

Dear Reader:

As one who considers herself to be an advocate of all animals, I would like to take this opportunity to explain my role as one member of the Howard County Deer Task Force. A few months after the Task Force was appointed, I learned of its existence and asked if I might join it since I have always been concerned about deer and other wildlife. A representative of the Task Force then contacted me and invited me to sit in on the next meeting. Since attending that meeting, I became a "regular" and attended most Task Force meetings over the past few years, listening to speakers, questioning and asking for clarification, and contributing to the development of the county-wide questionnaire. I also received drafts of this report which I read and offered my critique and ideas for inclusion. Some of my suggestions were incorporated into the final copy, many others were not. I arranged for two speakers to address the issue of highway reflectors and consulted with Allen Rutberg, Ph.D., Wildlife Biologist for the Humane Society of the United States, and coordinator of the National Institutes for Standards and Technology Deer Contraception Study which has been taking place for the past few years in Gaithersburg, Maryland.

Dr. Rutberg was extremely helpful in familiarizing me with the latest scientific knowledge about suburban deer, their behavior, home ranges, and their reproduction and mortality rates. He was also helpful in regularly providing me with updates regarding the feasibility of using contraception as a practical means of controlling deer populations. While two doses of contraception are currently required to effectively protect against pregnancy in deer, a single-dose administration has been perfected for use on horses. Dr. Rutberg believes that a single dose will be reliable for deer as well.

This is very encouraging news to people like me who strongly believe that we have a responsibility to solve any deer overpopulation problems non-lethally. According to numerous comments returned on the questionnaire mailed to landowners, many county residents agree with me that, to a great extent, we have created many of the conditions that have resulted in an overabundance of deer. It has become quite evident to me as I have studied this issue over the past few years as a Task Force member that the problem of too many deer can be solved in humane ways. I recommend the following:

- 1) Install highway reflectors in "hotspots" (i.e. locations where deer have been known to cross. These reflectors are

highly effective in greatly reducing or even eliminating automobile-deer collisions at night when most deer come out to browse for food. Reflectors are cost-effective. They cost far less than noise buffers erected along highways.

2) Allocate funds to aggressively explore the perfection of a single-dose contraception and contact local, state, and even national legislators and urge them to add additional funding for this project in order to speed the approval process. Note: "Contraception was second most popular option selected by countians, with 30 percent rating it as "most acceptable" --31 percent rated "regulated hunting" as "most acceptable" I believe it is just as important to seriously pursue a contraception solution as it is to recommend any other.

3) Provide educational materials to residents: booklets listing the many specific trees, bushes, and flowers that do not appeal to deer, deterrent sprays, netting, etc.

4) Provide educational information to motorists to help them avoid colliding with deer on highways: e.g. obey posted speed limits, drive cautiously on roads where deer have been sited, stay alert for groups of crossing deer, etc.

5) Educate people about ways to protect themselves from Lyme disease: e.g. wear protective clothing, apply repellents, inspect clothing and body for ticks, consider getting vaccinated against Lyme Disease, etc.

Martha E. Gagnon, Ph.D.
President, Animal Advocates of Howard County

*Note: Animal Advocates of Howard County has prepared a booklet which is available at no charge by contacting: P.O. Box 1403, Ellicott City, Maryland 21041 or by visiting our website at www.animal-advocates.org.

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**HOWARD COUNTY DEER MANAGEMENT
TASK FORCE REPORT**

EXECUTIVE SUMMARY

At the turn of the twentieth century whitetail deer population in the eastern United States was so sparse that in many areas they were believed to be extinct. The rare sighting of a deer was so noteworthy that it often prompted a mention of the event in local newspapers (Ellingwood and Caturano, 1996). In 1896 the Maryland General Assembly created the State Game Department in response to the need to manage, protect and conserve the state's wildlife resources. A number of years later, at the Meadow Mountain Game Refuge in Garrett County, a 100-acre deer corral was established so that surplus deer born there could be released to restock the state population. The first year that deer hunters in Maryland were required to report their harvest was 1931. Thirty-two deer were taken in Garrett and Allegany Counties that year. Twenty years later, for the first time, the statewide deer harvest exceeded 1,000. By 1960 all counties, except Montgomery, were reporting a deer harvest and the statewide total reached 5,000 (Hanyok, 1996).

Today, a little more than a century after the formation of the State Game Department, Howard County residents regularly see deer throughout the year. More than 60 percent (61%) of the respondents to a countywide Deer Survey mailed to property owners throughout the county indicated that they observed deer within two miles of their property. Of the survey respondents, 70 percent of agricultural landowners and 40 percent of residential landowners reported that they now observe more deer than 5 or 10 years ago. Obviously, the conservation efforts of our ancestors have been successful, as the deer population of Howard County has increased significantly.

There are other factors, however, which have contributed to the high deer population levels that we are experiencing today. These elements include: a) fewer licensed hunters today compared to 25 years ago b) more residential and commercial development, which not only provides more woods/grazing borders that the deer need, but also limits the areas available for hunting; and c) better land use and development practices, allowing more of our environmentally-sensitive and valuable habitats to be preserved, which provides improved deer habitat. All these factors have contributed to the increase in deer population. There is no

single cause of our present high deer populations. And, just as significantly, there is no one single solution for controlling the deer population that will work everywhere.

Over the past three years, Howard County's Deer Management Task Force heard from numerous professionals in many fields related to whitetail deer biology, management and effects on the environment. Additionally, information from other parts of the state and county were reviewed, including the work of other citizen task forces. Seven thousand, seven hundred Howard County property owners were polled by means of a mailed questionnaire. This survey sampled their experiences with deer, their attitudes toward deer, and their perception on the acceptability of various deer management options. These property-owner responses, along with background information gathered by the Task Force, form the basis for the recommendations in this report.

Deer management recommendations, which include many different options, have been separated into categories for private property owners (agricultural and non-agricultural) and public lands. The report has been formatted so that the reader can access information on any of the many topics related to the whitetail deer population and to all management options which should be considered when making the best decision for the numerous diverse site-specific conditions found in Howard County.

The majority of respondents to the Howard County Deer Survey (62%) thought that additional deer population management is needed in Howard County. This report outlines the current relationship between people and deer in Howard County, explains possible management techniques and provides recommendations for deer population management.

HOWARD COUNTY DEER MANAGEMENT TASK FORCE

Reason for Formation. In 1995 and 1996, the Howard County Cooperative Extension (CE) staff noticed that they were receiving an increasing number of calls and inquiries from Howard county residents about deer. These calls originated from both the rural and the metropolitan areas of the county.

Due to the apparently increasing deer population in Howard County and the application of deer management strategies in neighboring Montgomery County, the Howard County CE availed itself of a grant opportunity from Maryland Cooperative Extension/Small Grants Program for County Natural Resource Programs. The grant allowed the CE staff to begin laying the foundation of a task force to look at the deer situation in Howard County. The CE staff drew upon their resources and contacts in the community and brought together a group of individuals to form a task force. These people represented both the public and private sectors at the county and state levels, as well as animal protection organizations and concerned citizens.

In July and August, 1996, the Howard County Council adopted a resolution which formally sanctioned and gave direction from the Howard County government for the Howard County Deer Management Task Force. The Task Force's mission was to investigate the deer interactions in the county and develop recommendations for resolving human-deer conflicts throughout the county. A copy of that adopted County Council resolution is in Appendix A.

Current Task Force Participating Members:

Charles Rhodehamel- Task Force Chair, Columbia Association
Allan Bandel, Howard County Farm Bureau
Christopher Bushman, Maryland DNR State Forests & Parks Service
Larry Coburn, Sportsman
Ken D'Loughy, Maryland DNR Wildlife Biologist
Jeff Duguay, Howard County Dept. of Recreation & Parks
Georgia Eacker, Howard County Cooperative Extension
Caragh Fitzgerald, Howard County Cooperative Extension
Martha Gagnon, Animal Advocates of Howard County

Al Geis, Wild Bird Centers of America Research Director
Madeleine Greene, Howard County Cooperative Extension
Dennis Hubbard, Washington Suburban Sanitary Commission

Cathy Hudson, Citizen
Marilyn Mause, Maryland Dept. of Natural Resources
Wildlife Biologist Tom Owens, Cider Mill Farm
Brenda Purvis, Howard County Police Dept. Animal
Control Division

Task Force Resource Members:

Allen Rutberg, Humane Society of the United States
Jonathan Kays, Western Maryland Research & Education
Center
Lowell Adams, Urban Wildlife Resources
Robert Kratochvil, Central Maryland Research &
Education Center
John Byrd, Howard County Dept. of Recreation & Parks
Wendy Feaga, DVM

Task Force Funding and Other Support. Time required for Task Force involvement was supported by the employers of the public sector members and generously donated by private sector members. Costs of printing, mailing, data analysis, and other miscellaneous operating costs were covered by funds generated by a partnership between the Howard County government and the private sector. Task Force members were able to solicit about half the necessary budget funds and then successfully requested a matching amount from the county government, through the County Executive. The cooperation of both public and private sectors was considered necessary both in the development and the later implementation of solutions related to the deer-human situation.

The following organizations and groups contributed financially:

Howard County Farm Bureau
Howard County Forest Conservancy Board
Discoveries in Gardening
Washington Suburban Sanitary Commission
Maryland Horse Council
Howard County Dept. of Finance
Howard County Dept. of Recreation & Parks
Cider Mill Farm

HOWARD COUNTY BACKGROUND INFORMATION

Location and Size. Howard County is located in central Maryland, between the cities of Washington, D.C., Baltimore, Frederick and Annapolis. It is mostly in the area known as the Piedmont Plateau, which lies between the low-lying Coastal Plain and the Mountain region of western Maryland. Bordered by Montgomery, Frederick, Carroll, Baltimore, Prince Georges, and Anne Arundel Counties, Howard County consists of 160,640 acres of wooded hills and rolling country. It is the only major political jurisdiction in the state of Maryland that does not share a boundary with another state or with the Chesapeake Bay.

The northern and eastern boundary of the county is the Patapsco River and the Patapsco Valley State Park (6,347 acres). The western and southern boundary is the Patuxent River and the Patuxent River State Park (3,469 acres). Across the Patuxent River, the Washington Suburban Sanitary Commission (3,750 acres) constructed the Brighton Dam. The resulting Triadelphia Reservoir supplies water to the Washington suburbs. The T. Howard Duckett Dam and its corresponding reservoir, Rocky Gorge, are located on the Patuxent River just north of the town of Laurel, which is located at the southern tip of the county.

Population and Land Use. Historically, Howard County was primarily an agrarian county with small farm communities, towns and a correspondingly small population. However, modern development, in the form of low density communities, has increased the population of Howard County from 61,911 in 1970 to approximately 232,156 people in 1997 (Department of Planning & Zoning, December 1997 figures). Although the county has become more urban in recent times, Howard County has more than 17,500 acres of agricultural land in preservation easements and 20,388 acres in parkland and open space. An additional 1,800 acres are contained in the county's nine golf courses.

COMMUNITY GROUPS AFFECTED BY DEER

Affected Parties/Stakeholders. There are many segments of the Howard County community which have specific interest in the population of whitetail deer. Together they comprise a broad array of concerns, viewpoints and opinions. Specific groups which have been identified in Howard County include:

A) Agricultural producers, whose crops and livestock are susceptible to significant losses through damage and disease. This group owns a large portion of the deer habitat in the County and has personal control over whether or not to allow deer hunting on their land. They include commercial nurseries as well as crop and livestock growers. Their means of earning a living is often adversely affected by deer overabundance.

B) Homeowners and the general public, who may face damage to ornamental plantings, gardens, and woodlots and who also may have concerns about Lyme disease and traffic safety. The aesthetics of seeing deer in the landscape and the personal value placed on wildlife are also important factors to many members of the public.

C) Natural resource managers, such as The Columbia Association, Washington-Suburban Sanitary Commission, the Howard County Department of Recreation and Parks and Maryland Department of Natural Resources. These groups are concerned with ecological dynamics and wildlife populations in natural areas and must respond to the requests and concerns received from citizens, elected officials and the leadership within their own agencies.

D) Animal protection groups, whose concerns about the deer situation focus on the support of non-lethal methods of deer population management.

E) Sportsmen and those involved in the hunting industry, who are concerned about maintaining deer populations. Sportsmen may have a number of different reasons for their interest in deer. Their differing motivations to hunt (outdoor recreation, meat, trophy, etc.), may lead to vastly different perceptions of deer abundance, management goals and methods. Those who sell hunting licenses, equipment, and gear also have a vested interest in both the maintenance of deer populations and the choice of management options.

F) Environmental/conservation groups, such as bird clubs, the Sierra Club, hiking groups, wildflower societies, and Wild Bird Centers of America. These private organizations may or may not own properties as preserves or sanctuaries, and generally have a deep concern for ecological balance.

HOWARD COUNTY DEER SURVEY

Deer Survey Development¹. A significant accomplishment of the Task Force's efforts has been completion of the countywide deer survey. It was mailed to 7,700 property owners. These included all 624 rural, agricultural property owners and randomly selected residential property owners throughout the county. The twelve-question survey was designed to measure Howard County landowners' experiences with deer and their attitudes toward various deer management options. A copy of this survey can be found in Appendix B.

The highly stratified statistical design selected allowed for detailed results at a relatively low cost. Howard County was divided into 17 geographic areas, or strata (see map, Appendix F). The survey was further stratified by segregating property owners living on land classified as rural or agricultural from those living on land that was classified as residential. All of the 624 Howard County agricultural landowners were sent questionnaires. The more than 50,000 residential landowners were sampled at different rates in the various geographic areas in order to obtain reliable data from each area of the county while keeping the survey costs low. Thus, a much lower proportion of landowners were sampled in the urban areas such as Columbia compared to landowners in the rural portions of the county. This difference in sampling rates between the agricultural and residential landowners in the 17 geographic areas required a relatively complex estimating procedure to obtain a properly weighted, unbiased estimate of countywide results. The survey questions were posed so that the issues of deer population levels, damages incurred, control methods applied, and actions or possible management alternatives could be measured in specific portions of the county and in the county as a whole. The survey results give a reliable depiction of the deer population's impact

¹TheThe Task Force would likeThe Task Force would likeThe Task Force would like
survey statistician with the
U.S.U.S. Fish and Wildlife Service) and Dr. Paul Padding (Chief of
the U.S. Fish and
WildlifeWildlife Services) Harvest Survey Section forWildlife Services)
with the design and analysis
ofof this survey. Mr. Wayne Poole and Dina Shahmohammadi of the
Howard County Dept.
of Recreation and Parks provided assistance with the survey.

on the livelihood and lifestyles of county property owners and the general public.

The return rate of the mailed survey forms was unusually high. Almost half (46%) of those landowners receiving the mailing returned a usable responsive questionnaire. Fifty-five percent of agricultural landowners and 46 percent of residential landowners returned questionnaires. This high response rate indicated to the Task Force that the property owners of Howard County had strong opinions about various deer issues.

Deer Survey Results. The results of the survey have been incorporated into various sections of this report, with any remaining results described in Appendix C. Data gathered from the survey respondents have formed the basis for discussion of the various topics and is a source for the recommendations proposed by the Task Force. Major findings from the survey are discussed below.

Deer Sightings. A generation ago, a deer sighting was very rare in Howard County. Based on sightings reported by the survey respondents, it is estimated that about 25,000 deer sightings are made by Howard County landowners each day. (Average number of deer seen per day per respondent: Agricultural 2.46, Residential 0.47, Combined 0.5.) Of the survey respondents, 70 percent of agricultural landowners and 40 percent of residential landowners reported that they now observe more deer than 5 or 10 years ago (Appendix C, Table 4). The most frequent sightings were made by property owners near Patapsco Valley State Park and the Middle Patuxent Environmental Area. Conversely, fewest sightings occurred in Columbia neighborhoods away from the Middle Patuxent Environmental Area, and in the southern part of the county near Laurel and Jessup (Appendix C, Table 2). Most of the sightings (61%) were made within two miles of the survey respondents' property (Appendix C, Table 3). Frequency of deer sightings is described in Appendix C, Table 1.

Deer Population Trends. Seventy percent of the agricultural landowners and 40 percent of the residential property owners were of the opinion that Howard County's deer population was increasing (Appendix C, Table 4). The majority of residents (61%) having an opinion about the present deer population levels reported it as being "too high" (Appendix C, Table 6). Perceived differences in populations paralleled geographic differences in sightings (Appendix C, Tables 2 and 5).

Quality of Life. Property owners expressed varying views concerning whether or not deer added to the quality of life in Howard County. Summarizing the results, 33 percent of the respondents reported that "yes, deer add to the quality of life," while 27 percent and 25 percent respectively reported "mixed feelings" or "no." The geographic areas varied, with less than 20 percent of the respondents reporting "yes" in the four geographic areas adjacent to the Middle Patuxent Environmental Area and the Patapsco Valley State Park, compared to higher reports of "yes" from areas of the county where deer were less abundant. These results are reported in Appendix C, Tables 7 and 8.

Vegetation Damage. Deer damage to vegetation was reported by 62 percent of the rural or agricultural landowners and 26 percent of the residential property owners (Appendix C, Table 9). During the year before the survey, the estimated total value of losses to gardens, landscape shrubs, field crops, or other vegetation was approximately \$5.5 million (Appendix C, Table 11). The financial loss to agriculture was approximately \$700,000, which is 6 percent of the total county income for agricultural crop plants (USDA, 1997).

There were large differences in vegetation damage among the geographic areas of the county. The highest damage rates came from residents near the west side of the Middle Patuxent Environmental Area and from those who live near the Patapsco Valley State Park. On the east side of the Middle Patuxent Environmental Area, 62 percent of the surveyed residential property owners close to the area reported damage, while only 10 percent of the remaining Columbia residents reported damage to their vegetation. These results are reported in Appendix C, Table 10.

Survey results indicated that deer damage to vegetation on residential property clearly reflected a relationship between the geographic location of respondents and the level of damage. Damage was most likely to occur in areas abutting parkland, such as the western Middle Patuxent Environmental Area and the northeast and central rural areas of Patapsco State Park. In these areas, more than 83 percent of respondents reported deer damage, with an average cost of \$104 per respondent (Appendix C, Table 10; per respondent data not shown). In contrast, only 15 percent of respondents in areas such as Columbia and the sites abutting Columbia indicated damage, which averaged \$82 per

respondent. It is estimated that deer damage to vegetation on residential property is \$4.7 million (Appendix C, Table 11).

Based on responses to the 1998 Deer Task Force Survey, it is estimated that Howard County residents spent over \$2.4 million annually to prevent deer feeding on vegetation. The estimated costs of preventive measures are summarized in Appendix C, Table 14.

Vehicle-Deer Accidents. Accidents involving vehicles and deer were reported with great frequency by the survey respondents. Seventy-nine percent of respondents reported having seen dead or dying deer that had been hit by a vehicle in the year prior to the survey (Appendix C, Table 17). Two percent of respondents reported that they had actually been in a vehicular collision with a deer. A few of these accidents resulted in very serious bodily injuries to vehicle occupants. Projecting these data countywide provides an estimate of approximately 1,080 deer-related vehicle accidents in the last year by property owners alone. The total vehicle-deer accidents in the county must be much higher than this number if the data is extrapolated to include non-resident drivers and Howard County residents who do not own land.

Lyme Disease. About one-third (33%) of the county property owners surveyed were of the opinion that the incidence of Lyme disease was directly related to the currently high local deer population levels (Appendix C, Table 19). More than half (57%) of the respondents, however, admitted that they did not know.

Deer Management. Public opinion about the need for deer population management was also assessed through the survey. About 2.5 times (61%) as many survey respondents agreed that deer population levels should be managed, compared to the number who disagreed (24%) (Appendix C, Table 20).

There was a great geographic variation in the attitude toward deer population management (Appendix C, Table 21). Property owners living near the Middle Patuxent Environmental Area (MPEA) and the Patapsco Valley State Park were most strongly in favor of population control. Respondents from Columbia (not near the MPEA) and from southern and eastern areas such as Jessup, Laurel, Ellicott City and Elkridge (not near Rockburn Park or Patapsco Valley State Park) gave less support for reducing current deer populations.

Deer Management Options. When asked to rate each of 9 deer management options on a scale of 0 (not acceptable) to 5 (most acceptable), responses varied greatly. Some respondents gave a rating of "not acceptable" to the same option that other respondents reported as being "most acceptable." Certain management options were often not given a rating, while other options almost always were rated.

Table 1 presents a summary of the percentage of countywide responses related to the various management options (arranged alphabetically) which were rated as "most acceptable," "not acceptable," and "need more information" about that management option. Full data from the survey are presented in Appendix C, Tables 22 and 23.

Survey Respondent Comments. Many survey respondents responded to the request for additional comments by including comments about deer in Howard County in blank spaces provided in the survey. Upon review, most of these appeared to fall into 9 major categories. There were 3767 comments of this type returned, with as many as three major comments counted per respondent. The results of these comments are summarized in Table 2.

Table 1. Summary of results from the 1998 countywide deer survey, management options.

OPTIONS	COUNTYWIDE RESULTS		
	% OF RESPONSES REPORTING THEIR ACCEPTABILITY AS:		% OF RESPONSES REPORTING THEY:
	Most Acceptable	Not Acceptable	Need More Information
Contraception	30	16	16
Fencing	13	30	9
No action	8	41	6
Qualified sharpshooters	18	33	7
Regulated hunting	31	19	5
Re-introduce predators	4	44	16
Repellents	11	22	18
Supplemental feeding	8	28	20
Trap and transfer	25	18	8

Table 2. Summary of major concerns expressed by survey respondents in response to request for further comments.

Concern	% Total Comments Received*
Too many accidents from automobiles hitting deer	29
Effects of deer are intolerable	18
Too much human population growth/development	16
Hunt deer more	9
Deer were here first--enjoy them	8
Do something	6
Worried about Lyme disease	6
No problem	6
No hunting	3

* This total is not 100% because of rounding errors.

WHITETAIL DEER IN HOWARD COUNTY

Whitetail Deer Biology. The whitetail deer is a large mammal which stands about 3 feet tall at the rump and shoulder and is approximately 5 to 6 feet in length. In Howard County, the average adult weight is approximately 135 pounds for males and 115 pounds for females. Whitetail deer are browsers and require 2 to 7 pounds of vegetation daily per hundred pounds of weight.

A deer's home range is the area traversed by an individual animal on an annual basis in its normal activities of food gathering, mating and caring for young. Throughout the year, the radius of a deer's home range does not greatly exceed 1 mile (Wildlife Management Institute, 1984), and the deer tend to use the same ranges from year to year. However, in suburbia, deer home ranges are much smaller than in rural areas, and for females they are often less than half a square-mile. (Swihart, et al., 1995.) When their range is significantly altered, the deer may leave, or they may simply adapt to the change in vegetation and may also alter their bedding locations if necessary. "In suburbia deer home ranges are much smaller than in rural areas, and for females they are often less than half a square mile. (Swihart, R.K., P.M. Picone, A.J. DeNicola, G.S.Kania, and L. Cornicelli. 1995. Ecology of urban and suburban white-tailed deer, Pp. 35-44 in J.B. McAninch (ed.), Urban Deer: A Manageable Resource? Proc. 1993 Symp. N.C. Section, The Wildlife Society." (Note: also substantiated in: Grund, M.D., J.B. McAninch, and E.P. Wiggers. 1998. Home range, movements, and habitat use of white-tailed deer in an urban landscape. Technical Report, Minnesota Department of Natural Resources, Madelia, MN., and Kilpatrick, H.J., and S.M. Spohr. 1999. Movements of female white-tailed deer in Mumford Cove and Groton Long Point, Connecticut. Report from the Connecticut Department of Environmental Protection, Wildlife Division, North Franklin, CT.) " Deer populations consist of social groups of related females in geographically distinct matriarchal units, and 97% of adult females remain on their natal range for life." (McNulty et al. 1997) as well as Kilpatrick & Spohr (1999) McNulty, S.A., W.F. Porter, N.E. Mathews, and J.A. Hill. 1997. Localized management for reducing white-tailed deer populations. Wildlife Society Bulletin. 25:265-271.

By mid-August, hormone levels increase in males (bucks). Bucks lose their antler velvet and begin to mark their territory and spar with other bucks. In Maryland, chasing of females (does) by bucks peaks in November. Does attempting to escape from pursuing

bucks, as well as the bucks who are in pursuit, are responsible for many of the vehicle collisions with deer. It is during this period that insurance adjusters report the greatest number of vehicle-deer accidents. Deer are also most vulnerable to hunters at this time. However, in recent years hunters have been restricted to the use of bows during this period of peak deer activity. While the deer hunting season in Maryland runs from September to January, the greatest reduction in the deer herd is during the modern firearm season, which is a 2-week period in the beginning of December. Pressure from gun hunters might also increase the movement of some deer at this time.

Doe fawns may attain puberty as early as six or seven months of age. Relative physiological state, which is influenced by quality of habitat and food, chiefly determines when the doe fawns become sexually mature. In low density areas, female deer may begin producing young by the time they are one year old. (Swihart, R.K., P.M.Picone, A.J.DeNicola, G.S.Kania, and L.Cornicelli 1995. Ecology of urban and suburban white-tailed deer. pp. 35-44 in J.B.McAnich (ed.), Urban Deer: A Manageable Resource? Proc. 1993 Symp. N.C.Section, The Wildlife Society. also Thiele, L.A. 1999. A field study of immunocontraception of a white-tailed deer population. M.S. thesis, University of Maryland, College Park, 119 pp." However in areas where deer are abundant, the first fawn is usually borne at two years of age. Thus, by the time they are one year old, these females may be producing young. However, in areas where deer are abundant, the first fawn is usually borne by two-year-old does (Swihart, et al.,1995). The productivity rate of whitetail deer increases rapidly, with young females typically producing a single fawn. Maximum reproductive potential of an individual generally occurs from three to seven years of age and then declines. Under ideal conditions for the deer, twins or even triplets may be common during the time of a doe s maximum reproductive potential. In suburban areas where deer are abundant, triplets are quite unusual, and even twinning can become uncommon. (Shihare, et al.,1995) "In areas where deer may be abundant (e.g. suburban areas), triplets are quite uncommon, and even twinning can become uncommon. (Swihart et al. (1995) and Thiele (1999)"

Mortality factors not related to humans of whitetail deer include predation, disease and parasites, and weather. Diseases affecting whitetail deer are commonly caused by viruses, bacteria, and protozoa. Viral diseases include epizootic hemorrhagic disease (EHD), skin tumors, arboviruses, foot-and-mouth disease, and

other miscellaneous diseases. Bacterial and protozoan diseases include anthrax, listeriosis, foot rot, brucellosis, tuberculosis, actinomycosis, salmonellosis, anaplasmosis, theileriasis, sarcocystis, and miscellaneous diseases. Miller and Ozoga (1997) report higher neonatal mortality at high densities, especially among younger mothers, even when food supplies are unlimited. (Miller, K.V., and J.J. Ozoga. 1997. Density effects on deer sociobiology. Pp. 136-150 in W.J.McShea, H.B.Underwood, and J.H. Rappole (eds.), The Science of Overabundance: Deer ecology and population management. Smithsonian Institution Press, Washington, D.C.

If it occurs, harsh winter weather may cause high deer mortality. Deep snow may make movement difficult for the deer, requiring more energy than can be supplied by the food available during the winter. Body fat acquired in the fall is depleted as the winter progresses. Although uncommon in Howard County, a long winter or late winter snowstorm can cause significant mortality, especially of very young or old deer, or deer of poor health.

Human/Deer Interactions - Aesthetic & Recreational Value. The relationship between deer and humans is complex - increasingly so as suburbia spreads and deer find less danger and more quality food in this rich matrix of agricultural, rural and residential land uses. Truly a full array of positive and negative emotions exist regarding the perceived benefits and drawbacks of our frequent interactions with deer. The balance between these two perceptions of deer is dynamic and broad, with as much area for common ground as there is room for disagreement.

Deer are generally considered to be an attractive and desirable element in the Howard County landscape. They are symbolic of wildness and the grace and beauty of wild things. Some residents purposely attract deer into their yards so that they can be viewed, photographed and enjoyed for their inherent beauty. Deer hunters usually enjoy a certain camaraderie during hunting season, and look forward to the recreational benefits of spending time in natural surroundings, as well as the satisfaction of supplying meat for the table or of taking home a trophy buck. Many hikers, canoeists and other outdoor recreationists feel that seeing deer, and knowing that they are "out there," adds to the pleasure they gain from these outdoor activities.

Economic Impact of Whitetail Deer. Whitetail deer are an economically important animal. Unknown sums of money are spent by

people wishing to supplement natural foods in order to attract and/or observe deer on their property, or traveling to parks and other natural areas where they may observe deer in natural surroundings. According to the Maryland Game Program Annual Report for 1996-97 (available from the Maryland Department of Natural Resources), the total economic benefit to Maryland through deer hunting exceeds \$209 million and creates 3,250 full- and part-time jobs. Through various formal and informal programs, thousands of pounds of venison are donated to charity every year. There are also negative economic impacts, such as landscape damage to residential and commercial property, crop damage, collision repair costs, and the medical costs associated with accidents. These costs are quantified elsewhere in this report.

Human/Deer Conflicts. The Task Force identified five areas of concern within which humans and deer come into conflict. These areas of conflict formed the core around which the Task Force focused its fact finding efforts. Stated briefly, conflicts with deer exist in:

- 1) Agricultural losses: through deer depredation on crops, diseases carried by deer which may affect livestock, and damage to other agricultural operations either by deer browsing or by antler rubbing;
- 2) Homeowner losses: from landscape and garden damage due to deer browsing.
- 3) Vehicle-deer collisions: estimated to be 1,080 per year for Howard County property owners (extrapolated from survey results);
- 4) Disease transmission: primarily Lyme disease, which is carried by *Ixodes scapularis*, the black legged tick, commonly known as the deer tick;
- 5) Ecological damage: on public and private lands, damage to plants and to animal habitat by deer browsing, competition with other animals for food.

Agricultural Losses. Howard County consists of 160,640 acres of land area. According to the Maryland Agricultural Statistics Service of the Maryland Department of Agriculture, 38,000 Howard County acres remained in farmland in 1996. Approximately 17,500 acres have been permanently preserved by the County's Agricultural Land Preservation Program.

Even today with a large proportion of eastern Howard County converted to an urban environment, agriculture remains a major industry in Howard County. According to 1995-96 survey data, income from just a few of Howard's major agriculturally related enterprises are estimated to represent a contribution of approximately \$35 million annually to the local economy. If all other known sources of agricultural income were included, agriculture's total economic contribution to Howard County would likely exceed \$100 million annually.

Crop and Other Vegetation Losses Attributed to Deer Damage. The extent of crop losses suffered by Maryland farmers due to deer damage is difficult to measure precisely, although some estimates can be derived from a recent study and survey data. In a 1992 replicated field study designed to measure deer damage, agronomists at the University of Maryland's Central Maryland Research and Educational Center, Beltsville Facility reported that soybean yield losses ranged from 24 percent to 74 percent, depending upon variety. Averaged across all cultivars tested, deer damage reduced yields by 51 percent, from 37.5 bushels/acre to 18.3 bushels/acre. With soybeans valued at near \$7.00/bushel in the fall of 1997, this would have represented an economic loss of about \$134/acre. If this feeding pressure had been present across all of the county's 1996 soybean acreage, losses to deer damage would have cost Howard County soybean farmers more than \$750,000. This figure may over-estimate actual losses, since average deer feeding pressure in the county is likely to be less than in the area specifically chosen to study deer damage.

One thousand Maryland farmers were randomly surveyed in 1997 by members of the University of Maryland's Department of Agricultural and Resource Economics (UM AREC) in order to obtain an estimate of crop damage caused by deer. Of those surveyed, 468 responded. In Central Maryland, deer-related losses of corn, soybean and wheat were estimated to be slightly more than \$6.5 million annually. Corn losses were the highest at \$3.52 million (7.4 percent of the total crop), followed by soybean at \$2.76 million (11.8%), and then wheat at \$0.25 million (2.0%). If we apply these same percent deer related crop loss estimates to the latest available Howard County crop production records (1996), corn, soybean and wheat losses would have been about \$162,000, \$154,000 and \$16,000 respectively for a total annual loss of \$332,000. Again, these losses are equivalent to yield reductions of 7.4 percent for corn, 11.8 percent for soybeans, and 2.0 percent for wheat.

Statewide, the UM AREC economists estimated that deer damage to corn, soybean and wheat was approximately \$38 million annually. The authors suggested that total agricultural losses in Maryland were probably much higher since their survey encompassed only three crops. It did not include other crops of higher value which were likely to be affected by deer.

Most recently, results from 1998 Deer Task Force survey of Howard County landowners indicated that deer cause significant property damage to many kinds of vegetation, resulting in heavy financial losses to county residents. A summary of the data is presented in Appendix C, Table 11. It was estimated that on an annual basis, deer are currently responsible for nearly \$700,000 damage to vegetation in county agricultural areas and almost \$4.8 million in residential areas, for a total loss of slightly under \$5.5 million annually. The losses to agricultural areas are approximately 6 percent of a \$12.1 million agricultural industry (plant crops only) (USDA, 1997).

Obviously, estimated financial losses caused by deer to Howard County agriculture vary widely depending upon the source of the information. However, all data indicate that there is a significant cost to the agricultural community caused by whitetail deer.

In an effort to reduce deer damage to vegetation in Howard County, many residents chose to spend additional money on preventive measures. Using results from the 1998 Deer Task Force Survey, these additional costs would total over \$2.4 million annually. The estimated costs of preventive measures are summarized in Appendix C, Table 14. The cost of these efforts is concentrated in residential areas. Agricultural areas and publically-owned lands are generally too large to justify the relatively high cost or management requirements of these techniques on large areas of land.

Homeowner Losses. Data provided by the University of Maryland Home and Garden Information Center (a telephone assistance service provided to persons in Maryland, Delaware and Washington, D.C.) indicated that in 1993, 28 Howard County calls regarding deer management were received. From January through July, 1996, 43 calls were handled, and during 1997, 32 calls were received. In a letter to the Task Force, one Howard County resident reported a total loss of \$6,432 due to deer damage.

Results of the Deer Task Force Survey, which were discussed earlier, indicate that over \$4.5 million have been lost to deer damage to vegetation in residential areas. To prevent these losses, almost \$2.2 million have been spent in these areas for fencing, repellents, and other deer deterrents. These results are summarized in Appendix C, Tables 11 and 14.

Some Economically Important Diseases Common to Whitetail Deer, Domestic Livestock and Humans. Because of its potentially serious negative effects on human health, the connection between deer and Lyme disease has been well publicized in recent years. This topic is covered more thoroughly in another section of this report. There are also other potentially damaging pathological relationships between deer, humans and numerous agriculturally important animals. Diseases that may be transmitted to livestock from deer are bovine viral diarrhea (Frolich and Hofmann, 1995), infectious bovine rhinotracheitis (Ingebrigtsen et al., 1986), and parainfluenza 3 virus (Ingebrigtsen et al., 1986). Diseases which may be transmitted to humans or livestock from deer are leptospirosis (*Leptospira interrogans*) (Ingebrigtsen et al., 1986; Fournier et al., 1986), Lyme disease (Carmel and Edwards, 1989-90), salmonellosis (*Salmonella* sp.) (Robinson, 1981), cryptosporidiosis (*Cryptosporidium parvum*) (Palmer et al., 1998) and toxoplasmosis (*Toxoplasma gondii*) (Humphreys et al., 1995). Brucellosis (*Brucella* sp., Bang's Disease) (Ingebrigtsen et al., 1986), the meningeal parasite worm (*Parelaphostrongylus* sp.) (Kokan et al., 1982), and tuberculosis (*Mycobacterium* sp.) (Schmitt et al., 1997; McCarty and Miller, 1998) may also be transmitted to humans or livestock by deer. Through careful management and prevention, Maryland livestock are currently free of brucellosis and tuberculosis and are certified as such by the United States Department of Agriculture--Animal and Plant Health Inspection Service. However, this status could be jeopardized if these diseases are introduced by deer, which, of course, are not managed for disease prevention. The meningeal worm is currently not known to be in Maryland (Roger Olsen, DVM, State Veterinarian, Maryland Department of Agriculture, pers. comm., July 1999). A particularly dangerous pathogen, *Escherichia coli* 0157:H7, can be spread to humans through consumption of unpasteurized fruits and vegetables which have been contaminated by deer or other animal feces (from Food and Drug Administration Center for Food Safety and Applied Nutrition, Draft Guidance Document Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables. April 13, 1998; Niemi and Niemi, 1991). Whitetail deer may serve as a reservoir for *Ehrlichia*

species which cause diseases that can be transmitted to humans by ticks. Current state laws and regulations do not require that cases of human ehrlichiosis be reported to local health departments in Maryland, but several human cases have been reported recent years in Maryland residents (Beth Karp, DVM, Chief of the Division of Rabies and Vector-borne Diseases, Center for Veterinary Public Health, Epidemiology and Disease Control Program, Community and Public Health Administration, Maryland Department of Health and Mental Hygiene, pers. comm., July, 1999). Potential impact of some of these diseases is discussed more completely in Appendix D.

Vehicle/Deer Collisions. Results from the Deer Task Force Survey indicated that most respondents (79%) in all parts of Howard County had observed deer killed by vehicle-deer collisions, with the highest frequency of observation in western Howard County. These data are provided in Appendix C, Tables 17 and 18.

A 1996 telephone survey of various auto body repair shops in Howard County revealed that they had repaired an estimated 259 cars that had been damaged by collisions with deer. Estimated average repair costs ranged from \$400 to \$2,500 with a total repair cost estimate of \$204,700.

The Howard County Police Department's Animal Control Division hires contractors to remove roadside animal carcasses, including deer. In 1997, the Division reported that a total of 306 deer carcasses were picked up on Howard County roads at a cost of \$15,280. In 1998, with a new contract in effect, the cost to county taxpayers to remove 389 deer carcasses increased to \$25,835.

Ecological Damage from Deer Overabundance. For the purpose of this discussion, deer are considered to be overabundant when their numbers cause ecosystem dysfunction (i.e., suppressed forest regrowth, adversely affected water quality, or reduction of species diversity). Whitetail deer overabundance can and does have an adverse impact on both the plants and animals of a region. Circumstantial evidence suggests that deer overabundance reduces the variety and number of plants in an area. An intensive vegetation study conducted during the summer of 1998 at the Middle Patuxent Environmental Area (MPEA) in Howard County has revealed that many areas of the park have large oak (*Quercus* spp.) and hickory (*Carya* spp.) trees, but either do not have small shrubs and herbaceous plants or have only spicebush

(*Lindera benzoin*) as an understory. Spicebush is a plant species that is not favored by deer. In forest areas with large oak and hickory trees, there is normally thick growth of small plants, much of which consists of small oaks and hickories. When areas become overpopulated with deer, the deer eat the majority of the palatable small vegetation (which they can reach) and acorns and nuts, thus suppressing forest regrowth. The MPEA currently has a whitetail deer density of 106 deer/mi², as determined by using forward looking infra-red survey (FLIR) in March 1998. This density appears to be sufficient to change the type and number of plants at the MPEA.

Scientific studies from other areas using deer exclosures also indicate that deer overabundance negatively affects vegetation. A seven-year study was conducted in central Massachusetts to determine the effect of excluding deer from an area. The exclusion of deer led to an increase in the density of oak seedlings in the exclosed areas compared to areas in which deer were not excluded (Healy 1997). Examination of vegetation in forest areas of high (more than 16 deer/mi²) and low (0-15 deer/mi²) deer densities revealed that at high densities deer prevent certain plant species from becoming established. This greatly reduced the amount of small vegetation. In areas of low deer densities, small vegetation was abundant and diverse (Tilghman, 1989; Healy, 1997). The lack of a balanced forest ecosystem with several layers of varied plant growth can lead to declines in plant and animal species (vertebrate and invertebrate) abundance and diversity (deCalesta, 1994, M Closkey and Lajoie, 1975). Reduced forest vegetation can lead to increased water runoff during storms and cause a reduction in surface water quality.

A FLIR survey conducted in March, 1998, at nine Howard County Parks revealed deer densities of 47-118 deer/mi². Research data (Healy, 1997; Tilghman, 1989) indicate that even at a density of 47 deer/mi², deer are likely to reduce the small vegetation to the point where adverse effects on plant number and diversity, wildlife, and water quality are seen.

DEER MANAGEMENT OPTIONS

Introduction. Along with considering the ways in which deer and humans interact, the Task Force investigated various approaches to managing the deer herd and the damage caused by an abundance of deer. The Task Force was presented with information, through presentations by experts and/or written reports, on different possible methods for curbing the negative impacts of high deer pressure in the County. These methods fall into two basic categories: Methods of controlling deer behavior (fencing, repellents, headlight reflectors and supplemental feeding) and methods of controlling deer populations (contraceptives, regulated hunting, reintroduction of predators, sharpshooters and trapping and transporting). These options and the option of no action were presented to Howard County landowners in the Deer Survey. These options are briefly summarized below and are detailed in the following text. All presentations list the options alphabetically.

- 1) Contraceptives - for controlling reproduction and, ultimately, herd size.
- 2) Fencing - as a physical barrier to prevent deer access to crops, landscaping and home vegetable gardens.
- 3) Headlight Reflectors - a device which can be installed along roadways where vehicle-deer collisions are common. The reflectors apparently deter animals from crossing roadways when traffic is present at night, when most collisions occur.
- 4) No Action - allowing current trends to continue unchanged.
- 5) Regulated Hunting/Modification of Legal Harvest - working within existing state-run programs for hunting by regular licensed hunters. This method includes special managed hunts, Deer Management Permits (often called "crop damage permits"), and adjusting the typical bow, muzzle loader and firearms regulations for hunting on public and private lands.
- 6) Re-introduce Predators - large predators such as timber wolves and mountain lions as a natural means of controlling herd size.
- 7) Repellents - the application of different chemicals which deter deer from feeding on treated vegetation.

8) Sharpshooters - contracting with specially qualified sharpshooters to kill deer. With special permits, this might be done outside of normal hunting regulations regarding seasons, bag limits and weapon types, possibly over bait stations at night, using silencers to reduce noise.

9) Supplemental Feeding - Providing extra food for the purpose of reducing environmental and/or crop damage, or to draw deer away from specific sites where such damage, or other negative impacts may occur.

10) Trapping and Transporting deer from areas where deer-human conflict levels are too high. This method requires a location to which the deer may be moved, and wherein they will be both capable of surviving and compatible with resident deer and human land uses.

In Table 3, a matrix is presented of the management methods investigated, their length of effect, benefits and potential problems.

Table 3. A comparative matrix of deer management alternatives.

Alternate	Likely Result	Relative Cost	Time Frame for Results	Area of Coverage	Comments
Contraception	Controls population growth	Costly per animal with current technology	Long term	Confined or semi-isolated areas only	Still an advancing experimental technology
Fencing	Controls damage in small areas	Varying costs of installation and maintenance	Immediate and long term, if maintained	Specific and localized	Restricts deer access to specific areas.
Headlight reflectors	Reduced vehicle collisions in specific areas	Variable, depending on road length	Immediate, long-term with maintenance	Along roads in high deer populations	Potentially effective against night-time accidents when properly installed and maintained.
No Action	Unknown	Unknown	Unknown	Countywide	Conflicts increase or decrease with herd size and human population growth.
Re-introduce Predators	Unknown	Expensive. May be impossible	Long term, if predator levels maintained	Unknown	Requires Federal and State approval. Low chance of success.

Table 3 Cont. A comparative matrix of deer management alternatives.

Alternate	Likely Result	Relative Cost	Time Frame for Results	Area of Coverage	Comments
Regulated Hunting	Temporarily reduces herd size in specific areas	Variable administrative costs	Immediate and long term, if continued	Countywide on suitable areas	Requires land safe and accessible for hunting.
Repellents	Effective in small areas	Costly in severe cases	Immediate. Longer-term possible with re-treatments	Specific areas	Displaces feeding to untreated areas. Does not eliminate damage. Deer may become accustomed to repellents.
Sharpshooters	Temporarily reduces herd size in specific areas	May be costly	Immediate, long term if continued	Where safe and cost effective	Precedent set in other states. No standards or regulations currently exist in Maryland. Safety and feasibility must be determined.
Supplemental feeding	Concentrate deer in small areas	Variable	Long-term, but may be opposite to desired effect.	Restricted to areas densely populated with deer	Unlikely to see desired results. Can cause problems of spreading disease and ecological damage.
Trap and transfer	Temporarily reduces herd size where trapped	Costly	Immediate, long term if continued	None recommended	High stress and mortality for deer. No place to release trapped deer.

Contraception. Contraception may prove to be a helpful tool in controlling some deer populations. Currently, the Humane Society of the United States (HSUS) is sponsoring a number of deer immunocontraception projects throughout the United States. These are all confined populations where deer can be closely monitored.

As a class, immunocontraceptives work by inducing an immune response that blocks some aspect of reproduction. Porcine zona pellucina (PZP) is the best tested immunocontraceptive to date. PZP is extracted from pig ovaries, being the porcine version of a protein that surrounds the eggs of all mammals. In nature, sperm must lock onto the ZP protein before they can penetrate the egg. Animals (other than pigs) injected with PZP produce antibodies to it. In females, these antibodies latch onto their own ZP proteins, prevent sperm from attaching, and thereby block fertilization.

PZP has several practical advantages. PZP is given in very small amounts (micrograms), and therefore dart-delivery is possible. So far, side effects in deer and horses have been limited to minor reactions at the injection site and (in horses) loss of ovulation after multiple years of treatment. There are no indications that the vaccine interferes with ongoing pregnancies. Unlike synthetic steroids, proteins are destroyed during digestion, thus easing concerns for animals or people that eat PZP-treated animals. This characteristic of PZP makes an oral PZP vaccine unattainable at this time.

One disadvantage with the current vaccine is the need for two initial injections and annual boosters to maintain contraception. Also, individual animals seem to vary in their response to immunocontraceptive treatment, and a few don't respond at all.

Based on the initial successes of PZP research conducted at Fire Island National Seashore (FINS) in New York, the National Park Service has tentatively agreed to allow the study to continue for an additional 5 years with the goal of improving and evaluating the effectiveness of PZP as a management tool. At FINS, a group of volunteers identified and monitored individual deer. Subsequently hundreds of deer have been individually identified by their face and body markings. In 1993, 73 does were treated with PZP via darts delivered at short range with blowguns. By 1997, over 200 deer were being treated. Repeated treatments and improvements in delivery techniques have further lowered fawning

rates, which range from 6 to 21 percent in animals that have been treated for at least two years (Rutberg, 1998).

Before immunocontraceptives could be adopted for deer population management, regulatory concerns about the vaccine must be addressed and field techniques for efficient and cost-effective field delivery must be refined. The quality of the vaccine must also be improved to enhance response. If these issues are addressed, the PZP vaccine may have the potential to help control deer populations in self-contained urban and suburban situations, where repeated treatments can be given to individually identified deer. These are also situations where other management techniques (particularly lethal methods) may not be safe or may be perceived to be risky. Immunocontraception is a rapidly advancing technology that requires additional research.

Fencing. Another alternative for protecting property from deer is fencing. Several types of fencing are available, including chain link fence, wooden fence, electric fence, and mesh netting. Both material costs and labor during the initial installation can be substantial, perhaps prohibitive, especially when large areas are being enclosed. Periodic monitoring and fence repair also are necessary. To serve as a physical barrier, fences should be at least eight feet high to prevent deer from jumping them. It should be noted that zoning regulations require property owners to obtain a permit for a fence higher than 6 feet. Other zoning regulations may also apply. In some cases a three-foot electric fence baited with an attractive substance will be a successful deterrent to deer. The deer, attracted to the bait, will touch the fence with its nose, and the ensuing shock discourages the animal from venturing further forward. Despite installation and maintenance costs, the 95 to 100 percent success rate of properly constructed fences could make this a practical option when keeping deer away from a property is imperative. However, fencing does not alleviate problems of wide-scale deer effects on plant and animal communities, because it is too expensive to install on many agricultural and publicly-owned lands.

Headlight Reflectors. The headlight reflectors are a wild animal highway warning reflector system. The system is designed so that headlights from passing vehicles strike rows of reflectors along each side of the highway, with each reflector in turn directing reflected light across the road. Entering light is reflected at approximately 90 degrees into the roadsides and is not seen by motorists. When properly installed, the reflector should provide

complete reflective light cover for almost any roadside condition. The system works on the principle that the reflected light can act as a deterrent to wildlife attempting to cross the road at night as vehicles approach. The reflector systems have been installed in areas where deer have been known to frequently cross the highway. Observations from a number of locations in the United States have shown the reflector systems reduce vehicle-deer collisions at night. However, one study indicated that deer may become habituated to these devices, and this would limit their efficacy over time (Ujvári et al. 1998). However, the manufacturer of one type of headlight reflectors disputes this (John Strieter, 1999, pers. comm.). Deer also may learn to cross roads at the ends of the lines of reflectors to avoid the reflected light, although new installation methods appear to alleviate this problem. Table 4 summarizes observations from other areas.

The average cost to purchase and install this reflector system is about \$7,500 per mile. Based on testimonials and experience elsewhere, Howard County Department of Recreation and Parks is exploring the use of these headlight reflector systems in selected areas of Howard County in the coming year (John Byrd, 1999, pers. comm.).

Table 4. Headlight reflector observations from several locations in the United States.

Location	Accident Rate Reduction, Percent	Number of Years Tested
Iowa, Waukon (Hoilien, 1995)	98	7
Maryland, Harford Co., Rts. 24 & 23 (Malkowski, 1996)	38	2
Michigan, Marshall (Randolph, 1997)	100	11 months
Minnesota (Pafko and Kovach, 1996; Ingebrigtsen and Ludwig, 1986) Rt. I-94 Rts. 27,64 &69 Sable State Park Zumbro Lake	91 100 60 84	4 1 3 2
Wisconsin (Hessel, 1994) Fond du Lac Sturgeon Bay Algoma Highway 26 (Ft. Atkinson by-pass) (Roethe, 1998)	88 100 90 100	5 2 3 1.5
Washington (Schafer and Carr, 1985)	90	10

No Action. The no action option means that deer populations would fluctuate in response to environmental conditions, predators, and birth and death rates and that management options such as hunting would not be implemented. Deer evolved in North America under intense predation and hunting pressure. Colonization and urban development has resulted in displacement of large predators, such as wolves, mountain lions, bobcats, bears and our Native American populations. This translates to lower mortality rates of deer now than during precolonial times. Based on past research in other areas, it is likely that deer populations in Howard County would continue to increase in size if no action was taken. This could possibly result in increased human-deer conflicts. In the Howard County Deer Survey, this option was rated as one of the least acceptable, with an average acceptability score of 1.44 (Appendix C, Table 22). Only the reintroduction of predators was considered less acceptable.

Regulated Hunting. Regulated hunting has long been relied upon as the primary tool for regional deer population management. Through the use of regulated hunting, wildlife biologists work toward maintaining deer populations at desirable levels. Population levels are adjusted in accordance with local biological or social needs. Deer populations can be manipulated through hunting season length, bag limits, type of hunting weapon allowed, time of season and issuance of special permits.

The harvesting of female deer is critical to population control. Removing sufficient female deer from the population through regulated hunting would affect population levels. This would minimize adverse effects of high deer populations. On select public lands the taking of antlered deer has been restricted in order to increase the take of antlerless deer. Specific information about deer hunting seasons and bag limits in Maryland is outlined in the *Guide to Hunting and Trapping in Maryland*. This guide is published annually by the Maryland Wildlife and Heritage Division.

There are locations, such as residential communities, where regulated hunting may not be an acceptable management option. Concern over regulated hunting at these sites can include real or perceived safety interests, conflicting social attitudes and perceptions about wildlife, weapons ordinance zones, liability or public relations issues. If regulated hunting is to be implemented as a management option in these locales, it will

require the support of local communities, government and municipalities and also be tightly controlled to insure safety.

Modifying legal harvest by special permits allows for the taking of deer outside of the regulated hunting season and in greater numbers. Implementing a change requires the authorization of the Maryland Department of Natural Resources, Wildlife and Heritage Division. Modification of legal harvest has occurred on both private lands (largely agricultural) and lands administered by state or county governments.

Reintroduction of Predators. Reintroduction of predators has been discussed but never implemented in Maryland as a means to control increasing deer populations. Predators such as wolves and mountain lions are efficient deer predators, but they were eliminated from Maryland's landscape hundreds of years ago. There have been reported sightings in Maryland of smaller predators such as coyote and bobcat. However, these species are not known to be able to consistently control deer populations. The occurrence of these two species is questionable or, at best, limited in Howard County.

The idea of reintroducing predators such as wolves and mountain lions into Howard County is problematic simply because Howard County is too densely populated by humans to provide suitable habitats for these species. Not only would such predators require large undisturbed tracts of land unaffected by humans, but the agricultural community would likely express concern over the potential loss of livestock to reintroduced predators. Human safety concerns in both suburban and rural areas would also be an issue.

Even though this management approach is frequently suggested as an option, Howard County is not a suitable location for the reintroduction of predators. The deer survey respondents also gave this option a low acceptability rating, with only 4 percent of the responses as most acceptable and with 44 percent responses as not acceptable.

Repellents. Repellents are intended to deter deer from feeding on certain plants. They will reduce, but not eliminate browsing, and they do not prevent vegetation damage caused by rubbing. Both the cost and success of repellents vary considerably, depending on the type of repellents used, environmental conditions (rain and snow) and deer density. Generally, much of the success of

repellents is derived from the deer's natural fear of anything new. By rotating repellents frequently, deer will not become accustomed to a single taste or smell. However, all repellents tend to wear off quickly and require frequent re-application. If repellents are to be considered as an option, they should be used as one component of an overall strategy to control deer damage.

Repellents have been found to be most cost effective when there is light to moderate deer pressure, when only a small area needs to be protected from deer browsing, and when no more than 2 to 3 applications are required. Repellents are least effective when deer densities are high. Like fencing, repellents do not address concerns relating to wide-scale deer impacts on plant and animal communities.

As an alternative to repellents, homeowners may also consider using landscape plants that are naturally less attractive to deer. However, in areas of high deer densities, even these less attractive plants may be browsed.

Sharpshooters. Traditionally, regulated hunting has been the preferred approach for the management of deer populations. However, there are an increasing number of sites inaccessible to sportsmen where deer herds have become abundant. Sharpshooting has been used in several locations with considerable success and has been demonstrated to be an effective and efficient nontraditional management tool (Peck and Stahl, 1997; Frost et al., 1997). Typically, sharpshooting involves hiring expert marksmen to shoot deer over bait, often from a tree stand at night or from a vehicle using the aid of a spotlight after dark (DeNicola et al., 1997). Using qualified sharpshooters may alleviate public safety concerns in suburban areas.

The exact procedure followed by the sharpshooters can be modified to minimize risk to surrounding areas. Near Chicago, an earthen backstop for bullets was constructed behind the baited areas. In Gettysburg Battlefield, its open character and road layout made spotlighting deer at night from a vehicle feasible and safe.

A study examining deer reduction by sharpshooters in the Chicago Metropolitan area revealed an average cost of \$72 per deer (1991 Progress report). In Gettysburg the cost of sharpshooters was \$88 per deer (Frost et al., 1997). Use of sharpshooters over controlled hunting, where controlled hunting is viable, could result in a loss of income to the local economy from hunters. In

Connecticut, for example, deer hunters contribute approximately \$600 per deer harvested into the state economy (Ellingwood and Caturano, 1996).

Supplemental Feeding. The purpose of supplemental feeding option is to provide food to draw deer away from specific sites where negative impacts may occur from deer feeding on crops or ornamental plantings. Supplemental feeding programs are likely to create some undesired results because they tend to encourage population increase in the local area (Dasmann, 1971). This could exacerbate the browsing and feeding problems on desired plants. Doenier et al. (1997) found that supplemental winter feeding caused localized increases in browse damage because deer were concentrated around the feeding stations. The amount of natural browsing was not reduced by the supplemental feeding. Increased competition and dehydration are possible negative impacts of supplemental feeding.

Supplemental feeding programs can be costly. Costs per deer were \$37 to \$53 per deer in Michigan and Colorado, respectively (Baker and Hobbs, 1985, Ozoga and Verme, 1982). Concentrating deer in and around supplemental feeding sites could encourage the spread of diseases and parasites (including deer ticks) and increase the chance of predation by domestic dogs.

Trap and Transfer. Trap and transfer as a deer management option appeals to many people because it sounds benign and humane. In fact, this option had the third highest acceptability rating among the management options proposed in the Howard County Deer Survey. Unfortunately, this option is very labor-intensive and costly, and the end results are often less than humane. Research conducted in California, Wisconsin and New Hampshire showed that capture costs ranged from just over \$400 up to \$800 per deer (Ellingwood and Caturano, 1996).

The second aspect of this method, the transfer, also poses difficulty. Given the overall increase in deer populations on the East coast, it is uncertain if there are any acceptable areas into which the transfers could be made without disrupting the receiving habitats. Other concerns about the translocated deer include potential disease transfers and possible land use conflict which may raise issues of liability.

The process of trapping, handling, transporting, and re-establishing the deer can be fatal to many deer. Approximately 4

percent of animals die because of trauma during the trap and transfer process itself. A delayed mortality caused by stress-related factors known as capture myopathy has been reported to be as high as 26 percent with transferred deer. Survival rates for transferred deer in their new location have also been reported to be low. After a period of four to fifteen months, trap and transfer projects in New Mexico, Florida and California reported losses of 55, 58 and 85 percent, respectively, of animals transferred (Ellingwood and Caturano, 1996).

Capturing and transferring free-ranging deer herds from Howard County would require many large live traps or nets or some type of immobilization efforts. Transportation for a large number of deer and finding a suitable receiving site would be difficult. Given this, it is best to consider this option impractical. There may be some very limited isolated situations in which this option may prove useful, but trap and transfer will not meet the needs of a county-wide program.

SUMMARY OF FACT FINDING

In the course of its investigations, the Task Force heard reports, received documents and questioned numerous experts and authorities regarding different areas of concern. Summaries of these explorations are provided below.

Deer Management Permits. Deer Management Permits may be issued by the Maryland Wildlife and Heritage Division to landowners or their agricultural lessees who have sustained damage and economic loss to commercial agricultural crops, orchard, nursery stock or woodland areas that have a forest management plan. A Deer Management Permit allows a landowner to kill a specified number of deer outside of the regulated deer hunting season.

Cooperative Wildlife Management Area Program. The Maryland Department of Natural Resources (DNR) has a program that allows private and local government land owners to open their land to regulated or managed hunting. A contract detailing the arrangement between the two parties is signed. The contracts are usually for a duration of one to five years. Signs are placed along the property boundaries naming the area as a managed hunt site. Safety zones and parking areas are also marked with signs by DNR staff. DNR determines the number of hunters that can hunt in the area on a daily basis. The landowner decides what days the property will be open to hunting and what game will be hunted. The Cooperative Wildlife Management Area Program managed hunt program has been successful at reducing deer populations in Maryland's metro counties in the last 25 years. The managed deer hunts of the past 6 years have been successful at partially reducing deer populations in Howard County parks. Population reductions for 1989 to 1998, as measured by number of deer harvested during all Maryland hunts, are shown in Appendix E.

Hunter Safety. The goal of Maryland's Hunter Education Program (coordinated by Maryland DNR) is to graduate a responsible, knowledgeable and safe hunter. Over the past five years over 40,000 individuals have completed the course. Maryland law requires all new hunters to be trained in hunter education and safety. Graduates of the Hunter Education Course receive a Certificate of Competency in Firearms and Hunter Safety from Maryland DNR. To purchase a hunting license in Maryland, law requires:

1) Presentation of a Certificate of Competency in Firearms and Hunter Safety or

2) Certification that you held a hunting license prior to July 1, 1977 or

3) Certification that you hunted on private property prior to July 1, 1977 and were legally exempt from purchasing a hunting license or

4) Certification that you are purchasing a nonresident license and will only hunt waterfowl.

According to the Maryland Department of Natural Resources, from 1986 to 1998, there was a total of 381 hunting accidents in Maryland. Of these, 3 were in Howard County.

Enforcement. The Maryland Department of Natural Resources has promulgated laws and regulations to manage our deer resource. Enforcement of these laws and regulations is an important component to achieve the objective of managing Maryland's deer resource for the citizens of the state.

The Maryland Department of Natural Resources, Natural Resources Police are responsible for enforcing laws and regulations pertaining to hunting and the taking and possession of deer. They assure that hunters do not exceed the established deer bag limits, weapon use restrictions, safety zones or trespass laws. These law enforcement officers also investigate the illegal spotlighting of deer and illegal sale and transport of venison or other deer parts. Since the Natural Resources Police are few in number, game law compliance depends largely on public attitudes.

Managed Hunting in State Parks. The Department of Natural Resources State Forest and Park Service conducts managed deer hunting programs on certain state parks and natural resource management areas throughout the state. The objective of these managed deer hunts is to manage the whitetail deer population and reduce habitat damage. Public hunting as controlled only by state-wide regulations has been permitted for many years in the Patuxent Valley State Park. The results of this management can be seen in the survey results, with 25 percent of respondents adjacent to this park reporting daily deer sightings, while as many as 64 percent of respondents adjacent to the Patapsco State Park reported daily deer sightings. Patapsco State Park has only recently begun a managed hunting program.

Before a special, or controlled, managed deer hunt is conducted in a state park, the State Forest and Park Service conducts public information meetings, holds lotteries to select a limited number of hunters, selects hunters demonstrating proficiency with the weapon to be used, and provides security at the state park during the actual hunts. The Park Service is trying to achieve a balance between resource management, recreational opportunities and safety. Participating hunters are allowed to harvest a specific number of antlerless deer, which originally did not count toward the regular statewide bag limit. However, expanded regional bag limits now allow managers to conduct these hunts in conformance with the standard limits, although the harvest continues to be limited to antlerless deer.

Lyme Disease. Lyme Disease in humans is potentially a very dangerous, often debilitating affliction, especially if not properly diagnosed and treated in its early stages. It is an infectious, normally non-contagious disease caused by the spirochete *Borrelia burgdorferi*. It is transmitted to humans and animals by the black-legged tick, *Ixodes scapularis*, also known as the deer tick. An infection can be transmitted to humans or other mammals any time that an infected black-legged (deer) tick takes a blood meal.

Reports of Lyme Disease are becoming increasingly frequent in the Northeastern region of the United States. First recognized in 1975 as an important people disease in the U.S., Lyme Disease has a high rate of occurrence from Massachusetts to Maryland. According to a recent survey, 185 cases were reported in Maryland in 1992. By 1997, 494 cases had been reported, and 1998 estimates were for 653 cases (CDC, 1999b). This translates to a rate per 100,000 people of 3.9 in 1992, 9.8 in 1997, and 13.0 in 1998. According to the Federal Center for Disease Control and Prevention (CDC) in Atlanta, 15,934 new cases were reported nationwide in 1998 (provisional data). In 1997, 12,801 new cases were reported and in 1996, 16,455 cases were reported (CDC, 1999a). The true number of Lyme cases are estimated to be 10 times the number meeting the narrow CDC criteria (Wendy Feaga, DVM, practicing Howard County veterinarian, pers. comm.).

The adult tick that carries Lyme disease depends upon the whitetail deer as one of its two primary maintenance hosts. Higher populations of deer may lead to an increased incidence of Lyme disease in animals, including pets, and humans. Magnarelli et al. (1985) found Lyme disease to be more common in forested,

urban settings and rural areas that were inhabited by ticks, rodents, birds and large mammals. Daniels et al. (1993) found that exclusion of deer from certain areas reduced the number of deer ticks in these areas. This suggests that this method or methods of deer population control could limit deer ticks and thus Lyme disease.

In humans, the effects of Lyme disease range from hidden to overt and from acute to chronic. One characteristic early symptom is a red rash at the site of the tick bite. This rash may clear in the center, giving a bull s eye appearance. Other early symptoms of the disease may include fatigue, chills and fever, headache, muscle and joint pain and swollen lymph nodes. Late symptoms may or may not include arthritis, especially of the knees; nervous system abnormalities, such as numbness; pain; Bell s palsy; and meningitis. Frequently, irregular heart rhythm may occur. The development of antibodies following natural exposure does not appear to provide immunity to future infection. A vaccine, requiring three injections over more than a year, has recently been developed and is just now available to the public with a prescription. Because the vaccine does not give complete protection and because not all people will be willing or able to take the vaccine, prevention of tick bites remains a necessary defense against Lyme disease.

Clearing brush, leaves and tall grass from around homes and gardens may help to reduce the number of ticks in areas that people frequent. Routine use of tick repellents would also be useful. Because whitetail deer serve as a maintenance host for the black-legged (deer) tick, reducing and controlling whitetail deer populations may help to reduce black-legged (deer) tick populations. This would in turn reduce the opportunities for Lyme disease to be transmitted to humans and domestic mammals. Overall population control, using methods described above, may help achieve this. Also, where possible, removing plants attractive to deer or constructing barriers will prevent deer from approaching close to homes and other areas frequented by people.

People can also take some additional action to prevent tick bites and, possibly, Lyme disease. Wearing long-sleeve shirts with tight cuffs and long pants tucked into socks will reduce the likelihood that ticks can find a place to feed. After being outside, people can check their hair and skin for ticks and remove them before they start feeding. Wearing light-colored clothing makes it easier to find the dark-colored ticks. For a

further discussion of Lyme disease in humans, please consult the Maryland Department of Health and Mental Hygiene website at <http://edcp.org/html/lyme.html>.

Effect of Deer on Forest Ecosystems. Currently, there are no hard data on the ecological effects of deer in Howard County, nor any quantitative data on herd size or density. However, Montgomery County's Maryland-National Capitol Park and Planning Commission (MNCPPC) has measured changes in the forest ecosystem caused by high deer density (Gibbs, pers. comm.). Although this work was not designed to be a fully rigorous study, results do reveal local feeding preferences and changes in balance of species and structural composition of the forest. Because of the similarity of the forest types and the geographical proximity of the counties, results derived from Montgomery County may be considered indicative of changes likely occurring in Howard County.

During the course of the research, plant canopy cover, undergrowth density, and the number, species, and height of seedlings were measured inside and outside of a 20 x 20 meter (approximately 484 square yard) fenced enclosure at MNCPPC. In the study areas where deer were free to browse, there were no seedlings in the 20-150 cm (8-60") size range. There was a shift in species composition towards those species which deer tend not to eat, specifically spicebush and pawpaw. These species had become the most common small plants and bushes. Deer had stripped bark off of trees in some locations, indicating a scarcity of food for the animals. Trees suffering this bark removal will not survive. Some Montgomery County parks now lack ground and shrub-level plants, and the fate of threatened and endangered species has become a serious concern. Wild azaleas are disappearing from several parks, and browsing has stressed many woody plants by repeatedly removing buds and tender new growth.

There is an increasing amount of literature reporting on the ecological impact of large deer herds on forest ecosystems. The Wildlife Society Bulletin, Volume 25, Number 2 (Summer 1997) devoted nearly 600 pages to the subject of deer overabundance. These reports detailed how whitetail deer negatively affect forest regeneration, biodiversity and a variety of plants and animals which are dependent on the forest habitats within which deer are proliferating. Some of these impacts, such as the suppression of tree regeneration, may have impacts which will last for decades.

Landowner Liability. Many property owners have concerns and questions about their liability if they permit the general public to use their land for recreational pursuits such as hiking, nature study, camping, fishing and hunting. Misconceptions and uncertainty about Maryland laws relating to recreational use of private land has led to many acres being closed to the public. All landowners considering recreational use of their property should seek a knowledgeable and competent source to review their situation. However, some insight into the issue of landowner liability can be provided in the discussion below, derived from Cooperative Extension Service Bulletin 357, Recreational Access and Landowner Liability in Maryland, by Jonathan S. Kays.

Landowner liability in these cases is governed by Maryland's Recreational Statute a subtitle to the Natural Resources Article of the Maryland Annotated Code. The purpose of the statute is to encourage any owner of land to make that land and water available to the public for recreational purposes "by limiting the owner's liability toward any person who enters on land, water, and airspace above the land and water areas for these purposes." This statute was first enacted in 1957 and has been amended and refined several times in intervening years. In an effort to improve public access to private land for recreation, the scope of landowner liability has been narrowed in recent years.

The major factor defining or limiting a landowner's liability is the status of the visitor on the property. The degree of owner liability is often referred to as the duty of care. Visitors to the property fall into the following categories:

%I A *trespasser* is a person who enters or remains on another's property without the permission of the landowner. Generally, a landowner owes little or no duty to a trespasser. For example, a landowner has no duty to seek out, discover, or correct unsafe conditions. However, in Maryland, the landowner is liable for malicious or willful injury to the trespasser.

%I There are two classes of visitor that enter the owner's property with permission; however, common law has not been quite as precise on the duty of care owed these visitors. A *licensee* is a person who has received the owner's permission to be on the land to further his or her own purposes, with no particular benefit for the owner. The owner generally has a duty to warn of, but not correct hazards. The owner usually has no duty to inspect the premises for dangerous conditions or activities but, should

he or she know of any, has an obligation to correct them or inform the licensee.

%I An *invitee* or business visitor is highest on the scale of visitors. This is a person specifically invited to enter the property for the benefit of the owner. People who pay a fee to use the property, such as hunting clubs, are invitees. People who visit a commercial enterprise, such as a marina, bed and breakfast, or pick-your-own operation are also invitees. The owner generally has a duty to seek out, discover, correct, and prevent dangerous conditions or activities, and to warn the invitee of those that cannot be corrected.

After defining the broad range of recreational purposes and educational activities covered by the recreational statute, the Annotated Code of Maryland, Natural Resources Article, Title 5-1104, clarifies the liability of the landowner who permits recreational use of land without charge:

"The owner of land who directly or indirectly invites, or permits without charge, persons to use the property for any recreational or educational purpose or to cut firewood for personal use does not by this action:

- 1) extend any assurance that the premises are safe for any purpose;
- 2) confer upon the person the legal status of an invitee or licensee to whom a duty of care is owed; or
- 3) assume responsibility for or incur liability as a result of any injury to the person or property caused by an act of omission of the person or persons."

The Annotated Code of Maryland, Natural Resources Article, Title 5-1103, addresses the issue of how safe the premisses are to be kept for recreational use as follows:

"An owner of land owes no duty to keep the premises safe for entry to use by others for any recreational or educational purpose, or to give any warning of a dangerous condition, use, structure, or activity on the premises to any person who enters on the land for these purposes."

Thus, the landowner is protected from liability as long as due, reasonable care is taken in the maintenance of the property and there is no fee charged to the users for their recreational pursuit on the land.

While the statutes provide good liability protection for landowners, this protection is not absolute. The Annotated Code of Maryland, Natural Resources Article, Title 5-1106, states the limit of liability of the landowner:

"The provisions of this subtitle do not limit in any way any liability which otherwise exists for *willful or malicious failure* to guard or warn against a dangerous condition, use structure, or activity; or for injury suffered where the owner of the land charges the person who enters or goes on the land for recreational educational use. However, if land is leased to the State or any of its political subdivisions, any consideration the owner receives for the lease is not a charge within the meaning of this section."

As the interest in controlling deer populations increases, more pressure may be focused on the owners of large parcels of Howard County land to allow the public to hunt. The relevant landowner liability statutes indicated that the state encourages the cooperation of these landowners and has attempted to reduce and limit any liability they may expose themselves to by cooperating. This discussion should not be considered a substitute for consultation with an attorney and/or insurance agent as it relates to a specific landowner's situation.

HOWARD COUNTY DEER TASK FORCE RECOMMENDATIONS

Based on the citizen responses to the Howard County Deer Survey, residents indicated that whitetail deer are important and add to the quality of life in Howard County. However, residents also indicated that whitetail deer in Howard County need to be managed at acceptable population levels. The Howard County Deer Task Force recommends the following action to be initiated by the Howard County Council.

Formation of a Work Group to implement a comprehensive deer management program for Howard County.

The Maryland Department of Natural Resources (DNR) has the legal authority and responsibility for conservation and management of all the state's wildlife resources, including whitetail deer. By combining the skills and expertise of a variety of professionals with a stake in deer management within Howard county, a balanced and comprehensive program will result. The Howard County Deer Task Force recommends the Howard County Executive and Howard County Council request the Maryland Department of Natural Resources (DNR) to work cooperatively with designated Howard County agencies, other appropriate government entities, and citizens appointed by the County to develop a comprehensive deer management program. The core work group might include members from the Department of Natural Resources, Howard County Recreation and Parks, Maryland Cooperative Extension, and the Howard County Police Department. The management program should identify specific priorities for the county which have been outlined within the Howard County Deer Task Force Report and the Maryland DNR Deer Management Plan. A memorandum of understanding should be drafted that identifies the purpose of the group and key responsibilities of each partner. This Work Group would draw upon outside expertise and resources as needed.

The Work Group should take a community-based approach to selecting and implementing deer management options. Recognizing that community needs and options are likely to vary it is recommended that Howard County government establish a single point of contact for citizen concerns.

The following Task Force recommendations should be addressed and implemented within the comprehensive deer management program for Howard County:

1.) Develop and implement a public education program about deer biology, deer management, recreational opportunities and the impacts of the deer population on Howard County landscapes and citizens.

Suggested actions include:

-develop brochures and information fact sheets on deer biology and management.

-enlist Howard County cable to televise educational video programs on deer.

-prepare and distribute news releases on timely deer management topics.

-use public service announcements through local media to increase understanding of deer management issues.

2.) Work with individual landowners and local communities in developing effective deer management strategies on private lands, including farms and forest holdings.

* Meet with local community home owner associations and agricultural, woodland owner operators to determine desired deer population levels and facilitate the activation of effective deer management programs.

* Provide technical information to landowners, homeowners, agricultural and woodland owner operators in cooperation with Maryland Cooperative Extension and other partners to educate citizens about deer management in rural and suburban habitats.

* Work with the Department of Natural Resources to explore changes to existing hunting regulations that pertain to deer on private lands in Howard County.

Suggested actions include:

-modifications to the deer bag limits to more effectively manage the antlerless deer population.

-adjust the length of the regulated firearm season. (November is the month when maximum deer management can be most effective.)

*Address risk management issues and hunter access on private lands.

Suggested actions include:

- educate private landowners about the legalities and associated strategies of permitting hunting on their lands.

- recommend improvements to the Department of Natural Resources Hunter Education Program that enhances hunter ethics, safety and allows for optional higher levels of advanced hunter training and certification than is now available.

- *Work with the Department of Natural Resources to improve and streamline the process for obtaining and implementing the goals of Deer Management Permits.

Suggested actions include:

- maximize the time period during the year for landowners to take deer causing damage.

- streamline the application and issuance procedure for obtaining Deer Management Permits.

- modify current weapons restrictions to improve the efficiency of removing deer causing damage.

- establish or identify a compensation fund to pay for the processing of deer donated to food banks taken under the authority of Deer Damage Permits.

- *Work with Maryland Cooperative Extension to develop an improved mechanism to monitor financial losses caused by deer to residential landscapes and agricultural, woodland operations in Howard County.

Suggested actions include:

- explore potential options for government financial compensation to agricultural, woodland and commercial nursery operations for deer related crop losses.

- *Identify, evaluate and test new methods for non-lethal deer management techniques.

Suggested actions include:

- investigate new fencing and repellent technologies that control deer behavior.

-monitor and evaluate the research and explore the practical application of deer fertility control in managing Howard County deer populations.

3.) Manage deer populations at acceptable levels on public lands in Howard County.

*Continue to promote deer herd reduction as a primary management tool to control deer populations on state and county lands.

* Promote public access on state and county lands for the purpose of regulated hunting or other deer herd reduction techniques.

* Consult with local communities to determine desired deer population levels on state and county lands.

* Monitor changes to vegetation and other ecological indicators impacted by deer populations on state and county lands.

Suggested actions include:

-conduct studies of deer overabundance on state and county lands which could include placement of deer exclosures and conduct browse surveys.

-continue aerial Forward Looking Infra Red (FLIR) surveys to measure changes in deer population density trends on state and county lands.

*Integrate traditional deer management approaches with new deer management techniques.

Suggested actions include:

-identify and integrate the use of new, developing or potential non-traditional deer management techniques to supplement traditional options to manage deer populations on state and county lands.

4.) Address human safety and health considerations in Howard County.

* Reduction of vehicle- deer collisions across Howard County.

Suggested actions include:

-educate the public on defensive driving techniques to avoid collisions with deer.

-improve the system of record keeping of vehicle-deer collisions in Howard County by the state/county agencies charged with this responsibility.

- work with state and county highway transportation authorities to install appropriate signage and determine feasibility of installing highway warning reflector systems to reduce vehicle - deer collisions on Howard County roads.

*Increase public awareness of Lyme Disease in Howard County.

Suggested actions include:

-work with Howard County Health Department to develop public education program about Lyme disease and its prevention.

-encourage Howard County Health Department to explore the possibility of providing a Lyme disease vaccine in their inoculation program.

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APPENDIX C

Survey Results

Table 1. Frequency of deer observation at different intervals. Landowner responses to Deer Task Force Survey Question 1: How often do you see deer in Howard County? Percent respondents choosing each option, by land use.

<u>Frequency</u>	<u>Agricultural</u>	<u>Residential</u>	<u>Combined</u>
	-----percent-----		
Never	0	11	11
Weekly	13	46	45
Monthly	37	24	24
Daily	46	10	11

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 2. Number of deer seen per day and percent respondents seeing deer daily. Landowner responses to Deer Task Force Survey Question 1: How often do you see deer in Howard County? Presented by geographic stratum, ordered from highest to lowest.

<u>Stratum#</u>	<u>Stratum Location</u>	<u>Average # deer per day</u>	<u>% Seeing deer daily</u>
21	NW adj. Patapsco SP	4.2	64
61N	NE Patapsco SP	3.7	45
61S	SE Patapsco SP	2.4	46
81	Central adj. Patapsco SP	2.3	42
42O	MPEA (East Clarksville ZIP)	2.0	38
20	Northwest	1.9	39
13	W adj. Patapsco SP	1.6	25
40	South Central	1.4	25
70	Central Suburban	1.4	22
10	Western	1.3	23
42N	MPEA (West Columbia ZIP)	1.3	27
30	Southwest	1.0	20
92	Columbia near MPEA	0.8	13
60	Eastern	0.5	10
80	Central Rural	0.4	5
50	Southern	0.3	4
90	Columbia away from MPEA	0.2	2

Table 3. Location of deer observed. Landowner responses to Deer Task Force Survey Question 2: Most of these deer were: . . . Percent respondents choosing each option, by land use.

<u>Location</u>	<u>Agricultural</u>	<u>Residential</u>	<u>Combined</u>
	-----percent-----		
Within 2 miles of my property	89	61	61
Seen elsewhere in Howard County	3	27	27
Do not remember location of sightings	0	2	2

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Geographic variation: Relatively little compared to the number and frequencies of deer seen. The greatest number of sightings within 2 miles of home ranging from highs of 100% to 90% for strata near the west side of the MPEA and for various strata near the Patapsco State Park to lows of 44% for residents of Columbia not near the MPEA and 44.3% in the southern area (Laurel).

Table 4. Perceived change in deer populations. Landowner responses to Deer Task Force Survey Question 4: Compared to deer populations five to ten years ago, do your observations indicate that the current population near your home is: . . . Percent respondents choosing each option, by land use.

<u>Change</u>	<u>Agricultural</u>	<u>Residential</u>	<u>Combined</u>
	-----percent-----		
Lower	4	8	8
About the same	21	26	26
Higher	70	40	40
No basis for comparison	4	25	25

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 5. Perceived increases in deer populations. Landowner responses to Deer Task Force Survey Question 4: Compared to deer populations five to ten years ago, do your observations indicate that the current population near your home is: . . . Percent respondents reporting higher populations, by geographic stratum, ordered highest to lowest.

<u>Stratum #</u>	<u>Stratum Location</u>	<u>Percent</u>
61N	NE Patapsco SP	78
42O	MPEA (East Clarksville ZIP)	66
21	NW adj. Patapsco SP	66
81	Central adj. Patapsco SP	64
42N	MPEA (West Columbia ZIP)	64
30	Southwest	61
20	Northwest	60
40	South Central	59
70	Central Suburban	56
10	Western	53
61S	SE Patpasco SP	50
80	Central Rural	49
92	Columbia near MPEA	46
13	W. adj. Patapsco SP	46
90	Columbia away from MPEA	33
60	Eastern	30
50	Southern	29

Table 6. Perceived appropriateness of deer population size. Landowner responses to Deer Task Force Survey Question 5: In your judgement, the current deer population in Howard County is: . . . Percent respondents choosing each option, by land use.

<u>Response</u>	<u>Agricultural</u>	<u>Residential</u>	<u>Combined</u>
	-----percent-----		
Too Low	1	3	3
About Right	20	24	24
Too High	67	42	43*
No Opinion	11	28	27

*This number is equivalent to 61% of those expressing an opinion (43% of the 70% who had an opinion).

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 7. Effect of deer on quality of life. Landowner responses to Deer Task Force Survey Question 6: Does the current population of deer add to the quality of life in Howard County? Percent respondents choosing each option, by land use.

<u>Response</u>	<u>Agricultural</u>	<u>Residential</u>	<u>Combined</u>
	-----percent-----		
Yes	28	33	33
No	39	25	25
Mixed feelings	25	27	27
No opinion	5	14	14

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 8. Effect of deer on quality of life. Landowner responses to Deer Task Force Survey Question 6: Does the current population of deer add to the quality of life in Howard County? Percent respondents choosing yes, by geographic stratum, ordered highest to lowest.

<u>Stratum #</u>	<u>Stratum Location</u>	<u>% Reporting Yes</u>
13	W. adj. Patapsco SP	38
60	Eastern	37
50	Southern	37
10	Western	35
61S	SE Patapsco SP	34
90	Columbia away from MPEA	34
20	Northwest	31
80	Central Rural	30
30	Southwest	30
40	South Central	29
70	Central Suburban	27
21	NW adj. Patapsco SP	24
81	Central adj. Patapsco SP	23
92	Columbia near MPEA	18
420	MPEA (East Clarksville ZIP)	15
61N	NE Patapsco SP	15
42N	MPEA (West Columbia ZIP)	11

Table 9. Occurrence of deer damage to vegetation. Landowner responses to Deer Task Force Survey Question 7: Have you experienced damage to vegetation by deer on your property? Percent respondents choosing each option, by land use.

Response	Agricultural	Residential	Combined
	-----percent-----		
Yes	62	26	26
No	29	67	67
Possibly	8	7	7

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 10. Incidence of deer damage to vegetation. From Deer Task Force Survey Question 7a. Landowners responding yes to Deer Task Force Survey Question 7: Have you experienced damage to vegetation by deer on your property? Presented by geographic stratum.

<u>Stratum #</u>	<u>Stratum Location</u>	<u>Percent Suffering Damage</u>
10	Western	33
13	W. adj. Patapsco SP	41
20	Northwest	56
21	NW adj. Patapsco SP	80
30	Southwest	41
40	South Central	55
42N	MPEA (West Columbia ZIP)	87
42O	MPEA (East Clarksville ZIP)	79
50	Southern	14
60	Eastern	21
61N	NE Patapsco SP	89
61S	SE Patapsco SP	47
70	Central Suburban	51
80	Central Rural	32
81	Central adj. Patapsco SP	83
90	Columbia away from MPEA	10
92	Columbia near MPEA	62

Table 11. Incidence and value of deer damage to vegetation. Landowner responses to Deer Task Force Survey Question 7.a. of type and value of damage to vegetation by deer. Presented by land use.

Vegetation Type	<u>Agricultural</u>		<u>Residential</u>		<u>Combined</u>	
	percent	value*	percent	value*	percent	value*
Vegetable Garden	39	\$60,800	15	\$657,600	15	\$718,400
Shrubs/Flowers	34	\$144,700	23	\$3,030,700	23	\$3,175,300
Agricultural Crops/Orchards	39	\$484,100	2	\$603,000	3	\$1,087,100
Naturally Occurring Vegetation	21	\$4,300	6	\$464,400	6	\$468,600
Total	---	\$693,000	---	\$4,755,700	---	\$,449,400

*These values are extrapolated for the entire agricultural, residential, or combined populations, based on survey responses.

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 12. Extrapolated value of deer damage to vegetation. From Deer Task Force Survey Question 7a. Presented by geographic stratum.

<u>Stratum #</u>	<u>Stratum Location</u>	<u>Vegetation Type</u>			
		<u>Vegetable Gardens</u>	<u>Shrubs/Flowers</u>	<u>Agricultural Crops/Orchards</u>	<u>Naturally Occurring Vegetation</u>
		-----extrapolated value -----			
10	Western	\$36,200	\$95,300	\$164,000	\$59,100
13	W. adj. Patapsco SP	\$3,700	\$12,500	\$118,400	\$100
20	Northwest	\$39,900	\$101,700	\$78,200	\$9,200
21	NW adj. Patapsco SP	\$33,300	\$116,900	\$40,600	\$12,400
30	Southwest	\$25,400	\$221,700	\$208,800	\$7,200
40	South Central	\$86,400	\$380,600	\$189,300	\$52,700
42O	MPEA (East Clarksville ZIP)	\$4,100	\$47,100	\$2,800	\$2,500
42N	MPEA (West Columbia ZIP)	\$5,700	\$90,200	\$0	\$2,700
50	Southern	\$58,000	\$220,000	\$4,600	\$53,600
60	Eastern	\$103,700	\$418,000	\$47,800	\$0
61N	NE Patapsco SP	\$14,300	\$114,800	\$13,500	\$9,900
61S	SE Patapsco SP	\$16,900	\$77,600	\$44,000	\$0
70	Central Suburban	\$82,300	\$394,100	\$154,000	\$239,400
80	Central Rural	\$141,300	\$197,900	\$0	\$11,200
81	Central adj. Patapsco SP	\$23,700	\$311,500	\$14,400	\$8,600
90	Columbia away from MPEA	\$36,100	\$209,500	\$6,400	\$0
92	Columbia near MPEA	\$7,400	\$165,900	\$300	\$0

Total	\$718,400	\$3,175,300	\$1,087,100	\$468,600
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Table 13. Attempts to prevent deer damage to vegetation. Landowner responses to Deer Task Force Survey Question 7.b: Did you attempt to prevent this damage? Percent respondents choosing each option, by land use.

<u>Response</u>	<u>Agricultural</u>	<u>Residential</u>	<u>Combined</u>
	-----percent-----		
Yes	37	13	14
No	38	28	25

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 14. Frequency and cost of use of methods to prevent deer damage to vegetation. Landowner responses to Deer Task Force Survey Question 7.c: If yes, did you attempt to prevent this damage by using: . . . Percent respondents choosing each option, by land use.

<u>Method Used</u>	<u>Agricultural</u>		<u>Residential</u>		<u>Combined</u>	
	percent	cost*	percent	cost*	percent	cost*
Repellents	14	\$10,200	8	\$187,600	8	\$197,800
Fencing	19	\$7,400	7	\$1,585,900	7	\$1,823,300
Other	12	\$7,800	4	\$402,400	4	\$410,200
Total Costs	--	\$25,400	---	\$2,175,900	---	\$2,431,300

*These costs are extrapolated for the entire agricultural, residential, or combined populations, based on survey responses.

Table 15. Effectiveness of preventing deer damage to vegetation. Landowner responses to Deer Task Force Survey Question 7.d: Was it [damage prevention attempt] effective? Percent respondents choosing each option, by land use.

Method	Agricultural			Residential			Combined		
	<u>Yes</u>	<u>No</u>	<u>Partially</u>	<u>Yes</u>	<u>No</u>	<u>Partially</u>	<u>Yes</u>	<u>No</u>	<u>Partially</u>
-----percent-----									
Repellents	2	8	7	1	4	4	1	4	4
Fencing	7	6	9	2	3	3	2	3	3
Other	5	6	7	1	1	2	1	1	2

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 16. Contact with government agencies about deer damage. Landowner responses to Deer Task Force Survey Question 8: Have you contacted any government agency regarding deer damage in the past two years? Percent respondents choosing each option, by land use.

Response	Agricultural	Residential	Combined
-----percent-----			
Yes	9	2	2
No	70	93	93

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Geographic variation: Deer damage was infrequently reported to government agencies from all strata. Highest values of 15.6 and 11.6 percent were for land owners in the North Eastern Patapsco State Park and for the Northern Patapsco State Park, respectively. The rest of the strata ranged from 5.6 percent to low values of 1.9, 1.7 and 1.2 percent for the Northwest Patapsco State Park area, Southern strata and Columbia away from the MPEA, respectively.

Table 17. Observations of vehicle-deer accidents. Landowner responses to Deer Task Force Survey Question 9: Please indicate your experience(s) during the past year with accidents between vehicles and deer. Percent respondents choosing each option, by land use.

Option	Agricultural	Residential	Combined
	-----percent-----		
I saw no evidence of a deer related vehicular accident	4	11	11
I have seen deer that were killed or injured	90	79	79
I know someone who hit a deer	3	6	6
I hit a deer	2	2	2

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 18. Geographic variability in observations of vehicle-deer accidents. Landowner responses to Deer Task Force Survey Question 9: Please indicate your experience(s) during the past year with accidents between vehicles and deer. Percent respondents choosing each option, by geographic stratum.

Stratum #	Stratum Location	I saw no	I have seen	I know	I hit
		evidence of a deer related vehicular accident	deer that were killed or injured	someone who hit a deer	a deer
-----percent-----					
10	Western	3	89	3	3
13	W. adj. Patapsco SP	6	81	5	3
20	Northwest	3	89	4	3
21	NW adj. Patapsco SP	3	89	1	5
30	Southwest	3	89	4	3
40	South Central	6	85	4	3
42O	MPEA (East Clarksville ZIP)	4	87	4	0
42N	MPEA (West Columbia ZIP)	2	87	4	7
50	Southern	17	74	4	2
60	Eastern	10	82	4	1
61N	NE Patapsco SP	6	85	3	1
61S	SE Patapsco SP	7	88	4	1
70	Central Suburban	4	87	5	2
80	Central Rural	8	81	7	2
81	Central adj. Patapsco SP	5	85	6	2

90	Columbia away from MPEA	13	74	7	2
92	Columbia near MPEA	15	72	8	3

Table 19. Opinions about Lyme disease incidence. Landowner responses to Deer Task Force Survey Question 10: Do you believe that the incidence of Lyme Disease in Howard County is related to the current deer population? Percent respondents with each answer, by land use.

Response	Agricultural	Residential	Combined
-----percent-----			
Yes	47	33	33
No	10	9	9
Don t Know	41	57	57

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 20. Opinions of the need for deer population mange. Landowner responses to Deer Task Force Survey Question 11: Do you think additional deer population management is needed in Howard County? Percent respondents with each answer, by land use.

Response	Agricultural	Residential	Combined
-----percent-----			
Yes	74	61	62
No	17	24	24

Note: Totals do not equal 100% because some respondents did not answer this question and because of rounding error.

Table 21. Geographic variation in opinions of the need for deer population manage. Landowner responses to Deer Task Force Survey Question 11: Do you think additional deer population management is needed in Howard County? Percent respondents reporting yes, by geographic stratum, ordered highest to lowest.

Stratum #	Stratum Location	Percent
42N	MPEA (West Columbia ZIP)	95
420	MPEA (East Clarksville ZIP)	85
61N	NE Patapsco SP	84
81	Central adj. Patapsco SP	84
92	Columbia near MPEA	76
21	NW adj. Patapsco SP	76
30	Southwest	75
70	Central Suburban	72
40	South Central	72
20	Northwest	70
80	Central Rural	69
10	Western	67
13	W. adj. Patapsco SP	64
61S	SE Patapsco SP	61
60	Eastern	59
90	Columbia away from MPEA	57
50	Southern	50

Table 22. Attitudes toward various deer population management strategies. Landowner responses to Deer Task Force Survey Question 12: What is your opinion of the following list of possibilities for managing deer? Options ranked from 0" (not acceptable) to 5" (most acceptable). Average scores, presented by stratum. Continued on following page.

Stratum #	Stratum Location	Contraception	Fencing	No Action	Regulated Hunting	Reintroduce Predators	Repellants	Qualified Sharpshooters	Supplemental Sharpshooters	Feeding	Trap and Transfer
10	Western	2.50	1.19	1.26	3.90	0.80	1.80	2.20	1.54		1.93
13	W. adj. Patapsco SP	2.90	1.50	1.66	3.79	0.86	1.82	2.27	1.40		2.53
20	Northwest	3.25	1.58	1.32	3.42	0.91	2.24	2.45	1.71		2.57
21	NW adj. Patapsco SP	3.43	1.65	0.83	3.43	0.94	1.77	2.61	1.60		2.50
30	Southwest	3.30	1.35	1.26	3.38	0.93	2.01	2.44	1.36		2.45
80	Central Rural	3.50	1.78	1.26	3.10	0.85	2.24	2.29	1.78		3.09
81	Central adj. Patapsco SP	3.44	1.72	0.74	3.28	1.25	2.32	2.58	1.73		2.91
40	South Central	3.00	1.28	1.19	3.37	0.99	1.80	2.52	1.37		2.33
70	Central Suburban	3.44	1.77	1.17	3.03	0.82	2.13	2.16	1.67		2.99

Stratum #	Stratum Location	Contraception	Fencing	No Action	Regulated Hunting	Reintroduce Predators	Repellants	Qualified Sharpshooters	Supplemental Sharpshooters	Trap and Transfer
60	Eastern adj. Patapsco SP	2.62	1.86	1.66	3.14	0.99	2.03	2.08	1.93	2.83
61N	NE Patapsco SP	3.55	1.51	0.72	3.74	1.12	2.04	2.68	1.89	2.61
61S	SE Patapsco SP	2.99	1.61	1.47	3.02	0.85	1.94	1.94	2.01	3.09
50	Southern	2.74	2.07	1.52	2.91	1.27	1.76	1.80	1.75	2.93
42N	MPEA (West Columbia ZIP)	3.42	1.93	0.47	2.42	1.31	2.80	2.80	1.98	3.27
42O	MPEA (East Clarksville ZIP)	3.00	1.35	0.22	2.87	1.08	2.18	2.18	1.88	2.58
92	Columbia near MPEA	3.91	1.85	1.28	2.84	1.30	2.87	2.28	1.79	3.36
90	Columbia away from MPEA	3.29	2.12	1.56	2.56	1.04	2.48	2.04	1.79	2.95
	Entire County	3.14	1.88	1.44	3.05	1.02	2.17	2.12	1.75	2.86

Table 23. Summary of landowner responses to Deer Task Force Survey Question 11: What is your opinion of the following list of possibilities for managing deer? Percent respondents responding 0" (not acceptable), 5" (most acceptable) and Need more information, for each option, by land use.

Option	Ag	Residential	Combined	Ag	Combined	Ag	Combined	Ag	Combined
	-----Average Score-----			Percent Most Acceptable		Percent Not Acceptable		Percent Need More Information	
Contraception	2.95	3.14	3.14	32	30	22	16	13	16
Fencing	1.30	1.89	1.88	8	13	40	30	6	9
No action	1.09	1.44	1.44	7	8	48	41	2	6
Regulated Hunting	3.76	3.04	3.05	49	31	12	18	6	5
Reintroduce Predators	0.61	1.02	1.02	4	4	54	44	13	16
Repellants	1.63	2.17	2.17	9	11	30	22	15	18
Qualified Sharpshooters	2.60	2.11	2.12	28	18	27	33	6	7
Supplemental Feeding	1.12	1.75	1.75	6	8	41	28	8	20
Trap and Transfer	2.12	2.87	2.86	16	25	31	18	10	8

APPENDIX D

Some Economically Important Diseases Common to Whitetail Deer, Domestic Livestock and Humans

Some Economically Important Diseases Common to White-Tail Deer, Domestic Livestock and Humans.

Because of its well publicized, potentially serious negative effects on human health, the connection between deer and Lyme disease has been well publicized in recent years. But there are also other, little publicized, yet still very important, potentially damaging, pathological relationships between deer, humans and numerous other agriculturally important animals. Brucellosis for instance, frequently called Bang's disease, is a very serious contagious ailment which, if an outbreak occurs, can cause premature abortions in cattle, swine, sheep, goats and deer (Ensminger, 1992; Ingebrigtsen et al., 1986). Maryland is presently certified Brucellosis free by the United States Department of Agriculture--Animal and Plant Health Inspection Service. But, this has not always been the case. Although thought to be free of Brucellosis at the present time, Howard County's increasingly large deer population has the potential to serve as a source of infection for cattle, swine and humans.

In addition to affecting certain kinds of farm animals and wildlife, Brucellosis is a significant public health concern since it causes undulant fever in humans. Among humans, the disease is most prevalent in owners of infected livestock, veterinarians, slaughterhouse employees, laboratory technicians, etc. An outbreak of Brucellosis in a dairy or beef herd can result in devastating economic losses for the farmer. To maintain its Brucellosis Free Certification, state and federal laws previously required that every herd be blood-tested regularly and that the positively reacting animals be immediately removed from the herd and slaughtered. In more recent years, blood testing has been restricted to animals moving across state lines. Dairy herds continue to be monitored closely through regular testing of the milk (Wendy Feaga, D.V.M., practicing Howard County veterinarian, pers. comm., 1997).

The state of Maryland fortunately, is currently certified Brucellosis free, and has been for some years. But Maryland has been able to achieve this highly desirable status only because of the strict control measures that have been enforced for many years. However, if ever a Brucellosis outbreak should occur, this dreaded disease can be carried by and then transmitted to cattle by deer. The danger of a Brucellosis outbreak should not be taken lightly. Only because it has been taken very seriously in the past, when deer were not a significant factor, was Maryland finally qualified to be certified Brucellosis free. But this favorable position is a fragile one that could change very quickly if we allow ourselves to become careless.

Deer are also known to be carriers of several other contagious diseases which can affect the health of livestock and man. Without attempting an extensive discussion of them all, another one of the more well known of these diseases is Leptospirosis (Ingebrigtsen et al., 1986; Fournier et al., 1986), a parasite spread when other animals come into contact with contaminated urine. Cattle can become infected by splashed urine or by eating and drinking contaminated feed and water. In cattle, this disease causes various levels of fever, loss of appetite, anemia, abortions, and dead or weak full-term calves. Severe infections may be followed by death. Morbidity usually approaches 100 percent in calves.

In Australia and New Zealand where deer farming is popular, workers in the meat processing industry are particularly susceptible to Leptospirosis infection (Marshall, 1995). The sources responsible for these infections are unvaccinated stock from dairy farms, beef cattle, pigs, deer and occasionally sheep. New Zealand veterinarians found that the only way to control the spread of the disease is through the systematic vaccination of livestock. Deer spread the disease after consuming infected feed, water, urine or aborted fetuses. Leptospirosis can be spread to humans by infected urine and fetal fluids. In humans, the disease resembles a severe incapacitating influenza for which there is no vaccine available (Fyffe, undated).

A couple of other potentially important animal health problems associated with the growing size of the white-tail deer herd are the Meningeal parasite worm and bovine tuberculosis. According to information reported in the Merck Veterinary Manual, parasitic migration through the spinal cord of sheep is often associated with the meningeal worm of white-tail deer, *Parelaphostrongylus tenuis*. Affected animals have a history of grazing on pastures that have been exposed to white-tail deer. Tuberculosis has been frequently diagnosed in deer and has recently been reported as a major problem in Michigan (Will Hueston, D.V.M. Chairperson, VA-MD Regional College of Veterinary Medicine., pers. comm., 1998). Through a meticulous eradication program, Maryland's dairy herds are currently tuberculosis free. But, the *Tubercle bacilli*, if present, can easily gain entrance to the body by mouth or breathed in through the nasal chambers. A single feeding of milk from a tuberculous udder can result in infection.

Over the last couple of years, numerous reports of human illness and even some deaths due to a particularly dangerous pathogen, *Escherichia coli* 0157:H7, have been reported in the news media. According to the U.S. Food and Drug Administration Center for Food Safety and Applied Nutrition, in their Draft Guidance Document entitled Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables which was released on

April 13, 1998 for comment, Animal manure and human fecal matter represent a significant source of human pathogens. Quoting further from this document, it was stated that *E. coli* 0157:H7 is known to originate primarily from ruminants such as cattle, sheep and deer, which shed it through their feces. In addition, animal and human fecal matter are known to harbor Salmonella, Cryptosporidium, and other pathogens. Potential sources of contamination include high concentrations of wildlife in the growing and harvesting environment (such as heavy concentrations of migratory birds or deer in fields). The FDA recommends that, to the extent feasible, direct or indirect manure-to-produce contact be minimized, especially close to harvest time. High concentrations of wildlife (such as deer or waterfowl in a field) may increase the potential for microbial contamination. Although the viability of *E. Coli* 0157:H7 in deer manure over time was not specifically addressed in this document, it was reported that researchers have found that *E. Coli* can survive in dairy cattle manure for at least 70 days and in sheep manure for more than a year. Because of the abnormally excessive wild deer and waterfowl concentrations now present in Howard County, and their inability to totally quarantine their crops from wildlife feces, some local fresh fruit and vegetable growers and marketers are now being forced to spend several tens of thousands of dollars each to install specialized equipment to minimize any dangers from these newly created human health hazards.

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Marshall, R.B. 1995. A Review of Cattle Leptospirosis in New Zealand. <http://www.infrobok.co.nz/cattlrev.htm>.

Merck Veterinary Manual. *per* David L. Greene, Carroll County Cooperative Extension.

APPENDIX E

Howard County Deer Harvest

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Antlered	391	441	422	539	584	693	860	765	666	875
Antlerless	277	309	349	436	463	548	672	809	808	1147