting was a less efficient method of deer removal than controlled hunting [28]. If a sharpshooter program was instituted, local economies would experience a loss of income from hunters [34] paying to control deer numbers (Connecticut deer hunters inject approximately $600 per harvested deer into the state economy, excluding permit expenditures). Finally, the use of sharpshooters would be exceedingly controversial in those situations where regulated hunting could be conducted, because it would deny citizens access to a renewable public resource.

Option 8

REINTRODUCE PREDATORS TO CONTROL DEER POPULATIONS.

In moderately fluctuating environments, a complement of effective predators can maintain stability in a deer herd [24]. However, in general terms, predator-prey interactions are highly variable [25], and tend to stabilize populations at relatively high densities [23]. Wolves and mountain lions are examples of efficient deer predators which have been eliminated from much of the United States. Both species are frequently suggested as candidates for reintroduction to control deer herds.

Restoration of wolves and mountain lions is infeasible in much of the United States because it is too densely populated by humans to provide suitable habitat for these species. In addition, it is unlikely that rural residents would tolerate large predators at levels dense enough to limit deer populations because such predators also readily consume livestock. Predation of non-target species including native wildlife and pets, as well as concerns for human safety, are but a few examples of the conflicts that would arise as a result of predator reintroductions.

Predator-prey relationships are complex and the impact of predators on herbivore populations is variable. Although many answers are lacking, several points can be made concerning deer and their predators. Coyotes, bobcats, and bears are potential deer predators that currently reside throughout much of North America. These species appear to be opportunists that capitalize on specific periods of deer vulnerability. None of these predators has demonstrated a consistent ability to control deer populations. Where coyotes, bobcats, and bears are common, deer herds often exceed BCC and/or CCC. Coyote populations have increased and their range has expanded in North America during the past 20 years. In many areas, both deer and coyote populations have increased simultaneously. In northern New England, some biologists do suspect coyotes are partly responsible for declining deer numbers. Yet in other areas, changes in deer populations appear unrelated to coyote density. In many circumstances, coyotes and bears represent serious agricultural pests. As a consequence, they are frequently less welcome than white-tailed deer.

Timber Wolf

Even in the presence of predator-induced stable deer herds, a population reduction may be desirable from an ecological or social perspective. The fact that a deer herd has stabilized is no guarantee that such a herd is in balance with CCC or BCC.

Heavy predation coupled with year-round hunting by Native Americans was the norm for precolonial deer herds. It has been estimated that approximately 2.3 million Indians occupied the precolonial range of the white-tail and that they harvested 4.6 to 6.4 million whitetails annually [22]. The human species clearly constitutes an efficient and natural deer predator. Ecological and social constraints preclude the reintroduction of large predators in much of North America.

Conclusion

Fifty years of research and management experience have shown regulated hunting to be an ecologically sound, socially beneficial, and fiscally responsible method of managing deer populations. Options routinely suggested as alternatives to regulated hunting are typically limited in applicability, prohibitively expensive, logistically impractical, or technically infeasible. As a consequence, wildlife professionals have come to recognize regulated hunting as the fundamental basis of successful deer management.

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