REPORT OF THE
DEPARTMENT OF GAME AND
INLAND FISHERIES ON

URBAN AND SUBURBAN DEER MANAGEMENT OPTIONS STUDY

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

HOUSE DOCUMENT NO. 28

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COMMONWEALTH of VIRGINIA

George Allen
Governor
Becky Norton Dunlop
Secretary of Natural Resources

Department of Game and Inland Fisheries

William L. Woodfin, Jr.
Director

December 9, 1997

To: The Honorable George F. Allen, Governor of Virginia and Members of the General Assembly:

House Joint Resolution 489, adopted by the 1997 General Assembly, directed the Department of Game and Inland Fisheries to study options for controlling the deer population in urban and suburban areas. The Department's response to the resolution is found in the following materials, including four recommendations developed by the study committee. This study is actually a subset of the Department's draft Deer Management Plan produced this past year by a constituent-based Deer Management Planning Committee. The constituent driven Deer Management Plan directed the Department " to develop a management program for urban deer by January 1, 2004". Specific strategies included in the draft plan were utilized in HJR 489 study to formulate the four recommendations.

The cost in producing the constituent-based Deer Management Plan draft has been estimated at $10,000. Since the HJR 489 study was a part of the overall plan, limited funds had to be expended to do the study. Study cost estimates are approximately $1,000. No general funds were expended for this study or the Department's Deer Management Plan. All costs were paid for by Virginia sportsmen's license dollars.

We have the honor of submitting herewith the report on options for controlling deer populations in urban and suburban areas in the Commonwealth.

Respectfully submitted,

William L. Woodfin, Jr.
Director
Department of Game and Inland Fisheries

PREFACE

This study was undertaken in response to House Joint Resolution 489 requesting that the Virginia Department of Game and Inland Fisheries "... be requested to study options for controlling the deer population in urban and suburban areas."

We wish to recognize the individuals of the study committee who contributed their time and expertise to this effort. The study committee members were: W. Matt Knox, Deer Program Supervisor and David E. Steffen, Forest Wildlife Supervisor, Virginia Department of Game and Inland Fisheries.

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EXECUTIVE SUMMARY

Current population estimates, based on computer reconstruction models, indicate that Virginia's deer herd is relatively stable with a conservative statewide population estimate of approximately 850,000-900,000 animals.

Virginia's deer management direction has changed from establishing and allowing deer herd expansion to controlling population growth. This change has been based on the cultural carrying capacity, which is defined as the maximum number of deer that can coexist compatibly with humans.

Urban and suburban deer conflicts are one of the fastest growing deer management issues in Virginia.

Urban deer management circumstances typically involve nonhunted residential areas where deer populations have exhibited significant population increases leading to high levels of damage to ornamentals and property.

Urban deer management issues are expected to increase significantly in the Northern Piedmont and Tidewater regions as human populations continue to expand.

Numerous examples and research from Virginia and throughout the country have concluded that successful implementation of urban deer management programs hinges on public understanding, involvement, and acceptance. The VDGIF already has employed an integrated approach involving citizen participation to resolve urban/suburban deer management problems. Stakeholder participation in urban management decisions will be critical to successful programs.

Urban deer management options include: regulated hunting, allowing nature to take its course, trap and transfer, abatement techniques (fencing and repellents), fertility control, supplemental feeding, sharpshooters, and predator reintroduction.

Urban deer management is expensive. Under its current funding paradigm, the VDGIF does not have adequate staff or resources to effectively address Virginia's growing number of urban deer management issues.

No single deer management option or set of deer management options will always be the best to control deer populations in urban/suburban areas. While regulated hunting has been shown to be the most cost-effective method of managing deer populations, its general use in urban and suburban environments is more limited. The best application of the available deer management options in urban settings should consist of the most socially acceptable, safe, humane, effective, and affordable combination.

The Draft Deer Management Plan for Virginia (VDGIF 1997), produced by a constituent-based Deer Management Planning Committee, directs the VDGIF "to develop a management program for urban deer by January 1, 2004". Specific strategies include: to provide and promote site-specific deer management programs, to develop and adopt standard Department protocol and procedures for addressing urban deer management issues, and to provide site-specific technical assistance to help communities implement management programs for urban deer. Additionally, the plan calls for deer population reductions in the urban/suburban counties/cities of Fairfax, Hampton, Loudoun, Newport News, and Prince William.

The urban and suburban deer management options study offers the following recommendations:

Recommendation 1:

That the VDGIF develop a management program for urban deer.

Strategies include:

to provide and promote site-specific deer management programs,
to develop and adopt standard Department protocol and procedures for addressing urban deer management issues, and
to provide site-specific technical assistance to help communities implement management programs for urban deer.

Recommendation 2:

That the deer population be reduced in the urban/suburban counties/cities of Fairfax, Hampton, Loudoun, Newport News, and Prince William.

Recommendation 3:

That the VDGIF seek additional/alternative funding sources to address urban deer management issues.

Recommendation 4:

That the VDGIF seek legislation through the General Assembly to prohibit anyone from administering any chemical, biological compound, or device to free roaming or non-captive wildlife for the purpose of fertility control, except as specifically authorized by the Director of the Department of Game and Inland Fisheries.

INTRODUCTION

Public attention to white-tailed deer is arguably greater than the interest exhibited for any other species of wildlife in Virginia. As Virginia's most popular game species, implications of white-tailed deer vary from welcome public viewing opportunities to serious damage and public safety concerns. The divergent citizen interests associated with white-tailed deer provide unique management challenges for all Virginians as well as for the Virginia Department of Game and Inland Fisheries (VDGIF).

Historical changes in deer distribution patterns, population trends, and management practices in Virginia are representative of those in many Southeastern states. Deer herds at the time of European settlement around 1600 were plentiful and widespread. Although the exact number of deer that inhabited Virginia at the time of European settlement is unknown, there may have been approximately 400,000 deer across the Commonwealth. Over-exploitation during the next 300 years resulted in near extirpation of deer by the turn of this century. Sound wildlife management and restoration coupled with favorable habitat conditions produced the record deer densities that exist today in some areas. Current population estimates, based on computer reconstruction models, indicate that Virginia's deer herd is relatively stable with a conservative statewide population estimate of approximately 850,000-900,000 animals.

Although white-tailed deer are the most popular game species in Virginia, deer management direction has changed from establishing and allowing deer herd expansion to controlling population growth. This change has been based on the cultural carrying capacity, which is defined as the maximum number of deer that can coexist compatibly with humans. Based on a combination of social, economic, political, and biological perspectives, cultural carrying capacities can vary widely among communities. The cultural carrying capacity for deer generally occurs well below the biological carrying capacity.

Public concerns about deer-related damage have shifted the management direction to either stabilize or reduce deer herds in many areas of the state. Adverse impacts of deer involve crop depredation, deer-vehicle collisions, urban deer conflicts, and deer ecosystem impacts.

Urban and suburban deer conflicts are one of the fastest growing deer management issues in Virginia. Over the past five years, numerous city and county governments, landowner associations, and private landowners regarding urban deer issues have officially contacted the Department. Urban deer management circumstances typically

involve nonhunted residential areas where deer populations have exhibited significant population increases leading to high levels of damage to ornamentals and property. Several Virginia cities currently have urban deer management programs in place (e.g., Colonial Heights, Danville, Harrisonburg, Lynchburg, and Williamsburg) and several more are being contemplated. Urban deer management issues and their unique deer management situations are expected to increase significantly in the Northern Piedmont and Tidewater regions as human populations continue to expand.

In urban and suburban settings, there are many options available to manage deer populations for specific cultural carrying capacities. Deer population control methods may involve lethal approaches (e.g., regulated hunting, sharpshooters) and nonlethal methods (e.g., allowing nature to take its course, trapping and transferring excess deer to other locations, using fences and repellents, using fertility control agents, providing supplemental food, reintroducing predators, managing habitat). Commonly associated with urban localities are ordinances prohibiting the discharge of firearms (i.e., hunting) and/or recent annexation of significant amounts of suburban areas (i.e., deer habitat). As urban/suburban development occurs, there will be an increasing number of situations where traditional deer management practices such as sport deer hunting is either illegal, unsafe, or publicly unacceptable. Human population growth will continue to alter the opinions and expectations of the public served by the Department's deer management programs. Alternative deer management options such as trap and transfer, use of fertility control agents, and use of sharpshooters, may be required.

A comprehensive evaluation of deer population management options already has been compiled (New Hampshire Fish & Game Dept. 1996). *An Evaluation of Deer Management Options* was co-authored by Mark R. Ellingwood, a Deer Biologist for the Connecticut Department of Environmental Protection, Wildlife Bureau and Suzanne L. Caturano, Public Awareness Biologist for the Connecticut Department of Environmental Protection, Wildlife Bureau. Originally published in 1988 by the Connecticut Department of Environmental Protection, Wildlife Bureau (Publication No. DR-11), the publication was collectively developed by the New England Chapter of The Wildlife Society and the Northeast Deer Technical Committee. The second and third printings were paid for by the U.S. Fish and Wildlife Service Federal Aid Administrative Funds, FY89 and FY96. The text in the next section (An Evaluation of Deer Management Options) is an abridged version of the latest revision, NH Fish & Game Dept. (1996), which appears as Chapter 4 in the Draft Virginia Deer Management Plan (VDGIF 1997) with the permission of the lead author and the Connecticut Department of Environmental Protection, Wildlife Bureau.

AN EVALUATION OF DEER MANAGEMENT OPTIONS

Introduction

The white-tailed deer 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

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) (McCullough 1979). More recently, the George Reserve herd grew from ten deer in 1975 to 212 deer in 1980 (McCullough 1984).

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 (Ellingwood and Spignesi 1986). 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 (Dasmann 1971, Dasmann 1981).

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 herd health. This decline is manifest in

decreased body weights, lowered reproductive rates, lowered winter survival, increased parasitism, and increased disease prevalence (Eve 1981). 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 (Marquis and Brenneman 1981, Matschke et al 1984). 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 (Anderson et al 1987).

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 (Hesselton et al 1965, McCullough 1979). In addition, it has been shown to be the most efficient and least expensive technique for removing deer (Palmer et al 1980). 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 (Langenau et al 1984). Ecological benefits derived from regulated hunting include protection of our environment from overbrowsing (Arnold and Verme 1963, Behrend et al 1976), protection of flora and fauna that may be negatively impacted by deer overpopulation and the maintenance of healthy, viable deer populations (Hesselton et

al 1965, McCullough 1979) 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 non-hunters was $12.3 billion and $18.1 billion, respectively (U. S. Fish and Wildlife Service 1992). 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.

Option 2 - Allow Nature to Take Its Course

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 (Dasmann 1981). High density herds such as these are prone to cyclic population fluctuations and catastrophic losses (McCullough 1979). 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 (Rue 1979); 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 (Smith 1986).

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 (McCabe and McCabe 1984). 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 (Ishmael and Rongstad 1984) 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 (O'Bryan and McCullough 1985) resulted in costs of $800 and $431 per deer, respectively.

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 (Rongstad and McCabe 1984).

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 (O'Bryan and McCullough 1985).

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.

Option 4 - Use Fencing and Repellents to Manage Conflicts with Deer Populations

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 (Ellingwood et al 1983). 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 (Conover 1984). 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 an eight-foot woven-wire fence (Ellingwood and McAninch 1984). 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.

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 (Harder and Peterle 1974). 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 (Matschke 1977). 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 (Roughton 1979).

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 (Matschke 1977, Matschke 1980). 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 (Turner and Kirkpatrick 1988). 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 antifertilty 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 (Kirkpatrick and Turner 1988). 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 (Dasmann 1971). 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 (Ozoga and Verme 1982, Baker and Hobbs 1985).

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" (Ozoga and Verme 1982). 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 (Ishmael and Rongstad 1984), 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 (Palmer et al 1980).

If a sharpshooter program was instituted, local economies would experience a loss of income from hunters (U. S. Fish and Wildlife Service 1992) 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 (McCullough 1984). However, in general terms, predator-prey interactions are highly variable (Mech 1984) and tend to stabilize populations at relatively high densities (McCullough 1979). 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.

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 (McCabe and McCabe 1984). 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.

References Cited

Anderson, J. F., R. C. Johnson, L. A. Magnarelli, F. W. Hyde, and J. E. Myers. 1987. Prevalence of Borrelia burgdorferi and Babesia microti in mice on islands inhabited by white-tailed deer. J. Applied and Environ. Microbiol. 53(4):892-894.

Arnold, D. A. and L. J. Verme. 1963. Ten years' observation of an enclosed deer herd in northern Michigan. Trans. North Am. Wild. and Nat. Resour. Conf. 28:422-430.

Baker, D. L. and N. T. Hobbs. 1985. Emergency feeding of mule deer during winter: Tests of a supplemental ration. J. Wildl. Manage. 49(4):934-942.

Behrend, D. F., G. F. Mattfeld, W. N. Tierson and F. E. Wiley III. 1976. Deer density control for comprehensive forest management. J. For. 68:695-700.

Conover, M. R. 1984. Effectiveness of repellents in reducing deer damage in nurseries. Wildl. Soc. Bull. 12(4):399-404.

Dasmann, W. 1971. If deer are to survive. A Wildlife Management Institute Book. Stackpole Books, Harrisburg, Pa. 128 pp.

Dasmann, W. 1981. Wildlife biology. 2nd ed. John Wiley and Sons, Inc. New York, N. Y. 203 pp.

Ellingwood, M. R., J. B. McAninch, and R. J. Winchcombe. 1983. Evaluating the costs and effectiveness of repellent applications in protecting fruit orchards. Page 69 in Proc. of The First Eastern Wildlife Damage Control Conference, Ithaca, N. Y.

Ellingwood, M. R. and J. B. McAninch. 1984. Update on the Institute of Ecosystem Studies deer damage control project. Trans. Northeast Deer Technical Committee. 20:6-7.

Ellingwood, M. R. and J. V. Spignesi. 1986. Management of an urban deer herd and the concept of cultural carrying capacity. Trans. Northeast Deer Technical Committee. 22:42-45.

Eve, J. H. 1981. Management implications of disease. Pages 413-433 in W. R. Davidson, ed. Diseases and parasites of white-tailed deer. Southeastern Cooperative Wildlife Disease Study, Univ. Georgia, Athens.

Harder, J. D. and T. J. Peterle. 1974. Effect of DES on reproductive performance of white-tailed deer. J. Wildl. Manage. 38(2):183-196.

Hesselton, W. T., C. W. Severinghaus and J. E. Tanck. 1965. Population dynamics of deer at the Seneca Army Depot. N. Y. Fish and Game J. 12:17-30.

Ishmael, W. E. and O. J. Rongstad. 1984. Economics of an urban deer removal program. Wildl. Soc. Bull. 12:(4):394-398.

Kirkpatrick, J. F., and J. W. Turner Jr. 1988 . Contraception as an alternative to traditional deer management techniques. In S. Lieberman, ed. Deer Management in an urbanizing region. The Humane Society of the United States, Washington, D. C. (in press).

Langenau, E. E. Jr., S. R. Kellert, and J. E. Applegate. 1984. Values in management. Pages 699-720 in L. K. Halls, ed. White-tailed deer ecology and management. A Wildlife Management Institute book. Stackpole Books, Harrisburg, Pa.

Marquis, D. A. and R. Brenneman. 1981. The impact of deer on forest vegetation in Pennsylvania. USDA Forest Service General Tech. Rep. NE-65, Northeast For. Exp. Stn. 7 pp.

Matschke, G. H. 1977. Microencapsulated diethylstilbestrol as an oral contraceptive in white-tailed deer. J. Wildl. Manage. 41(1):87-91.

Matschke, G. H. 1977. Fertility control in white-tailed deer by steroid implants. J. Wildl. Manage. 41(4):731-735.

Matschke, G. H. 1980. Efficacy of steroid implants in preventing pregnancy in white-tailed deer. J. Wildl. Manage. 44(3):756-758.

Matschke, G. H., D. S. deCalesta, and J. D. Harder. 1984. Crop damage and control. Pages 647-654 in L. K. Halls, ed. White-tailed deer ecology and management. A Wildlife Management Institute book. Stackpole Books, Harrisburg, Pa.

McCabe, R. E. and T. R. McCabe. 1984. Of slings and arrows: An historical retrospection. Pages 19-72 in L. K. Halls, ed. White-tailed deer ecology and management. A Wildlife Management Institute book. Stackpole Books, Harrisburg, Pa.

McCullough, D. R. 1979. The George Reserve deer herd: population ecology of a K-selected species. Ann Arbor: Univ. of Michigan Press. 271 pp.

McCullough, D. R. 1984. Lessons from the George Reserve, Michigan. Pages 211-242 in L. K. Halls, ed. White-tailed deer ecology and management. A Wildlife Management Institute Book. Stackpole Books, Harrisburg, Pa.

Mech, L. D. 1984. Predators and predation. Pages 189-200 in L. K. Halls, ed. White-tailed deer ecology and management. A Wildlife Management Institute Book. Stackpole Books, Harrisburg, Pa.

O'Bryan, M. K. and D. R. McCullough. 1985. Survival of black-tailed deer following relocation in California. J. Wildl. Manage. 49(1):115-119.

Ozoga, J. J., and L. J. Verme. 1982. Physical and reproductive characteristics of a supplementally fed white-tailed deer herd. J. Wildl. Manage. 46(2):281-301.

Palmer, D. T., D. A. Andrews, R. O. Winters, and J. W. Francis. 1980. Removal techniques to control an enclosed deer herd. Wildl. Soc. Bull. 8(1):29-33.

Rongstad, O. J. and R. A. McCabe. 1984. Capture techniques. Pages 655-686 in L. K. Halls, ed. White-tailed deer ecology and management. A Wildlife Management Institute book. Stackpole Books, Harrisburg, Pa.

Roughton, R. D. 1979. Effects of oral MGA on reproduction in captive white-tailed deer. J. Wildl. Manage. 43(2):428-436.

Rue, L. L. III. 1979. The Deer of North America. An Outdoor Life book. Crown Publishers, Inc. New York. 463 pp.

Smith, R. P. 1986. The beaver basin story. Deer and Deer Hunting. 9(5):22-28.

Turner, J. W. Jr. and J. F. Kirkpatrick. 1988. New methods for selective contraception in wild animals. In U. S. Seal, ed. Contraception in wildlife (in press).

U. S. Fish and Wildlife Service, Div. of Fed. Aid, 1992. National Survey of Fishing, Hunting and Wildlife-associated Recreation.

URBAN/SUBURBAN APPLICATION OF DEER MANAGEMENT OPTIONS

Depending on the specific circumstances (e.g., land use, human density, habitat features, types of damage, public tolerances), no single option or set of options will always be the best to control deer populations in urban/suburban areas. The practical approaches to deer population control among the heterogeneous damage situations must be tailored to reflect the diversity among urban/suburban areas.

During the recent development of the VDGIF Draft Deer Management Plan, numerous special deer management areas possibly requiring unique and individual management approaches were identified. While their individual problems and situations differ, virtually all of these areas involved urban and suburban concerns. By VDGIF region and county, the following list documents the extent and diversity of special deer management concerns confronted by Virginia citizens. These areas identified during the planning process include, but are not limited to:

Region I

Accomack:	Town of Chincoteague
	NASA Wallops Island facility
Chesapeake:	urban/suburban areas
Hampton:	urban/suburban areas
James City:	Jamestown Island Colonial National Historic Park
	City of Williamsburg
Newport News:	urban/suburban areas
Prince George:	City of Hopewell
	Petersburg National Battlefield
Southampton:	Town of Franklin
Suffolk:	urban/suburban areas
Virginia Beach:	urban/suburban areas
Westmoreland:	Washington's Birthplace State Park
York:	Newport News Waterworks Watershed
	Yorktown National Battlefield
	Colonial National Historic Park
	U.S. Coast Guard Reserve Training Center
	New Quarter Park

Region II

Bedford:	City of Bedford
	USDI Peaks of Otter property
	City of Lynchburg
Dinwiddie:	City of Petersburg
Henry:	City of Martinsville
Nelson:	Wintergreen Resort and Community
Roanoke:	urban/suburban areas

Region III

Pulaski:	Claytor Lake State Park
	City of Pulaski
	City of Radford
Montgomery:	City of Blacksburg
Wythe:	City of Wytheville

Region IV

Alleghany:	City of Covington
	City of Clifton Forge
	Douthat State Park
Augusta:	City of Staunton
	City of Waynesboro
	Shenandoah National Park lands
Frederick:	City of Winchester
Page:	Shenandoah National Park lands
Rockbridge:	City of Lexington
Rockingham:	City of Harrisonburg
	Shenandoah National Park lands
Shenandoah:	Shenandoah National Park lands
Warren:	Shenandoah National Park lands

Region V

Albemarle:	urban/suburban areas surrounding City of Charlottesville
	Shenandoah National Park lands
Caroline:	Fort A. P. Hill
Chesterfield:	Presquile National Wildlife Refuge
	City of Colonial Heights

	City of Richmond
	urban areas north of Route 288
	City of Chester
	Pocahontas State Park
Fairfax:	Fort Belvoir
	U.S. Coast Guard Station
	Huntley Meadows County Park
	Riverbend County Park
	Bull Run Regional Park
	Fountainhead Regional Park
	Meadowlark Gardens Regional Park
	Northern Virginia Regional Park
	Occoquan Regional Park
	Pohick Bay Regional Park
	Potomac Overlook Regional Park
	Sandy Run Regional Park
	Mason Neck State Park
	Mason Neck National Wildlife Refuge
	Great Falls National Park
	George Washington National Parkway
	Mount Vernon National Park
	Dulles Airport
Fauquier:	Sky Meadows State Park
	Whitney Forest State Forest
Henrico:	City of Richmond
Greene:	Shenandoah National Park lands
Loudoun:	Algonkian Regional Park
	Harpers Ferry National Park
	Dulles Airport
Madison:	Shenandoah National Park lands
Orange:	Lake of the Woods Homeowners Association
Prince William:	Quantico
	Quantico National Cemetery
	Woodbridge Research Facility
	Locust Shade Regional Park
	Leesylvania State Park
	Prince William Forest Park
	Manassas National Battlefield National Park
	Marumsco National Wildlife Refuge
Rappahannock:	Shenandoah National Park lands

Stafford: Quantico

Recognizing the differences among communities throughout Virginia and the necessity for potentially unique solutions in every locality, no singular resolution to urban deer population problems exists. In addition to the general deer hunting seasons, the VDGIF already has empowered concerned citizens with other population reduction alternatives for specific sites. These site-specific alternatives include: the Deer Management Assistance Program (DMAP), the Damage Control Assistance Program (DCAP), out-of-season kill permits, and the Depopulation Program (DPOP). Extending the season beyond (before or after) the "traditional" deer season on site-specific areas, DPOP is a recently-conceived program which will provide additional regulatory latitude for urban deer problems.

The site-specific approach has been reinforced in the Draft Deer Management Plan for Virginia (VDGIF 1997). Produced by a constituent-based Deer Management Planning Committee, the draft plan directs the VDGIF "to develop a management program for urban deer by January 1, 2004". Specific strategies include: to provide and promote site-specific deer management programs, to develop and adopt standard Department protocol and procedures for addressing urban deer management issues, and to provide site-specific technical assistance to help communities implement management programs for urban deer.

Numerous examples and research from Virginia and throughout the country have concluded that successful implementation of urban deer management programs hinges on public understanding, involvement, and acceptance (Green et al. 1997, Messmer et al. 1997, Curtis and Hauber 1997). Consensus-based urban deer management programs usually involve the use of Citizen Task Forces (CTF) or advisory boards. Stakeholder participation in urban management decisions will ultimately enhance government's credibility and help achieve long-term deer management objectives (Doig 1995). The VDGIF already has employed an integrated approach involving citizen participation to resolve urban/suburban deer management problems (Appendix A). The draft deer management plan indicates continued emphasis on these urban and suburban issues and solutions.

URBAN/SUBURBAN DEER MANAGEMENT COSTS

Urban deer management is expensive. A thorough understanding of the relative effectiveness and costs associated with the various deer management options is necessary to adequately compare and choose between different urban/suburban deer management options. An updated cost summary of several of the most common urban/suburban deer management options is found in Appendix B.

Under its current funding paradigm, the VDGIF does not have adequate staff or resources to effectively address Virginia's growing number of urban deer management issues. Historically, the VDGIF has been funded by sportsmen and sportswomen and the boaters of the state. Additionally, the VDGIF receives federal funds from excise taxes on sporting equipment, gear, etc. that are collected from manufacturers and reapportioned back to the state. The VDGIF receives no general funds from the State. When compared to the other 17 southeastern states, Virginia is next to last in per capita funding of wildlife programs. According to VDGIF staff projections, and confirmed by the Auditor of Public Accounts, the VDGIF will be in the red at its current operating level by the year 2000. If nothing is done to improve funding, by the year 2000-2002, the VDGIF will have to begin a process of reducing or eliminating services to the public and to close, or not maintain, facilities currently in operation.

CONCLUSION

Depending on the specific circumstances, no single deer management option or set of deer management options will always be the best to control deer populations in urban/suburban areas. The practical approaches to deer population control among the heterogeneous damage situations must be tailored to reflect the diversity among urban/suburban areas. Stakeholder participation in urban management decisions will be critical to successful programs. Thoughtful consideration of public opinion will be required to formulate deer management objectives and select appropriate management programs.

While regulated hunting has been shown to be the most cost-effective method of managing deer populations, its general use in urban and suburban environments is more limited. The best application of the available deer management options in urban settings should consist of the most socially acceptable, safe, humane, effective, and affordable combination.

REFERENCES CITED

Curtis, P. D., and J. R. Hauber. 1997. Public involvement in deer management decisions: consensus versus consent. Wildl. Soc. Bull. 25(2):399-403.

Doig, H. E. 1995. Agency challenges in managing urban deer. Pages 171-175 in J. B. McAninch, ed. Urban deer: a manageable resource? Proc. symposium 55th Midwest Fish and Wildlife Conference, 12-14 December 1993, St. Louis, Mo. North Cent. Sect., The Wildl. Soc.

Green, D, G. R. Askins, and P. D. West. 1997. Public opinion: obstacle or aid to sound deer management. Wildl. Soc. Bull. 25(2):367-370.

Messmer, T. A., L. Cornicelli, D. J. Decker, and D. G. Hewitt. 1997. Stakeholder acceptance of urban deer management techniques. Wildl. Soc. Bull. 25(2):360-366.

VDGIF. 1997. Draft deer management plan for Virginia. VDGIF (in review). 80pp.

Appendix A. CTF approach for urban/suburban deer management in Virginia.

Application

For the Virginia Department of Game and Inland Fisheries to actively participate in suburban/urban deer management problems and/or authorize depopulation activities, a written request from the local governing body to the Department will be required. This would include, but not necessarily be limited to, County Board of Supervisors, City Councils or their Managers, Homeowner Associations and/ or Community organizations. Pursuant to receiving a written request for assistance with urban/suburban deer management, the Department will assign the local District Wildlife Biologist as the Department's official contact/spokesman. This staff member will be responsible for all Department responsibilities and duties related to the citizen's task force (CTF).

Methodology

Suggested Approach

To address suburban/urban deer problems, a local citizen's task force (CTF) is suggested. The CTF's responsibility is to recommend a deer population objective and the management option/strategies required to achieve the population objective. Additionally, the CTF should develop a time line for implementation of any recommended management action and identify the parties responsible for implementation of the recommendations.

Developing, administering, and funding the CTF will be the obligation of the local governing body. CTF meetings should be administered by an independent, trained facilitator. All community stakeholders, not to include government officials, should be included. One representative should represent each stakeholder group. The Department will assign a local Wildlife Biologist to serve as a liaison/technical advisor to the CTF. Department staff will not serve as an active CTF member.

In many cases, it may be desirable and/or necessary to initiate a random survey to determine the local public's knowledge of deer ecology and the community's perception of the current deer population and attitudes towards different deer management options.

Management Options

I. Population Objectives

1. Increase Population
2. Stabilize Population
3. Decrease Population

II. Management Options

Lethal

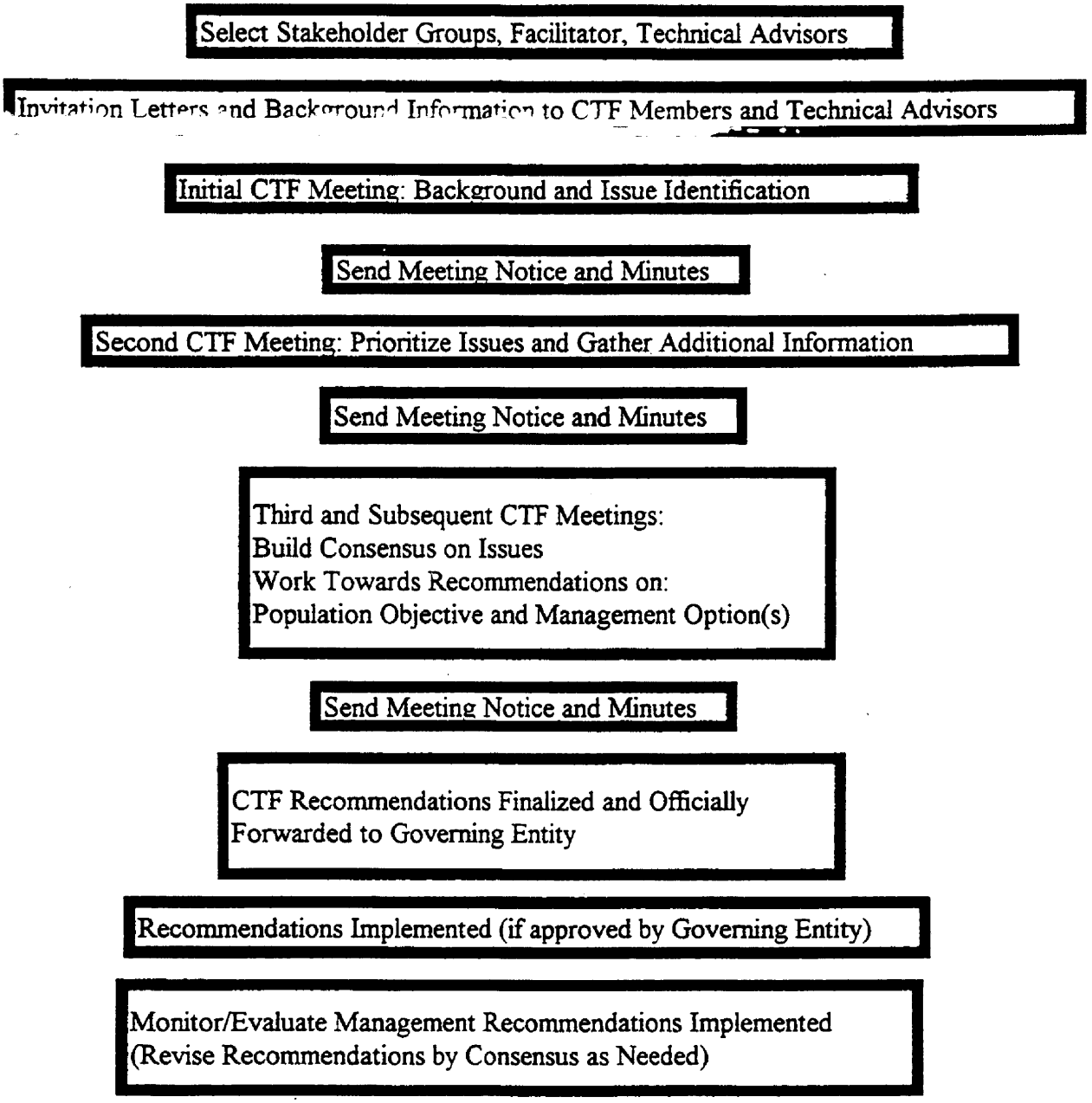
1. Regulated hunting
2. Trap and kill
3. Sharpshooters

Nonlethal

1. Allow nature to take its course (status quo)
2. Trap and transfer
3. Abatement techniques (fencing and repellents)
4. Fertility control
5. Supplemental feeding
6. Predator reintroduction

The following flow chart identifies the suggested steps to resolve an urban deer management issue using a Citizen Task Force:

Suggested CTF approach for urban/suburban deer management in Virginia.



adapted from:

Rebecca J. Stout and Barbara A. Knuth. August 1994. Evaluation of a Citizen Task Force Approach to Resolve Suburban Deer Management Issues. HDRU Series No. 94-3. Human Dimensions Research Unit, Department of Natural Resources, Cornell University, Ithaca, NY. 180pp.

Appendix B. Costs of various deer population management options.

Table 1. Hunting deer management costs.

Archery
Cost per deer: $90
Number of deer: 80
Location: Rock Cut State Park, IL
Reference: Ver Steeg et al. 1995

Firearms
Cost per deer: $200
Number of deer: Unknown
Location: Crane Beach, MA
Reference: Deblinger et al. 1995

Cost per deer: $110-134
Number of deer: 233
Location: Bluff Point Coastal Reserve, CT
Reference: Kilpatrick et al. 1997

Cost per deer: $45
Number of deer: 464
Location: Columbus and Franklin County Park District, OH
Reference: Peck and Stahl 1997

Cost per deer: $622
Number of deer:
Location: Watchung Reserve, NJ
Reference: Sigmund and Bernier 1994

HUNTING LITERATURE CITED

Archery

Ver Steeg, J. H. Witham, and T. J. Biessel. 1995. Use of bowhunting to control deer in a suburban park in Illinois. Pages 110-116 in J. B. McAninch, ed. Urban deer: a manageable resource? Proc. symposium 55th Midwest Fish and Wildlife Conference, 12-14 December 1993, St Louis, Mo. North Cent. Sect., The Wildl. Soc.

Firearms

Deblinger, R. D., D. W. Rimmer, J. J. Vaske, and G. M. Vecellio. 1995. Efficiency of controlled, limited hunting at the Crane Reservation in Ipswich, Massachusetts. Pages 82-86 in J. B. McAninch, ed. Urban deer: a manageable resource? Proc. symposium 55th Midwest Fish and Wildlife Conference, 12-14 December 1993, St Louis, Mo. North Cent. Sect., The Wildl. Soc.

Kilpatrick, H. J., S. M. Spohr, and G. G. Chasko. 1997. A controlled deer hunt on a state-owned coastal reserve in Connecticut: controversies, strategies, and results. Wildl. Soc. Bull. 25(2):451-456.

Peck, L. J. and J. E. Stahl. 1997. Deer management techniques employed by the Columbus and Franklin County Park District, Ohio. Wildl. Soc. Bull. 25(2)440-442.

Sigmund, C., Jr. and D. J. Bernier. 1994. Deer management program for Watchung Reservation, Union County, New Jersey: summary and evaluation of the 1994 deer reduction program. Div. Parks and Recreation, Union County, NJ 13pp.

Table 3. Trap and transfer deer management costs.

Cost per deer: $300
Number of deer: 28
Location: Coyote Hills, CA
Reference: Clark 1995

Cost per deer: $800
Number of deer: 27
Location: Long Island, NH
Reference: DeNicola et al. 1997

Cost per deer: $113-570, avg. $323
Number of deer: 16
Location: Univ. of Wisconsin Arboretum, WI
Reference: Ishmael and Rongstad 1984

Cost per deer: $273-400
Number of deer: 348
Location: River Hills, WI
Reference: Ishmael et al. 1995

Cost per deer: $431
Number of deer: 215
Location: Angel Island, CA
Reference: O'Bryan and McCullough 1985

Cost per deer: $3,148 Note: includes cost of pre-study, capture, and follow-up monitoring
Number of deer: 27
Location: Ardenwood Regional Preserve, CA
Reference: Mayer et al. 1995

Cost per deer: $133 Note: done not include the costs of independent contractors
Number of deer: 526
Location: Columbus and Franklin County Park District, OH
Reference: Peck and Stahl 1997

TRAP AND TRANSFER LITERATURE CITED

Clark, W. E. 1995. Capture and handling techniques for urban deer control. In J. B. McAninch, ed. Urban deer: a manageable resource? Proc. symposium 55th Midwest Fish and Wildlife Conference, 12-14 December 1993, St Louis, Mo. North Cent. Sect., The Wildl. Soc.

DeNicola, A. J., S. J. Weber, C. A. Bridges, and J. L. Stokes. 1997. Nontraditional techniques for management of overabundant deer populations. Wildl. Soc. Bull. 25(2)496-499.

Ishmael, W. E. and O. J. Rongstad. 1984. Economics of an urban deer-removal program. Wildl. Soc. Bull. 12:394-398.

Ishmael, W. E., D. E. Katsma, T. A. Issac, and B. K. Bryant. 1995. Live-capture and translocation of suburban white-tailed deer in River Hills, Wisconsin. Pages 87-96 in J. B. McAninch, ed. Urban deer: a manageable resource? Proc. symposium 55th Midwest Fish and Wildlife Conference, 12-14 December 1993, St Louis, Mo. North Cent. Sect., The Wildl. Soc.

Mayer, K. E., J. E. DiDonato, and D. R. McCullough. 1995. California urban deer management: two case studies. Pages 51-57 in J. B. McAninch, ed. Urban deer: a manageable resource? Proc. symposium 55th Midwest Fish and Wildlife Conference, 12-14 December 1993, St Louis, Mo. North Cent. Sect., The Wildl. Soc.

O'Bryan, M. K. and D. R. McCullough. 1985. Survival of black-tailed deer following relocation in California. J. Wildl. Manage. 49(1):115-119.

Peck, L. J. and J. E. Stahl. 1997. Deer management techniques employed by the Columbus and Franklin County Park District, Ohio. Wildl. Soc. Bull. 25(2)440-442.

Table 4. Fencing and repellent deer management costs.

Fencing
Cost per acre per year: $18, pro-rated over a 10 year period
Number of acres protected: 25
Type of fence: high-tensile electric fence
Location: NY
Reference: Ellingwood and McAninch 1984

Cost per acre per year: $60, pro-rated over a 10 year period (estimated)
Number of acres protected: 25
Type of fence: 8 foot woven-wire fence
Reference: Ellingwood and McAninch 1984

Repellents:
Cost per acre: $10-396, single application
Type of crop: Nursery
Location: CT
Reference: Conover 1984

Cost per acre per year: $70
Type of crop: Orchard
Location: Hudson Valley, NY
Reference: Ellingwood et al. 1983

FENCING AND REPELLENTS LITERATURE CITED

Fencing

Ellingwood, M. R. and J. B. McAninch. 1984. Update on the Institute of Ecosystem Studies deer damage control project. Trans. Northeast Deer Technical Committee. 20:6-7.

Repellents

Conover, M. R. 1984. Effectiveness of repellents in reducing deer damage in nurseries. Wildl. Soc. Bull. 12(4):399-404.

Ellingwood, M. R., J. B. McAninch, and R. J. Winchcombe. 1983. Evaluating the costs and effectiveness of repellent applications in protecting fruit orchards. Page 69 in Proc. of The First Eastern Wildlife Damage Control Conference, Ithaca, NY.

Table 5. Fertility control deer management costs.

Cost per deer: $3,833, experimental project
Number of deer: 15
Location: Coyote Hills Regional Park, CA
Reference: McCullough et al. 1997

Cost per deer: $1,100
Number of deer: 21
Location: Columbus and Franklin County Park District, OH
Reference: Peck and Stahl 1997

FERTILITY CONTROL LITERATURE CITED

McCullough, D. R., K. W. Jennings, N. B. Gates, B. J. Elliott, and J. E. DiDonato. 1997. Overabundant deer populations in California. Wildl. Soc. Bull. 25(2)478-483.

Peck, L. J. and J. E. Stahl. 1997. Deer management techniques employed by the Columbus and Franklin County Park District, Ohio. Wildl. Soc. Bull. 25(2)440-442.

Table 6. Supplemental feeding deer management costs.

Cost per deer saved: $175, winter feeding program only
Number of deer saved: 995
Location: Middle Park, CO
Reference: Baker and Hobbs 1985

Cost per deer annually: $83, year-round feeding program
Number of deer: 23-159, enclosed herd
Location: Shingleton, MI
Reference: Ozoga and Verme 1982

SUPPLEMENTAL FEEDING LITERATURE CITED

Baker, D. L. and N. T. Hobbs. 1985. Emergency feeding of mule deer during winter: tests of a supplemental ration. J. Wildl. Manage. 49:934-942.

Ozoga, J. J. and L. J. Verme. 1982. Physical and reproductive characteristics of a supplementally fed white-tailed deer herd. J. Wildl. Manage. 46(2):281-301.

Table 7. Sharpshooter deer management costs.

Cost per deer: $109-217, avg. $144
Number of deer: 1,127
Location: Landings on Skidaway Island, GA
Reference: Butfiloski et al. 1997

Cost per deer: $88, 1995-96 and $128, 1996-97, avg. $105
Number of deer: 503, 1995-96 and 355, 1996-97, total 858
Location: Gettysburg National Military Park and Eisenhower National Historic Site, PA
Reference: Frost et al. 1997
Special Note: in 1995-96 >14,350 kg and 1996-97 >10,430 kg of venison were donated to regional food banks and local homeless shelters

Cost per deer: $74
Number of deer: 34
Location: Univ. of Wisconsin Arboretum, WI
Reference: Ishmael and Rongstad 1984

Cost per deer: $207
Number of deer: 1,021
Location: Columbus and Franklin County Park District, OH
Reference: Peck and Stahl 1997
Special Note: 17,240 kg of venison were donated to area food banks

Cost per deer: $195, 1991 and $168, 1992, avg. $178
Number of deer: 95, 1991 and 167, 1992, total 262
Location: Bloomington, MN
Reference: Stradtmann et al. 1995

SHARPSHOOTER LITERATURE CITED

Butfiloski, J. W., D. I. Hall, D. M. Hoffman, and D. L. Forester. 1997. White-tailed deer management in a coastal Georgia residential community. Wildl. Soc. Bull. 25(2):491-495.

Frost, H. C., G. L. Storm, M. J. Batcheller, and M. J. Lovallo. 1997. White-tailed deer management at Gettysburg National Military Park and Eisenhower National Historic Site. Wildl. Soc. Bull. 25(2):462-469.

Ishmael, W. E. and O. J. Rongstad. 1984. Economics of an urban deer-removal program. Wildl. Soc. Bull. 12:394-398.

Peck, L. J. and J. E. Stahl. 1997. Deer management techniques employed by the Columbus and Franklin County Park District, Ohio. Wildl. Soc. Bull. 25(2)440-442.

Stradtmann, M. L., J. B. McAninch, E. P. Wiggers, and J. M. Parker. 1995. Police sharpshooting as a method to reduce urban deer populations. Pages 117-122 in J. B. McAninch, ed. Urban deer: a manageable resource? Proc. symposium 55th Midwest Fish and Wildlife Conference, 12-14 December 1993, St Louis, Mo. North Cent. Sect., The Wildl. Soc.

Appendix C. Text of HJR 489.

HOUSE JOINT RESOLUTION NO. 489

Requesting the Department of Game and Inland Fisheries to study options for controlling the deer population in urban and suburban areas.

WHEREAS, Virginia's deer population is high and will continue to increase at a high rate; and
WHEREAS, the explosion of the deer population is not statewide but rather appears to be occurring in selected areas; and
WHEREAS, as people move further from the central cities, less habitat is available for the deer population; and
WHEREAS, the presence of deer in the more populated areas of the state has resulted in an increasing number of deer/vehicle collisions, and greater threats to public health; and
WHEREAS, hunting has been the traditional method for controlling the deer population; and
WHEREAS, other options are available, such as birth control, trap and transfer, managed hunts, and out-of-season kill permits, which may enable deer and people to co-exist; now therefore, be it
RESOLVED by the House of Delegates, the Senate concurring, That the Department of Game and Inland Fisheries be requested to study options for controlling the deer population in urban and suburban areas.

All agencies of the Commonwealth shall provide assistance to the Department, upon request.

The Department shall complete its work in time to submit its findings and recommendations to the Governor and the 1998 Session of the General Assembly as provided in the procedures of the Division of Legislative Automated Systems for the processing of legislative documents.