Maryland Task Force on Non-Lethal Wildlife Management

Findings and Recommendations

Report to Governor Parris N. Glendening and the Maryland General Assembly:
18 January 2002

THE MARYLAND TASK FORCE ON NON-LETHAL WILDLIFE MANAGEMENT

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January 17, 2002

Governor Parris N. Glendening
State House, State Circle,
Annapolis, Maryland 21401

Dear Governor Glendening:

We are pleased to present the enclosed report of the Maryland Task Force on Non-Lethal Wildlife Management for your review.

The members of the Task Force are honored to have been given the opportunity to contribute to this vital project. Every day people and wild animals are forced into closer and closer contact. A farm is turned into a housing development, a few acres of woods become an industrial park, and wildlife habitat gives way to urban sprawl. Wild animals have adapted with great resourcefulness to their new circumstances, and the result is a rising number of conflicts between people and wildlife across Maryland.

After very careful consideration of all information and differing philosophical views, the Task Force has developed numerous recommendations to reduce or eliminate human/wildlife conflicts using non-lethal methods. We are confident that these recommendations will be a benefit to both Maryland citizens and wildlife, and that this report will be a useful resource for public officials in order to implement long-term, non-lethal solutions to human/wildlife conflicts.

Above all else, our year of study has made it abundantly clear that there is a lack of education among Maryland citizens and public officials regarding the availability and effectiveness of non-lethal tools for mitigating human/wildlife conflicts. Oftentimes, a citizen does not know which repellents and fencing techniques are most effective for deterring deer from ornamental gardens; a beehive farmer does not know that electric

fencing and aversive conditioning can prevent bears from depredating beehives; or a public official does not know a simple system of pipes installed through beaver dams can prevent flooding on roads. The Task Force believes that an aggressive public education campaign should be the cornerstone of any response to human/wildlife conflicts.

The enclosed report documents the causes of human/wildlife conflicts as well as includes recommendations for educational initiatives, policy initiatives and recommendations for addressing conflicts with specific species. Lists of resources and scientific studies for more information are also included. The numerous recommendations in the report include, but are not limited to, the following:

- the installation and monitoring of a roadside reflector system that can reduce automobile collisions with deer
- greater public participation in the decision-making processes of agencies that respond to human/wildlife conflicts
- the implementation of aversive conditioning and nuisance abatement practices for Canada geese, black bears, and other species
- state legislation to create alternative funding sources for the Department of Natural Resources' non-game and urban wildlife programs
- guidelines for developers to minimize their impacts on wildlife and, therefore, to minimize human/wildlife conflicts that are caused by development
- regulations for state-licensed private wildlife control operators who are often the first to respond to citizens' conflicts with wildlife
- continued research into fertility control for white-tailed deer

Although the members of the Task Force often had differing philosophical opinions on wildlife management and represented a broad spectrum of agencies, organizations, and citizens; we have come together to approve the enclosed report unanimously. We know that Maryland citizens value our state's rich wildlife heritage, and we believe that our recommendations will enrich and invigorate the lives of Maryland citizens by improving public safety, the aesthetic qualities of our communities, and our coexistence with Maryland's wildlife. We wholeheartedly support these efforts, and again, thank you for allowing us to be part of this extraordinary endeavor.

If you have any questions, or if I can help you in any way, please call me at 301 949-7600.

Sincerely,

Steven J. Kanstoroom

Steven J. Kanstoroom
Chairman

cc: MD Task Force on Non-Lethal Wildlife Management Members

Preface

As the population of Maryland grows, the interface between humans and wildlife increases, and the potential for conflict between humans and wildlife increases as well. In recent years, more and more of the State has been converted from rural and agricultural landscapes to urban and suburban population centers. Beyond doubt, Marylanders love their wildlife, but the choice of living with wildlife close at hand to enjoy and appreciate has become an increasingly complex proposition.

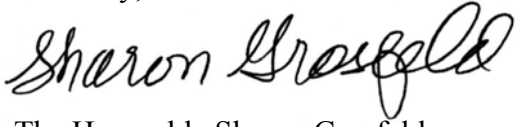
Many people have asked for solutions to help deal with human/wildlife conflicts in their neighborhoods and communities. Often, traditional methods of managing wildlife populations aren't appropriate in urban and suburban areas. Much discussion has taken place regarding the use of non-lethal options for managing wildlife.

The Department of Natural Resources is charged with the responsibility to manage wildlife and natural resources for stewardship of the resources and the benefit of all Marylanders. Likewise, the Maryland legislature is often faced with introducing and passing laws regarding wildlife management. We are continually seeking new ways to manage human/wildlife conflicts. Often times discussions lead to exploring the implementation of non-lethal options for wildlife management. We quickly came to realize that we needed to expand our knowledge in this arena regarding options available and the effectiveness in employing those techniques where appropriate.

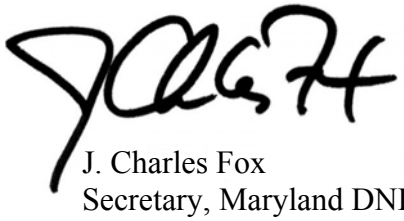
To that end, we created the Maryland Task Force on Non-Lethal Wildlife Management via a memorandum of understanding. The Task Force was asked to examine the causes of conflicts between humans and wildlife populations and develop recommendations regarding the use of nonlethal wildlife management techniques in the form of a report to the Governor and the Legislature.

We thank all involved for their efforts in breaking new ground and bringing various interests to the table in addressing this important issue.

Sincerely,



The Honorable Sharon Grosfeld
Member, The Maryland House of Delegates



J. Charles Fox
Secretary, Maryland DNR

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EXECUTIVE SUMMARY

The Maryland Non-Lethal Task Force (NLTF) was created via a memorandum of understanding between a member of the Maryland Legislature and the Department of Natural Resources (DNR). The mission of the Task Force was to study scientific documentation concerning the effectiveness of wildlife management techniques used by wildlife agencies; examine the causes of conflicts between human populations and wildlife populations in Maryland; assess current wildlife management policies; formulate recommendations regarding the use of non-lethal wildlife management techniques; and formulate recommendations for funding and implementing current and future non-lethal wildlife management initiatives.

It was the vision of the members of the NLTF to see that all Marylanders recognize the inherent worth of our State's rich wildlife resources and that the DNR along with citizens and communities across the State develop and employ non-lethal techniques in all cases where appropriate for the resolution of human/wildlife conflicts for the benefit of both wildlife and people.

The Task Force recognizes that there are different science-based, integrated wildlife management options available for state and local agencies to implement on a community-based and statewide level. Integrated wildlife management may utilize a wide range of options. It was the role of this task force to examine only non-lethal methods.

This report outlines a variety of human/wildlife conflicts that occur, especially those in suburban and urban settings. It focuses on the science of non-lethal measures that can be used to reduce or eliminate human/wildlife conflicts, research initiatives to advance our knowledge of non-lethal options, educational initiatives to better inform citizens, and specific policy initiatives to help promote greater utilization of non-lethal measures in managing human/wildlife conflicts.

The task force concludes that more public participation is necessary to ensure that Maryland citizens have a voice in wildlife management policies at the state and local level. Critical to this effort is the need for educational and research initiatives to ensure that Maryland citizens have a full range of information on non-lethal options readily available to address human/wildlife conflicts as they arise.

The Task Force found that human/wildlife conflicts exist at many different levels and have a variety of root causes. Conflicts identified included, among other things, property damage, automobile collisions, impacts to natural ecosystems, wildlife entering buildings, disease transmission, and fear. The causes of these conflicts were varied and included fragmentation of natural habitat, placement of housing in natural habitats, landscapes that attract wildlife, increased traffic, expansion of wildlife populations, lack of knowledge and use of preventative measures (e.g., fencing, repellents, vegetation management, etc.), and differing views of human/wildlife conflicts and resolution methods.

This report makes specific recommendations for reducing or eliminating conflicts with species such as black bears, beavers, white-tailed deer, other mammals, Canada geese and other birds – all employing non-lethal methods. These recommendations include, but are not limited to, the use of wildlife warning reflectors on roads and highways, fencing, repellents, aversive conditioning, exclusion devices, proper storage of food and trash, and habitat modification.

It is recognized that citizens need to be educated on human/wildlife issues and non-lethal options available to resolve conflicts. The Task Force notes that high populations of certain native or introduced species may have negative ecological impacts on native vegetation and other species. While this report does not address this biodiversity issue, the task force recommends that the Governor, General Assembly, and DNR address these and other biodiversity concerns.

To reach the educational and research objectives outlined, the Task Force recommends the following, among other things:

1. Enhance the DNR's urban wildlife program;
2. Expand DNR's public outreach role and encourage a greater appreciation of and respect for wildlife;
3. Develop a human/wildlife conflict resolution outreach program to assist communities with non-lethal human/wildlife conflict resolution;
4. Expand the use of the Maryland Cooperative Extension in education and research;
5. Incorporate land use and planning in development plans to proactively deal with human/wildlife conflicts;
6. Support research and education on fertility control;
7. Develop a team to assist communities with human/wildlife conflicts;
8. Train and educate natural resources professionals and teachers in implementing non-lethal wildlife conflict resolution programs and demonstrations;
9. Educate citizens about impacts upon the biodiversity of natural ecosystems caused by certain wildlife populations.

The task force recognizes that cost considerations are always a factor and should be analyzed when implementing strategies to resolve human/wildlife conflicts.

The task force concluded that more public participation is necessary to ensure that Maryland citizens have a voice in wildlife management policies at the state and local levels. In addition, the Task Force set forth the following policy recommendations, among other things:

1. As a general policy, state and local agencies responsible for dealing with human/wildlife conflicts should strive to address those conflicts using non-lethal measures, where appropriate, as a first option;
2. The Governor should continue to appoint members to the Maryland Wildlife Advisory Commission (WAC) in a timely manner who represent diverse opinions concerning wildlife management;

3. The WAC establish a subcommittee specifically to explore and promote non-lethal methods of eliminating or reducing human/wildlife conflicts;
4. DNR establish a training program for licensed Wildlife Control Operators (WCOs) and that this training be a requirement for all new or renewing WCO licensees;
5. Current recommendations for rehabilitation and release of rabies-vector species should be implemented;
6. The General Assembly should pass additional legislation to secure funding for DNR from non-consumptive wildlife enthusiasts;
7. Expand grassroots support for federal legislation which provides revenue to the states for non-game wildlife management; and
8. Create guidelines for developers to minimize impacts on wildlife.

In summary, this effort represents the first step toward a long-term commitment from Maryland officials and citizens to take responsibility and become knowledgeable about the wide variety of tools and resources available to solve human/wildlife conflicts in an effective and non-lethal manner.

Chapter 1: Human/Wildlife Conflicts and Their Causes

As the population within the State of Maryland continues to grow, the interface between people and wildlife increases. Although Marylanders love their wildlife, sometimes conflicts arise when people and wildlife interface. The non-lethal task force was charged with examining the causes of conflicts between the human population and wildlife population. Following are the results of that assessment.

I. SUMMARY OF COMMON CONFLICTS AND SPECIES INVOLVED

CONFLICTS	SPECIES OFTEN INVOLVED
DENNING OR NESTING IN HOMES OR STRUCTURES	RODENTS (I.E., SQUIRRELS, CHIPMUNKS, MICE, GROUNDHOGS), BIRDS, SNAKES, BATS, SKUNKS, RACCOON, OPOSSUM
DAMAGE TO LAWNS, PLANTS AND GARDENS	RODENTS, RABBITS, MOLES, VOLES, DEER, GEESE
DAMAGE TO BUILDINGS AND OTHER STRUCTURES	RODENTS, WOODPECKERS, BLACK BEAR, BEAVER
DAMAGE TO AGRICULTURAL CROPS	DEER, GEESE, BLACK BEAR, RODENTS
DISEASE TRANSMISSION	ALL ANIMALS. THIS REPORT ONLY ADDRESSES LYME DISEASE WHILE ACKNOWLEDGING THAT OTHER DISEASES EXIST AND CAN CREATE CONFLICT.
LARGE CONGREGATIONS OF BIRDS (NOISE/EXCREMENT)	PIGEONS, GEESE, VULTURES, BLACKBIRDS, CROWS
FEAR OF WILDLIFE	BLACK BEAR, FOX, COYOTE, SNAKES, VARIOUS OTHER SPECIES
AUTOMOBILE COLLISIONS	DEER, BLACK BEAR, VARIOUS OTHER SPECIES
IMPACTS TO NATURAL ECOSYSTEMS	DEER, BEAVER, GEESE, EXOTICS SUCH AS MUTE SWANS AND NUTRIA.

II. COMMON SPECIES, HUMAN/WILDLIFE CONFLICTS, AND THEIR CAUSES

A. White-tailed Deer

Deer populations in residential and forested areas have increased dramatically. The proliferation of edge habitat (small areas of woodland surrounded by golf courses, cropland, housing developments, industrial complexes, etc.), and lack of predators and other population controls, are some of the leading causes of an increase in human/deer conflicts. Also, a dramatic reduction of natural habitat has brought deer into closer proximity to people, sometimes resulting in conflicts. Additional causes are listed under each conflict.

1. *Vehicle/Deer Collisions:*

    a. Increased miles and widths of roads that fragment habitat; Increased traffic; Higher speed limits; Increased development of habitat forcing movement of deer populations; Failure of citizens to adapt driving habits (i.e. pay attention to warning signs, adjust speeds at dawn and dusk, etc.).

2. *Damage to agricultural crops (i.e., row crops, nurseries, orchards):*

    a. Limited number of cost effective management options for farmers; Lack of knowledge of options that are available; Limited implementation of management options that are available.

3. *Damage to home landscapes/gardens:*

    a. Suburban landscape provides excellent habitat and is very attractive to deer (highly fertilized ornamental native and exotic plantings are often more attractive to deer than native vegetation); Juxtaposition of housing and natural habitat; Deer have adapted to living close to people (change in behavior); Lack of knowledge of preventative measures (fencing, repellents, vegetation management, etc).

4. *Impacts to natural ecosystems:*

    a. Undisturbed forested, fragmented, and human-disturbed ecosystems are vulnerable to deer impacts.

5. *Concern with Lyme disease:*

    a. According to the Centers for Disease Control and Prevention (CDC), Maryland is among the ten states with the highest number of reported Lyme disease cases. Since official reporting began in 1982, the number of reported cases of Lyme disease in Maryland has increased but this could represent a reporting phenomenon and not necessarily reflect an increase in disease rates. (Personal communication: Dr. Tracy Duvernoy-Maryland Dept. of Health and Mental Hygiene).

    b. Increase in Black-legged tick (commonly known as “deer tick”);

    c. Lack of knowledge of preventative measures;

    d. Lack of knowledge of the disease by the general public and the experts.

B. Beaver

1. *Loss of trees due to cutting, girdling, and flooding*:

    a. Conflicts with goals of many environmental regulations intended to increase tree cover. Beaver damage can also increase forest fragmentation and, on extremely rare occasions, create safety hazards when trees are cut in yards, along roads, and other hazardous locations.

    b. Expansion of beaver populations and natural tree cutting activities due to limited habitat; Lack of knowledge of preventative measures; Lack of knowledge by general public and wildlife professionals of long-term impacts on ecosystem especially in urbanized areas.

2. *Flooding of and damage to roads, bridges, stormwater management facilities, and other structures:*

    a. Expansion of beaver populations and natural dam building activities; Poor design and placement of roads, culverts, stormwater management facilities

C. Geese

1. *Damage to turf and fouling of human-use areas with excrement:*

    a. High concentrations of geese attracted to man-made habitat; Increased resident goose populations due to creation of ideal goose habitat — large expanses of lawn, golf courses, open ponds, etc.;

    b. Public health concerns.

2. *Damage to crops:*

    a. High concentrations of geese attracted to food source; Increased resident goose populations;

3. *Damage to natural vegetation (loss of wetland vegetation / food supply for migratory waterfowl and other migratory birds):*

    a. High concentrations of geese attracted to food source; Increased resident goose populations

D. Black Bear

1. *Damage to agricultural crops and livestock, property/structures, and auto collisions*:

a. Re-establishment of bear populations (not to be confused with over-population); Lack of knowledge of preventative measures.

2. *Fear of a large carnivore:*

a. Lack of knowledge about black bear natural history

E. Other Wildlife Species

1. *Animals in and around homes — squirrel, raccoon, skunk, groundhog, chipmunk, fox, bats, woodpeckers, other birds:*

a. Lack of knowledge about species natural histories; Lack of knowledge about methods of exclusion; Poor structural design.

2. *Damage to yards, and gardens — rabbits, groundhogs, chipmunks, skunks, moles, etc.:*

a. Lack of knowledge about repellents and methods of exclusion.

F. People (i.e. Human Dimensions Issues)

1. *Conflicts between people with different views of human-wildlife conflicts and resolution methods:*

a. Lack of knowledge by the general public about ecosystems and their management;

b. Lack of knowledge about methods of conflict resolution;

c. Lack of knowledge of consensus building processes (i.e., how they work and why they fail);

d. Changing cultural paradigms regarding the management of wildlife populations (i.e., varied acceptance of population control).

CHAPTER 2: Specific Recommendations for Non-Lethal Conflict Resolution:

A. White-Tailed Deer

The Task Force considered conflicts with all wildlife species, however, increased public attention has been brought to the issue of white-tailed deer. Accordingly, the Task Force received more information on this species than any other.

Vehicle/Deer Collisions: The Task Force views vehicle/deer collisions as a major human health and safety concern. For this reason, a significant amount of time has been spent searching for technology that could reduce or eliminate such collisions.

One technology examined by the task force was wildlife warning roadside reflector systems. These systems are designed to reflect complete coverage of light visible to animals to the roadsides under all types of terrain. The animals see the unnatural moving light and either freeze or move away from the light source, thus discouraging the animal from entering the road. After the vehicle passes, the reflected light is no longer present and the animal may safely cross the road. The specific reflectors analyzed by the Task Force qualify for 80 percent Federal Highway Administration funds and cost approximately $8,000 - $10,000 per mile to install.

The results of scientific studies on the effectiveness of wildlife reflectors are mixed (Schafer and Penland 1985, Pafko, et al. 1996, DeNicola, et al. 2000). For example, the Task Force has received data from more than 50 municipalities across North America that implemented roadside reflector systems that resulted in reduced collisions with wild mammals (See Appendix F). Other studies, however, have questioned the premise of the design, noting that: the reflected light is extremely dim (Sivic 2001); the red color of light is within a spectrum for which deer have limited perception (Jacobs et al. 1993); and deer habituated to any reactions to the lights within a short period of time (Ujvari, et al. 1998). One Minnesota study found reflectors effective in rural areas but ineffective in more urban locations (Pafko, et al. 1996); deer adapt to considerable light sources in urban locations (See Upper St. Clair, Pa. Appendix F). Overall, scientific evidence is inconclusive.

The Task Force identified a disparity between the overwhelming success reported by the municipalities and the mixed results found in several scientific studies commissioned by various sources. The Task Force believes that several factors have contributed to the gap between actual results and some scientific studies: small sample size, lack of control sites, poor statistical design, lack of data on deer populations, poor site selection, traffic levels or other environmental trends, and device installations inconsistent with manufacturer's specifications or latest technologies.

Based on positive results from more than 50 test sites showing a reduction in vehicle/deer collisions (Appendix F) and the mixed results found in several scientific studies, the

Task Force recommends that the Governor and General Assembly support and encourage the use of wildlife-warning reflectors as follows:

- Direct the Maryland State Highway Administration (SHA) to collect deer-road kill data and identify roadways in the state with the highest concentrations of Vehicle/Deer collisions.

- Use an adaptive management process to allocate sufficient funds to support the installation, maintenance, and monitoring of wildlife-warning reflectors at selected locations in the state, along stretches of roadway identified by SHA as having the highest concentrations of collisions to determine effectiveness. Sites selected for study should include rural and suburban sites as well as sites in Western Maryland, Central Maryland and the Eastern Shore.

- Direct appropriate agencies to monitor sites in order to evaluate effectiveness of reflectors under various road conditions and surrounding land-use. Monitoring results will determine requests for additional funding for this effort as part of the annual budget cycle. Monitoring should include areas surrounding installation points to determine whether or not deer are altering movement patterns and being struck in other locations.

- Direct appropriate agencies to cooperate with sources of private funding to further expand the reflector system program.

- Direct agencies that address Vehicle/Deer collisions to make this report available to interested parties. Take appropriate steps to encourage local governments to initiate similar programs.

To further reduce the incidence of vehicle/deer collisions, in addition to recommending wildlife-warning reflectors, the following recommendations are also made to state and local transportation agencies:

- Improve "wildlife crossing" warning signage by making signs more varied, site specific, and "attention getting," such as using flashing lights that are motion-triggered.

- Install traffic-calming techniques such as rumble strips and speed humps, to encourage drivers to slow down on appropriate roads that have been identified as roadways with high concentrations of vehicle/deer collisions.

- Design roads and bridges with wildlife underpasses or overpasses that allow deer and other wildlife to cross safely.

- Install fencing to limit deer access on highways in conjunction with underpasses and overpasses. Care should be taken that fences are installed correctly, inspected regularly and kept in good repair so that deer do not become "trapped" on a road.

- Prohibit the establishment of landscaping that may attract deer onto roads. Vegetation attractive to deer in particular should not be used in median strips, cloverleaves, or road edges unless it is integral to the design of a wildlife underpass or overpass.

- Distribute information to drivers on safely avoiding deer and other wildlife. The Motor Vehicle Administration should develop and distribute this information with all new or renewed driver's licenses and vehicle registrations. Car insurance companies and automobile associations in Maryland should be encouraged to distribute similar information to their members and customers.

Damage to Crops and Ornamental Gardens: The following recommendations are made for eliminating or minimizing deer depredation to crops and ornamental gardens. (For more detailed information see list of resources in Appendix B).

- Install fencing to be used to protect orchards, nurseries, high-end crops (such as squash, pumpkins, and Christmas trees), and ornamental gardens from deer. A wide variety of fencing is available, including 8-foot wire, chain link, heavy duty plastic, electric fencing (baited and un-baited), and underground fencing used to keep dogs on the property as a deterrent to deer.

- Support research and development of additional products to adapt the typical 4-foot chain link fence to exclude deer. Possibilities include lightweight inexpensive materials that easily attach to an existing fence to extend its height to 8 feet or that attach an electric strand with bait to an existing fence to create a baited electric fence.

- Encourage expanded fence use in jurisdictions where covenants currently restrict or prohibit installation of fencing. Where deemed appropriate, changes should be made to increase use or fence height allowances.

- Provide lists of plants, shrubs, and trees that are less favorable to deer than many of the standard landscaping varieties commonly used. Information such as this should be made more accessible to homeowners, businesses, and developers via the DNR, cooperative extension services, web sites, and publications.

- Inform homeowners and lawn care companies about the existence of effective deer repellents on the market. Some products are ineffective and may disillusion homeowners from repellent use, so educational efforts are a key component of making homeowners aware of the effective products.

Lyme Disease: In the eastern United States, the Black-legged tick, commonly known as the "deer tick" (Ixodes scapularis), is responsible for transmitting Lyme disease bacteria to humans. The tick has a 2-year life cycle and immature stages (larvae and nymphs) feed on a broad range of hosts, with the white-footed mouse being the preferred host of both

larval and nymphal tick stages (Stafford et al. 1995). Adult ticks feed and mate primarily on deer.

Although scientists continue to gain new knowledge, there is evidence that increase of Lyme disease in humans is directly linked to elevated populations of white-tailed deer (Spielman 1988). However, according to the Centers for Disease Control (CDC), the transmission cycle begins with small rodents, such as the white-footed mouse, and can be spread via many mammals and more than 40 species of song birds. Lowering deer densities may reduce tick abundance (Daniels, et al. 1993; Stafford, 1993). However, this may not decrease the prevalence of lyme disease (Wilson, et al. 1985, 1988; Duffey, et al. 1994; Conover 1997). The following recommendations are made to eliminate or minimize the threat of transmission:

- Educate citizens about the methods of preventing Lyme disease, especially during peak tick season (May through August). Preventative measures include the use of proper clothing, physical examination using magnifying glass, tick repellents , and keeping yards clear of brush and debris. Citizens should consult health professionals for current information about Lyme disease vaccines.

- Support and monitor research studying the use of feeders that treat deer with insecticides in order to reduce tick populations.

B. Beavers

Install Water Flow Control Devices: State and local agencies and communities should install and properly maintain water control devices such as the Clemson Beaver Pond Leveler and PVC or flex pipe devices that are designed to stop flooding of roadways and private property caused by beaver dams while also leaving the beaver habitat intact, where appropriate. Other systems are available for areas that have less than 1½ feet of standing water or in areas where a large volume of water must be moved. These water control devices should be included in projects to restore wetlands, many of which are eligible for federal funding.

Apply Tree Wrapping: Rolls of heavy-gauge wire mesh (4-feet high with 2-inch by 4-inch mesh squares) purchased from hardware stores should be wrapped around certain palatable trees likely to be damaged by beavers.

Install Fencing: Low fences can be used to protect groups of trees, since beavers dislike being separated from the water and are not good climbers. An electrified wire strung 4-6 inches off the ground serves the same purpose as a low fence.

Support Repellent Research: There are no chemical repellents registered for beavers at this time. Therefore, it is recommended that research and development of repellents for beavers be supported.

C. Canada Geese

Reduce Population Growth: State and local agencies, in cooperation with volunteer citizens, should engage in reducing population growth of Canada Geese through egg addling (involves either replacing the egg with a fake one or coating it with corn oil), in accordance with federal and state permits under the Migratory Bird Treaty Act.

Practice Nuisance Abatement: Nuisance abatement practices should be used, including harassment devices such as mylar tape, chemical repellents, lawn sprinklers that are activated by movement detectors, various noisemakers, and trained dogs such as border collies and other herding breeds.

Erect Physical Barriers: Physical barriers including fences, hedgerows, tall grass, and other habitat modifications through strategic landscaping should be used to discourage the presence of Canada geese.

Enact Feeding Ordinances: Feeding of all wild and domestic waterfowl on both public and private property in urban situations should be prohibited as an important step in controlling Canada goose problems. A public education program should accompany the initiation of an anti-feeding ordinance to stimulate public interest, participation, and support. An anti-feeding ordinance must be enforced to be effective and may require a penalty sufficient to deter the activity. The General Assembly should consider legislation to implement alternative punishments to fines, such as requiring "community service" for violations.

D. Black Bear

Eliminate Attractants: Attractants such as discarded food in trash containers, birdfeed in or around birdfeeders, scraps and grease drippings on barbecue grills, and food stored at campsites should be eliminated or minimized. For example, organic waste and discarded food should be stored in bear-proof trash containers, birdfeeders should be taken inside at night, and pets should be fed indoors rather than outdoors.

Store Food Sources: Potential sources of food (such as organic waste, discarded food, birdseed, and pet food) should be properly stored in bear-proof trash containers, bear-proof food storage lockers, and at elevated positions that bears cannot reach or climb to.

Erect Fencing: Electric fences or woven-wire permanent fences should be used to eliminate bears' access to apiaries (beehives), orchards, gardens, high-value crops, and livestock.

Employ Aversive Conditioning: DNR personnel and other DNR-approved and properly trained personnel should frighten bears from areas where they are not welcome using loud noises or pyrotechnics, and should use aversive conditioning such as spraying bears with capsaicin or shooting them with blunt rubber projectiles. Repeat offending bears

should be relocated to suitable bear habitat if available or released on site after aversive conditioning is administered.

Promote Maryland Black Bear Conservation Stamp: The DNR should increase its efforts to promote the Maryland Black Bear Conservation Stamp, which raises money to compensate farmers for damage caused by bears to certain agricultural crops.

E. Other Wildlife: (e.g., Raccoons, Squirrels, Woodchucks, Coyotes, Fox, Skunks, Bats, Snakes, other Mammals and Birds)

Eliminate Attractants: Attractants that appeal to coyotes, foxes, raccoons, skunks, and other wildlife should be eliminated or minimized. Food and trash should be stored properly and with tight fitting lids, pets should be fed indoors rather than outdoors, and if possible, trash cans should be put out in the morning rather than at night.

Install Exclusion Devices: Exclusion devices (e.g., fencing, screening, chimney caps, etc.) should be used to prevent wildlife from entering properties and buildings. One-way doors and check valves should be used to help wildlife exit buildings, with special precautions taken during birthing and rearing seasons so young are not separated from their parents. Bat boxes and other alternative non-lethal solutions should be used to mitigate conflicts with these valued species.

Use Deterrents to Resolve Roosting Problems: Avian repellents, exclusion devices, and habitat modifications should be used to deter birds such as starlings and pigeons from roosting or nesting on and in structures where they are not wanted.

Live Capture and Relocation: There is widespread public belief that live capture and relocation is a humane solution to wildlife conflicts in and around the home and garden. For some species in Maryland (e.g., raccoon) this technique is illegal. However, the practice is widespread in the state for numerous species. Research to date shows that the technique is not particularly humane. Relocated animals released in areas already containing the species move extensively in an effort to find a new home not already occupied by other individuals. Mortality of such relocated animals is high (Frampton and Webb 1973, Wright 1977, Rosatte and MacInnes 1989, Bryant and Ishmael 1991, and Reeve 1998). Likewise, disease transmission in relocated animals remains a major concern.

In addition, removal of animals may create a vacuum at the problem site that is quickly filled by new animals. The task force recommends that, where possible, exclusion devices (e.g., fencing, screening, chimney caps, etc.) be used to prevent wildlife from entering properties and buildings. One-way doors should be used to remove animals from attics, basements, burrows under decks and porches, and similar situations. Animal access points should be shut off to exclude reentry.

The task force believes that exclusion devices represent a more effective approach than live capture and relocation in solving many, but not all, problems. With Exclusion device strategies, the animal is removed from unwanted areas, and is denied reentry, but remains in its home range. Using this practice, no vacuum is created for immigration of new animals. Increased effort should be made to educate the public regarding use of exclusion devices and additional research should be pursued to develop effective capture techniques.

CHAPTER 3: Education and Research Recommendations

For many citizens, information to address wildlife conflicts is only sought after they are impacted. Unless citizens are aware of where sound information is available to address their problem, they may implement activities that are not effective or humane. This requires the use of educational strategies at the community level that will inform citizens where the educational resources are readily available.

Educational media such as brochures, toll-free numbers, Internet resources, publications, and workshops can all be used effectively. The educational efforts should include publications and other media along with educational events that leverage limited resources to gain the greatest impact.

The Task Force makes the following specific recommendations for education:

I. ***Enhance DNR's Urban Wildlife Program:*** Maryland is one of the most urbanized states in the U.S. and its fledging urban wildlife program should be expanded to better meet the needs of metropolitan citizens. A major focus should be on permanent, non-lethal human/wildlife conflict resolution and educating the public towards an appreciation of wildlife in their neighborhoods. A reference for a comprehensive urban program is *Guidelines for Implementing Urban Wildlife Programs Under State Conservation Agency Administration* (Tylka et al. 1987). That document outlines program goals and objectives and recommends that an urban wildlife program incorporate four main elements:

a. Inventory and research (5 to 25 percent of program budget);
b. Wildlife planning and management (30 to 60 percent of program budget);
c. Public information, education, and extension services (30 to 60 percent of program budget); and
d. Urban habitat acquisition, development, preservation, and conservation (5 to 25 percent of program budget).

II. ***Expand DNR's Public Outreach Role***: DNR should take an active role in educating Maryland residents about non-lethal approaches to dealing with human/wildlife conflicts. One goal of this education campaign should be to encourage a greater appreciation of and respect for wildlife. Outreach methods could include:

a. Working with other governmental units;
b. Website information including links to educational information on repellents, exclusion devices, habitat modifications and other non-lethal methods of solving human/wildlife conflicts;
c. Mailings;
d. Press Releases;
e. Public Service Announcements.

III. ***Develop Human/Wildlife Conflict Resolution Outreach Plan:*** Convene a statewide meeting of partners and cooperators involved with human/wildlife conflict resolution to develop a coordinated outreach strategy for information and assistance on non-lethal human/wildlife conflict resolution, including short-range and long-range approaches.

IV. ***Expand Use of the University of Maryland Cooperative Extension:*** Increase the use of the Maryland Cooperative Extension (MCE) network in partnership with state and private agencies and organizations, and other Extension organizations in the Northeast United States to facilitate research and education concerning non-lethal wildlife management techniques. Provide funding to hire a state wildlife extension specialist with expertise in non-lethal wildlife management.

The responsibilities of that state wildlife specialist would include the following:

a. Cooperate with the "Northeast Wildlife Damage Management Committee" to develop and implement non-lethal research and extension projects;
b. Work with the State Highway Administration to develop a research protocol to substantiate the effectiveness of wildlife warning roadside reflectors on selected portions of roadways;
c. Develop training workshops for natural resource professionals and other individuals interested in non-lethal management techniques;
d. Expand the use of the existing MCE Home and Garden Information to assist the state's urban wildlife program by providing easily accessible information about non-lethal options to Maryland citizens;
e. Cooperate with other partners to provide publications for the public with information on non-lethal urban wildlife management, and technical publications that acquaint other professionals with observations and findings about non-lethal wildlife management techniques.

V. ***Incorporate Land Use Planning in Development Plans:*** A proactive program to deal with human/wildlife conflicts should be incorporated into the development review process. The planting of landscapes composed of plant species less preferred by deer, the inclusion of ordinances and covenants that allow tall fences, electric fences, habitat management and other methods to deal with problems would be an asset. Perhaps as important, an educational program to inform new and older residents on non-lethal approaches on how to live with and manage wildlife could reduce the conflicts.

VI. ***Support Research and Education on Fertility Control:***
Immunocontraception for fertility control of high populations of contained white-tailed deer is of considerable interest to wildlife researchers, managers, and the general public. Significant research is being conducted in Maryland

and elsewhere in an effort to develop the technology for management purposes.

Currently, fertility control is in the experimental stage. There are logistical, legal, and management issues that must be addressed. This technique, when readily available, is intended for use in suburban and urban locations where deer are confined by fencing or natural barriers and is not intended for use in rural or open areas. The task force recommends that fertility control research be supported and the public be educated regarding fertility control.

VII. ***Develop a Team to Assist Communities with Human/Wildlife Conflicts:*** When human/wildlife conflicts arise in a community, a lack of good information results in a lack of consensus on how to deal with problems. In many cases, communities spend excessive time and effort collecting information that has already been collected and summarized by other communities. A team of professionals familiar with human/wildlife conflict resolution and non-lethal methods could be developed. This team could meet with the community affected to provide essential information that would expedite their efforts. Decision-making should be made with strong community input.

VIII. ***Provide Professional Training:*** Provide training for DNR employees, foresters, and environmental managers and educators to implement non-lethal wildlife conflict resolution programs and demonstrations on properties, with school groups, etc. Provide training for interested teachers to incorporate non-lethal wildlife conflict management concepts and examples into the environmental and wildlife management school curricula.

IX. ***Provide Education on Biodiversity:*** Educate citizens regarding the importance of maintaining biodiversity in natural ecosystems and understanding that high populations of certain native and introduced species (caused by human disruption of natural ecosystems) can reduce the diversity of other species, some of which may be threatened or endangered.

CHAPTER 4: Policy Recommendations

After assessing current wildlife management policies in the state, the Task Force concludes that more public participation is necessary to ensure that Maryland citizens have a voice in wildlife management policies at the state and local levels. The DNR should invite more public participation during the developing or amending of wildlife management policies. Residents should become more educated and involved in wildlife management within their communities and across the state. If residents can play a larger role in wildlife management decisions within their communities and across the state, they will undoubtedly have more confidence in and support of the state and local agencies responsible for these decisions.

With the goal of greater cooperation and broader public participation in mind, the Task Force makes the following specific policy recommendations:

1. **Prioritize Non-Lethal Methods:** Solving human/wildlife conflicts in the least destructive means possible is important as a matter of social policy. As a general policy, state and local agencies responsible for dealing with human/wildlife conflicts should strive to address those conflicts using non-lethal measures as a first option. State and local agencies should implement, or in some cases expand, aggressive public outreach programs to teach residents how to solve or reduce wildlife conflicts using non-lethal measures. Policies that stress education will empower citizens to solve wildlife problems and will promote tolerance and greater appreciation for Maryland's diverse wildlife species. Written policies and procedures should be in place to provide guidance to the agencies on addressing human/wildlife conflicts and these policies should be made available to the public.

2. **Increase Representation on Maryland Wildlife Advisory Commission (WAC):** The Governor should continue to appoint members of the WAC who represent a greater diversity of opinions concerning wildlife management, such as qualified wildlife biologists, wildlife control cooperators, non-consumptive outdoors enthusiasts, and representatives of animal protection and wildlife conservation organizations. By appointing members who represent a broad constituency, the Governor can ensure that the WAC is more inclusive of diverse views and opinions and more accurately reflects the demographics of Maryland citizens. The Governor should solicit nominations for vacancies and appoint a new member on the WAC within one month of the vacancy announcement.

3. **Establish Subcommittee on Non-Lethal Methods**: The WAC should establish a subcommittee specifically to explore and promote non-lethal methods of eliminating or reducing human/wildlife conflicts. This subcommittee should be comprised of members who support non-lethal methods, and should advise the WAC of new and innovative methods of non-lethal wildlife management and new research concerning these methods.

4. **DNR should establish a training program with training requirements for licensed Wildlife Control Cooperators (WCOs).** WCO's are individuals or companies that are permitted by DNR to respond to human/wildlife conflicts such as wildlife in homes or sick or injured wildlife. At present, there are no educational or training requirements for WCOs and only minimal record-keeping requirements. DNR should develop standards in cooperation with appropriate professional wildlife organizations and/or member organizations of the Non-lethal Task Force.

   The training program should be a requirement for all new or renewing WCO licensees and should provide education and training in non-lethal methods of solving wildlife conflicts.

5. **Implement Rehabilitation and Release of Rabies-Vector Species**: Current recommendations for rehabilitation and release of rabies-vector species should be implemented.

6. **Enact Funding Initiatives**: The General Assembly should pass legislation to expand the funding base of DNR. Such legislation could take the form of measures that have been enacted in other states, such as a percentage of the state's sales tax, a lottery, taxes on non-consumptive outdoor enthusiast equipment and supplies, and motor vehicle or boating fees being directed to the DNR.

   Allowing wildlife enthusiasts and the general public to contribute through voluntary means to the state's wildlife programs will help the DNR meet its growing need to be more inclusive of the general public in its decision-making processes. Such programs already in existence include the Wildlife Conservation Stamp and Print Program, the Chesapeake Bay Non-Game and Endangered Species Tax Check Off, and the Maryland Black Bear Conservation Stamp.

7. **Expand Grassroots Support for Federal Legislation:** One of the greatest opportunities for broadening the funding base of state agency wildlife programs is through the creation of additional federal legislation which provides dedicated federal funding sources to the states. The Conservation and Reinvestment Act (CARA), as passed by the House of Representatives Resources Committee on July 25, 2001, is an example of this type of legislation. The Maryland Teaming With Wildlife Coalition, composed of 126 organizations, business firms, and other groups from across the state, is working to support passage of this legislation.

8. **Create Guidelines for Developers**: Municipal planning boards and other regulatory authorities should work with developers and property owners to minimize their impacts on wildlife.

a. The DNR should provide developers with lists of state-licensed wildlife rehabilitators to aid with injured or orphaned wildlife.
b. Maryland's "Smart Growth" program should include information on development policies that minimize impacts on wildlife and reduce human/wildlife conflicts.
c. The General Assembly should consider legislation to require that developers follow steps to minimize impacts on wildlife and reduce human/wildlife conflicts.
d. Building codes should be changed to require that all new homes have chimney caps and vent caps, thus preventing a major source of wildlife access and conflict.
e. Educational materials on reducing human/wildlife conflicts should be provided to realtors and encourage them to distribute the materials to new homeowners or renters.
f. Incorporate wildlife habitat planning into the development review process by encouraging land preservation, and cluster development.
g. Incorporate abatement techniques into the development process (i.e., changes in community covenants that allow fencing or building a fencing as part of the development; not planting certain species of shrubs).
h. An urban wildlife specialist should be actively involved in the development/revision of codes, standards, and guidelines for development and land-use planning, storm-water management facilities, buildings, roads, bridges, and other public infrastructure.

The following are examples of site-specific recommendations that can help reduce wildlife-human conflicts:

i. <u>Ponds/lakes</u>

1. Design inflow and outflow structures with wildlife exclusion devices especially for beaver.
2. Design low banks to prevent denning by muskrats and beaver.
3. Allow dense vegetation around perimeter to discourage geese.
4. Where possible, allow emergent vegetation to discourage geese and attract other non-problem species.

ii. <u>Buildings</u>

1. Eliminate all small openings in buildings that might attract nesting animals. Including lighting fixtures, vents, chimneys, crawl space openings, etc.
2. Eliminate all small openings in other public infrastructure including bridges, light poles, traffic lights, signs, etc.
3. Eliminate flat ledges to discourage perching birds.

iii. Roads/bridges

1. Design road system to minimize fragmentation of wildlife habitat.
2. Use bridges with adequate clearances to allow wildlife passage where roads cross-stream valleys and other greenways.
3. Build wildlife overpasses, underpasses, and culverts at critical wildlife crossing areas when new roads are built and when existing roads are improved.

APPENDIX A: Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING

WHEREAS, The Department of Natural Resources, under the authority of Natural Resources Article, §1-101, Annotated Code of Maryland, is charged with the responsibility to unify, coordinate and promulgate policies, plans, programs, and practices which insure the preservation, development, wise use, and enjoyment of all the natural resources for the greatest benefit to the State and its citizens; and

WHEREAS, The Secretary of the Department of Natural Resources, in accordance with Natural Resources Article, §1-105 may create an advisory board for the Department whose members shall be taken from the professional areas or fields of endeavor with which the Department is concerned;

NOW, THEREFORE the parties to this Memorandum of Understanding agree on this _____ day of _____, 2000:

(a) there is a task force on non-lethal wildlife management. The task force shall consist of the following sixteen members:

(1) one member from the House of Delegates to be appointed by the Speaker of the House;

(2) one member from the Senate of Maryland to be appointed by the President of the Senate;

(3) the Secretary of the Department of Natural Resources, or the Secretary's designee; and

(4) the following thirteen members appointed by the Secretary, as follows:

(i) one member from the Humane Society of the United States;

(ii) one member from the Fund for Animals; and

(iii) four members from the general public who have demonstrated an interest in wildlife preservation**;**

(iv) a member of a national conservation organization;

(v) a member of the Wildlife Services Division of the United States Department of Agriculture;

(vi) a member of the Maryland Sportsman's Association;

(vii) a member of the Maryland Wildlife Advisory Commission;

(viii) a member of the Montgomery County National Park and Planning Commission;

(ix) a representative of the University of Maryland, College of Agriculture and Natural Resources; and

(x) the State veterinarian.

(c) The chairman of the task force shall be determined by a consensus of the committee.

(d) A member of the task force may not receive compensation for serving on the task force, but is entitled to reimbursement for expenses under the standard state travel regulations, as provided in the state budget.

(e) The task force shall meet at least once every 2 months, at the call of the chairman.

(f) The task force shall:

(1) study scientific documentation concerning the effectiveness of wildlife management techniques used by wildlife agencies in the United States and Canada;

(2) examine the causes of conflicts between the human population and the wildlife population in the State;

(3) assess current wildlife management policies in the State;

(4) formulate recommendations regarding the use of non-lethal wildlife management techniques in the State; and

(5) formulate recommendations for funding and implementing current and future non-lethal wildlife management initiatives.

(g) The task force shall submit a final report to the Governor and, subject to § 2-1246 of the State Government Article, to the General Assembly on or before December 1, 2001.

IN WITNESS WHEREOF, the parties to this Memorandum of Understanding agree to the terms and conditions relating to the Non-Lethal Task Force and execute the Memorandum of Understanding by signing it on the day and year first written above.

The Department of Natural Resources

by:

_____ _____

Date

Sarah Taylor-Rogers, Ph. D.
Secretary of Natural Resources

_____ _____

Date The Honorable Sharon Grosfeld
Member, The Maryland House of Delegates

Reviewed for legal sufficiency this _____ day of _____, 2000 by

_____
Shara Mervis Alpert
Assistant Attorney General

APPENDIX B: Non-Lethal Task Force Members

The Maryland House of Delegates: Delegate Sharon Grosfeld;

The Maryland Department of Natural Resources (DNR): Assistant Secretary Carolyn Watson;

The Humane Society of the United States: Pat McElroy;

The Fund for Animals: Mike Markarian;

Four members from the general public:

Theresa Chonoski,
Marvin Tenberg,
Steven Kanstoroom: Chairman,
Dr. Martha Gagnon

American Bird Conservancy: Gerald Winegrad;

The United States Department of Agriculture-Wildlife Services: Scott Healey;

The Maryland Sportsman's Association: Tim Lambert;

The Maryland Wildlife Advisory Commission: Dr. Lowell Adams;

M-NCPPC, Montgomery County Department of Park and Planning: Rob Gibbs;

The University of Maryland, College of Agriculture and Natural Resources:
Jonathan Kays

The DNR-State veterinarian: Dr. Cindy Driscoll

APPENDIX C: Hot-line assistance for resolving human/wildlife conflicts:

United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, Maryland's Wildlife Information Line - 1-877-463-6497
Since 1991, this joint project between MD DNR Wildlife and Heritage Service and USDA, APHIS, Wildlife Services sponsors a toll-free telephone service that provides free professional information to help Maryland residents solve human/wildlife conflicts. General information about Maryland's wildlife, as well as contact information for state licensed Wildlife Control Cooperators and Wildlife Rehabilitators is available from this service. Information about Permits to Control Nuisance Wildlife (State issued) and Migratory Bird Depredation Permit Applications (Federal issued permits) is also available.

The Fund for Animals, Urban Wildlife Hotline- (203) 393-1050
The Urban Wildlife Hotline has been sponsored by Fund for Animals since 1993. The hotline receives 5,000 calls a year: 80% from Connecticut and 20% from other states. They work 7 days a week and give out free information (handouts as well) to callers who have concerns about orphaned, injured and humane solutions to "nuisance" wildlife. They also handle calls on training for nuisance animal control operators and other policy matters.

Home and Garden Information Center Hotline - 1-800-342-2507 (in Maryland Only)
Operated by Maryland Cooperative Extension. The Center provides research-based publications and assistance to help Maryland homeowners solve horticultural problems, including wildlife damage problems. Horticulture consultants are available to speak to clients on the telephone Monday through Friday from 8 a.m. to 1 p.m. Callers can also access a wide range of audio tapes 24 hours a day. Information available online includes publications, pictures of wildlife damage, and much more.
http://www.agnr.umd.edu/users/hgic

APPENDIX D: General Wildlife Resource Information

Contributions to this list were made from individual members of the task force and have not been endorsed by the task force as a whole. The purpose of this section is to direct the reader to the multitude of information available on the issues addressed in this report and may include information not endorsed by some members.

United States Department of Agriculture,
Animal and Plant Health Inspection Service,
Wildlife Services
1568 Whitehall Road
Annapolis, MD 21401
Tel: (410) 349-8055

The Humane Society of the United States,
Wildlife Department
700 Professional Drive
Gaithersburg, MD 20879
Tel: (301) 258-3000
Toll free: (877) 463-6497
www.hsus.org

University of Maryland Cooperative Extension
College of Agriculture and Natural Resources
Home and Garden Information Center
Toll Free: (800) 342-2507
www.agnr.umd.edu/users/hgic

The Fund for Animals
8121 Georgia Avenue, Suite 301
Silver Spring, MD 20910
Tel: 301-585-2591
Fax: 301-585-2595
Email: fundinfo@fund.org
Web: www.fund.org

Beavers: Wetlands & Wildlife
146 Van Dyke Road
Dolgeville, NY 13329
Tel: (518) 568-2077
Email: q&a@beaversww.org
Web: www.beaversww.org
*An organization that assists homeowners and communities with solutions to beaver/human conflicts.

American Lyme Disease Foundation
Web: www.aldf.com/templates/Lyme.cfm

GeesePeace
Tel: (703) 354-1713
Fax: (703) 354-1940
Email: dfeld@erols.com
Web: www.geesepeace.org
*A community-based organization that implements population stabilization and nuisance abatement programs.

"When Resident Geese Become A Problem"
Web: www.dnr.state.md.us/dnrnews/pressrelease/33099goose.html
Extensive guide and list of resources published by the Maryland DNR Wildlife and Heritage Service and USDA APHIS Wildlife Services.

Maryland Cooperate Extension - Natural Resource Website:
http://www.naturalresources.umd.edu/Wildlife_Damage.html
One of the links on this web site is to wildlife management and then to wildlife damage management. These and others are accessible on the Maryland Cooperative Extension website for natural resource programs.

Wildlife Damage Website http://wildlifedamage.unl.edu/
This is an USDA-funded and university-sponsored effort. You can also find the university nearest you and their on-line wildlife publications. The site also offers the professional in wildlife control the latest, library materials, news, business helps and job prospects. There also some fun links for kids.

Home and Garden Information Center. http://www.agnr.umd.edu/users/hgic
Operated by Maryland Cooperative Extension. The center provides publications and assistance to help Maryland homeowners solve horticultural problems, including wildlife damage problems. Horticulture consultants are available to speak to clients on the telephone Monday through Friday from 8 a.m. to 1 p.m. Callers can also access a wide range of audio tapes 24 hours a day. Call toll-free to speak to a horticulture consultant or access library of audiotapes: 1-800-342-2507 (in Maryland only).

The following materials are available for free by contacting:
The Fund for Animals
8121 Georgia Avenue, Suite 301
Silver Spring, MD 20910
T 301-585-2591
F 301-585-2595
fundinfo@fund.org
http://www.fund.org

"Bats in Your Belfry: Humane Ways to Solve Urban Wildlife Problems." Coexisting with Wildlife Fact Sheet #1. The Fund for Animals, 2001.

"Solving Urban Duck Problems." Coexisting with Wildlife Fact Sheet #2. The Fund for Animals, 2001.

"Solving Raccoon Problems." Coexisting with Wildlife Fact Sheet #3. The Fund for Animals, 2001.

"Solving Woodchuck Problems." Coexisting with Wildlife Fact Sheet #4. The Fund for Animals, 2001.

"Common Misconceptions about Rabies." Coexisting with Wildlife Fact Sheet #5. The Fund for Animals, 2001.

"Solving Skunk Problems." Coexisting with Wildlife Fact Sheet #6. The Fund for Animals, 2001.

"Living with Deer." Coexisting with Wildlife Fact Sheet #7. The Fund for Animals, 2001.

"Suggested Guidelines for Working with a Nuisance Wildlife Control Operator (NWCO)." Coexisting with Wildlife Fact Sheet #8. The Fund for Animals, 2001.

"A New Way to Solve Beaver Problems." Brochure and Video. The Fund for Animals, 2000.

"A Step by Step Guide to Solving Beaver Problems." Video. The Fund for Animals, 2000.

“Model Legislation Regarding Wildlife Control Cooperators.” The Fund for Animals and the Humane Society of the United States, 2001.

Prevention and Control of Wildlife Damage: This handbook is a comprehensive reference of North American vertebrate species. Each chapter is devoted to a specific animal. It contains five publications on damage identification, 23 on rodents, 16 on carnivores, 11 on other mammals, 20 on birds, 7 on reptiles and amphibians, and other sections on vertebrate pesticides, supplies and materials. The reference comes in both book and electronic format (CD-ROM). Each copy of the book is $40 plus $5 shipping. CD-ROM copies of the publication are $40 each plus $3 shipping. Copies of the book plus CD-ROM are only $60 plus $5 shipping. The website enables you to preview some of the chapters. http://www.ianr.unl.edu/pubs/handbook/index.htm

Extension Publications from Maryland Cooperative Extension:
Publications are available from county offices - http://www.agnr.umd.edu/ces/cooffices.html. A full listing of publications is found at: http://www.agnr.umd.edu/ces/pubs/toc.html

EB354 - Managing Wildlife Damage in Maryland ($2); FS654 - Reducing Vole Damage to Plants in Landscapes, Orchards, and Nurseries (no charge); FS655 - Resistance of ornamental to deer damage (no charge); FS791 - Got bugs! Get bats. EB357 - Landowner liability and recreational access ($2.50); Series - 17 wildlife management fact sheets on different species and their management ($10 per set); NR64 - Enhancing Wildlife Habitats: A practical guide for forest landowners. The following publications and their source is provided: HG64 - Snakes (available at www.agnr.umd.edu/users/hgic); Managing Vole Damage in Forest Plantations (available at www.naturalresources.umd.edu).

Deer as Public Goods and Public Nuisance: Issues and Policy Option in Maryland. 106-page proceedings from October 27, 1997 conference in College Park, MD. Edited by Bruce L. Gardner. Copies available for $5. Send check (payable to University of Maryland) to: Center for Agriculture and Natural Resource Policy, 2200C Symons Hall, University of Maryland, College Park, MD 20742-5535. (301) 405-0057. http://www.arec.umd.edu/policy/Deer-Management-in-Maryland/home.htm

Deer Overabundance. Published by the Wildlife Society. Edited by Robert Warren. Special issue with 50 articles addressing management issues related to deer overabundance. Published by the Wildlife Society, 5410 Grosvenor Lane, Bestheda, MD. Cost $22.50. (301) 897-9770.

Howard County Deer Management Task Force Report - Howard County Deer Management Task Force Report - The Howard County Deer Task Force was created in 1996 by the County Council. The Task Force was charged with investigating the deer situation within the county, examining the options available to deal with problems, and recommending a course of action. As a result of the Task Force's work, a comprehensive management plan for white-tailed deer in Howard County has been jointly developed by stakeholders. Available online at: http://www.co.ho.md.us/recparks/natres/deer.htm

A Literature Review for Assessing the Status of Current Methods of Reducing Deer-Vehicle Collision by Dr. Brent J. Danielson Dr. Michael W. Hubbard. Aa 25-page report prepared for The Task Force on Animal Vehicle Collisions, The Iowa Department of Transportation, and The Iowa Department of Natural Resources Submitted September 1998. Available online at: http://www.public.iastate.edu/%7Emhubbard/deer/litreview2.htm

Managing Canada Geese in Urban Environments: A Technical Guide. The 42-page manual is for anyone concerned with urban Canada Goose management. It provides a condensed, research-based source for Canada Goose biology, regulations, management strategies, techniques, references, as well as equipment suppliers. Cornell Cooperative Extension.

Managing White-Tailed Deer in Suburban Environments. The 52-page manual reviews the biology of the white-tailed deer and discusses methods for reducing deer-related problems. Comprehensive strategies are outlined. Fencing and repellents are covered, as

well as options for lowering deer populations and experimental techniques for deer fertility control. Cornell Cooperative Extension.
Managing Nuisance Beavers Along Roadsides: A Guide for Highway Departments. Created by Paul G. Jensen & Paul D. Curtis. Cornell Cooperative Extension.

Managing Canada Geese in Urban Environments: A Technical Guide. The 42-page manual is for anyone concerned with urban Canada Goose management. It provides a condensed, research-based source for Canada Goose biology, regulations, management strategies, techniques, references, as well as equipment suppliers. Cornell Cooperative Extension.

Montgomery County Deer Management Program and Recommendations - The Comprehensive Management Plan for White-Tailed Deer in Montgomery County, MD developed in 1995 calls for the Deer Management Work Group to review deer-impact data and present a list of recommendations for the upcoming year. This is done on an annual basis. Available online at: http://www.mc-mncppc.org/environ/deer/

The Science of Overabundance: Deer Ecology and Population Management. 1997. Edited by William J. McShea, H. Brian Underwood, and John H. Rappole. Smithsonian Institute Press, Washington, D.C. ISBN 1-56098-681-6

Fertility Control of Animals:
http://www.hsus.org/marketplace/humanesocietypress/State_of_Animals_Ch_12.pdf

The Human Dimensions of Wildlife Management Damage: A Practitioner's Guide. Decker et al. 2002. A resource for all communities looking for practical conflict resolution techniques and methods. To be released in Spring 2002.

Whitetails at the Crossroad:
Both the publication and the video are available from: Cornell University Media Technology Services Resource Center, 7 Cornell Business Technology Park, Ithaca, NY 14850. Phone: (607) 255-2080
E-mail: Dist_Center@cce.cornell.edu.
Website: http://www.cce.cornell.edu/publications/catalog.html

Wild Neighbors: The Humane Approach to Living with Wildlife. 1997. The Humane Society of the United States, Washington, D.C. Fulcrum Publishing, Golden, Colorado. 253-page book with 35 chapters covers non-lethal "how-to" strategies for 32 species with a number of appendices. Available for about $17.95 from bookstores.

APPENDIX E: Scientific and Research Reference Materials

Contributions to this list were made from individual members of the task force and have not been endorsed by the task force as a whole. The purpose of this section is to direct the reader to the multitude of information available on the issues addressed in this report and may include information not endorsed by some members.

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Anderson, J.F. and L.A. Magnarelli. 1980. Vertebrate host relationships and distribution of Ixodid ticks (Acari: Ixodidae) in Conneticut. J. Medical Entomology 17:314-323.

Barnes, T.G. 1995. A survey comparison of pest control and nuisance wildlife control operators in Kentucky. Proceedings of the Eastern Wildlife Damage Control Conference 6: 39-48.

Barnes, T.G. 1997. State agency oversight of the nuisance wildlife control industry. Wildlife Society Bulletin. 25: 185-188.

Braband, L.A. and K.D. Clark. 1992. Perspectives on wildlife nuisance control: results of a wildlife damage control firm's customer survey. Proceedings of the 5th Eastern Wildlife Damage Control Conference: 34-37.

Bromley, Extension Wildlife Specialist, North Carolina Cooperative Extension

Bryant, B. K., and W. Ishmael. 1991. Movement and mortality patterns of resident and trans-located suburban white-tailed deer. Pages 53-58 in L. W. Adams and D. L. Leedy, editors. Wildlife Conservation in Metropolitan Environments. National Institute for Urban Wildlife, Columbia, Maryland.

Brammer, T.J., P.T. Bromley, and R. Wilson. 1994. The status of nuisance wildlife policy in the United States. Proceedings of the Ann. Conf. Of the SE Assoc of Fish and Game Agencies. 48: 331-335.

Chamberlain, P.A., M. Caroline, and W.A. Wright. 1982. Urban vertebrate pest management: a practical approach. Proceedings of the Great Plains Wildlife Damage Control Workshop 5: 78-96.

Conover, M.R., W.C. Pitt, K.K. Kessler, T.J. DuBow, and W.A. Sanborn. 1995. Review of human injuries, illnesses, and economic losses caused by wildlife in the United States. Wildlife Society Bulletin 23:407-414.

Conover, M.R. 1997. Monetary and intangible valuation of deer in the United States. Wildlife Society Bulletin 25:298-305.

Curtis, P.D. 1995. Public policy education: an important wildlife management opportunity. Eastern Wildlife Damage Control Conference 6:201-202.

Curtis, P.D. and J.R. Hauber. 1997. Public involvement in deer management decisions: consensus versus consent. Wildlife Society Bulletin 25:399-403.

Conover, M.R., W.C. Pitt, K.K. Kessler, T.J. DuBow, and W.A. Sanborn. 1995. Review of human injuries, illnesses, and economic losses caused by wildlife in the United States. Wildlife Society Bulletin 23:407-414.

Conover, M.R. 1997. Monetary and intangible valuation of deer in the United States. Wildlife Society Bulletin 25:298-305.

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APPENDIX F: Wildlife Warning Roadside Reflectors

This information was compiled primarily by the Chairman of the task force and has not been verified or endorsed by the task force at large. The information contained herein is not meant to endorse, or imply an endorsement, of the products associated with these studies.

Percentage Reduction in Vehicle/Animal Collisions

Site	Years	% Reduction
Smithers, BC, Site 1	1996–98 (3)	100
Smithers, BC, Site 2	1997–98 (2)	100
Smithers, BC, Site 3	1996–98 (3)	100
Bovigon, BC, Site 4	1996–98 (3)	100
Smithers, BC, Site 5	1996–98 (3)	100
Niel, BC, Site 6	1996–98 (3)	100
Quick Road, BC, Site 7	1996–98 (3)	100
Babiwe, BC, Site 8	1996–98 (3)	100
Raymond, BC, Site 9	1997–98 (2)	100
Donaldson, BC, Site 10	1996–98 (3)	100
Van Horn, BC, Site 11	1996–98 (3)	83.5
Restoreu, BC, Site 12	1996–98 (3)	100
Hwy 3, Dist. 9 & Hwy 95A, Dist.11, BC	1991–94 (4)	23
Smithers to Wakefield Road	1995–96 (2)	96.5

Area Manager for the preceding sites: Eric Becker

Ministry of Transportation & Highways
3793 Alfred Street
Smithers, BC V0J 2N0
250-847-7403

Rock Creek, Nakusp, Grand Forks, Chistina Lake, BC [1]	Years Not Received	60
Colorado, Boulder District [2]	1997–2000	45.6
Henry County, GA [3]	1997–99	100
IL DOT, Mahomet [4]	1997–2000	97
Iowa City, Iowa, Site 1 [5]	1996–99	87
Iowa City, Iowa, Site 2 [6]	1999	92
IA DOT, Waukon, Site 1 [7]	1987–2000	97.1
IA DOT, Waukon, Site 2 [8]	1992–2000	98.5
KS DOT [9]	1991–99	90.9
Baltimore Cnty, MD [10]	1996–99	100
Falls Road, Baltimore County, MD [11]	1998–2000	100
Harford Cnty, MD, Site 1 [12]	1994–2000	74.5
Harford Cnty, MD, Site 2 [13]	1994–2000	56.7

Harford Cnty, MD, Site 3 [14]	1999–2000	87.5
Calhoun Cnty, MI, Sites 1 & 2 [15]	1996–99	84
Calhoun Cnty, MI, Site 3 [16]	1998–99	100
Calhoun Cnty, MI, Site 4 [17]	1999	100
Livingston Cnty, MI [18]	1996–98	67
New Ulm, MN [19]	1985–2000	100
Paynesville, MN [20]	1985–99	94.5
Trunk Hwys: 32, 71,71 & 64, MN [21]	1988–94	90
Trunk Hwys: 75, 23, 67 & 75, MN [22]	1988–94	79
Trunk Hwys: 371, 64, 169 & I-94 [23]	1988–94	87
Essex Cnty, NJ, Site 1 [24]	1999–2000	100
Essex Cnty, NJ, Site 2 [25]	1999–2000	100
Essex Cnty, NJ, Site 3 [26]	1999–2000	100
Essex Cnty, NJ, Site 4 [27]	1999–2000	100
Essex Cnty, NJ, Site 5 [28]	1999–2000	100
NJ Turnpike Authority, Site 1 [29]	1999–2000	100
Hunterdon Cnty, NJ [30]	1999–2000	82
Lewis County, NY [31]	1993- 1999	Data Not Avail.
Mexico, NY [32]	1996- 1999	Data Not Avail.
Owego District, NY [33]	1999- 2000	100
Fairfax County, VA [34]	1999- 2000	100
Fort Atkinson, WI [35]	1997- 2000	100
Upper St. Clair, PA.[36]	1999-2000	37% Increase

1 Area Manager: Helmut Klughammer
RR 1, Site-11.cop-1
Nakusp, BC V0G 1R0
250-265-4370

2 David M. Day, Hwy Maint. Supervisor I
1050 Lee Hill Road
Boulder CO 80302
303-546-5642

3 Herman Miller, Owner
3099 Hwy 155 N,
McDonough, GA 30252

4 Carl Phillips, P.E., Traffic Operations Engineer
Rt. 13473, IL Highway 133
Paris, IL 61944
217-466-7378

5-6 Misha Goodman, Animal Control
410 E Washington, Iowa City, IA 52240

7-8 Daryl Cooper, Maintenance Supervisor
848 Allamakee St., Waukon, IA 52172
319-568-3773

9 John Babcock, Area Superintendent
101 Gauge, Topeka, KS 66606
785-296-2291 ext 141

10 Dave Groft, Crew Chief
12200 C Long Green Pike, Glen Arm, MD 21057
410-887-8602

11 Andre Futrell, Asst. Resident Maint. Eng.
306 Mount Carol Road, Parkton MD 21120
410-329-6752

12-14 Neil B. Gray, Jr. Resident Maint.
3050 Churchville Rd., Churchville MD 21028
410-838-7788

15-17 Dennis Randolph, P.E. A.I.C.P., Managing Director
13300 15 Mile Road, Marshall MI 49068
800-281-5512 ext. 232

18 Mike Goryl, Traffic & Safety Engineer
3535 Grand Oaks Drive, Howell, MI 48843
517-546-4250, ext 19

19 Howard Zins, Chief of Police
15 S Washington St., New Ulm 56073
507-233-6750

20 Bill Legatt, Secretary/Treasurer,
MDHA Tri County River Bottom Bucks
Box 62, Nathes Marine, Hwy 55W, Paynesville MN 56362
320-243-4517

21-23 Frank Pafko, Area Manager
1500 W Cnty Rd B, Roseville MN 55113
651-582-1481

24-28 Joe Alercio, Sign Shop Manager
904 Bloomfield Ave., Verona NJ 07044
973-226-2084

29 Sean Hill, P.E., Projects Specification Engr.
State Rt. 18, Interchange 9, New Brunswick, NJ 08903
732-247-0900

30 Douglas Pursell, Supervisor
County Engineers Office,
One East Main Street, Victorian Plaza, Flemington NJ 08822
908-788-1182

31 Patrick Wallace, Asst. Resident Engineer
5527 Bostwick St, Lowville NY 13367
315-376-3523

32 James Tompkins, Asst. Resident Engr.
5826 Scenic Ave, Mexico NY 13114
315-963-3730

33 George Gabello, Highway Maint. Superintendent
1497 State Route 96, Owego NY 13827
607-687-3730

34 M.P.O. Bob Wall, Fairfax County Police Department
3911 Woodburn Rd, Annandale NY 22003
703-280-0567

35 Leo W. Roethe
Masonic Village on the Square
375 Hwy. 67, Apt 357B, Dousman, WI 53118
262-965-5862

36 Upper St. Clair, Pa.
Mark S. Mansfield, Asst. Township Mgr.
1820 McLaughlin Run Road
Upper St. Clair, PA. 15241
412-831-9000

The Task Force recognizes that more than one reflector technology is available on the market, however, all of the above results were based on reflectors using the technology described below.

I. GENERAL DESCRIPTION

Wild Animal Highway Warning Reflectors are designed for installation along the edges of roadways to divert headlights of approaching vehicles at right angles into the surrounding terrain.

The purpose of the Reflector is to reflect light from the headlights of moving vehicles, thereby preventing wild animals from crossing the road until the vehicle has passed.

The Reflectors shall consist of a plastic housing containing two reflective mirrors with plastic torical elements that reflect light from approaching traffic—traveling either in one or two directions—into the adjoining roadsides.

II. DETAILED SPECIFICATIONS

A. Design and Fabrication:

1. Dimensions:

The Reflector shall consist of one housing containing two reflectors.

Housing:	Base:	80.0 mm
	Height:	59.8 mm
	Length:	181.5 mm
	Angle:	60^{o}
	Cross Section:	Triangular
Reflector:	Length:	171.0 mm
	Width:	57.0 mm
	Number of Reflective Elements:	70

2. Surface:

The surface of the Reflectors shall be smooth with the exception of identification marks. All corners and edges facing towards traffic should be rounded for safety reasons.

3. Material:

The Housing shall be made of modified PMMA (Polymethyl Methacrylate).

The Reflectors shall be made of modified PMMA (Polymethyl Methacrylate) and shall be backed with aluminum foil or vapor deposition and protected against corrosion.

4. Weight:

The weight shall be 200–240 grams.

5. During the injection molding process, the reflector edges shall be completely sealed and welded with the housing materials to achieve an integral unit to withstand moisture infiltration and reduce oxidation of the reflective surfaces.

B. Optical Performance:

1. Field of Viewing :

The field of viewing shall be as set forth in the following illustration.

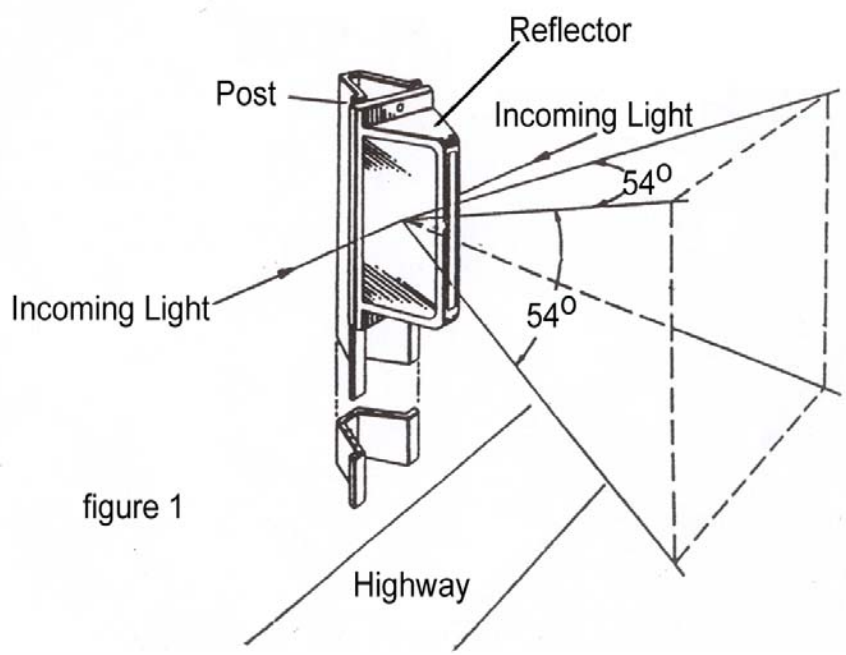

figure 1

VERTICAL FIELD OF VIEWING shall be 27° +/- from the horizontal to the highway.
HORIZONTAL FIELD OF VIEWING shall be 27° +/- from the perpendicular to the highway.

C. Mechanical Performance:

1. High Temperature Resistance:

The Reflector shall withstand temperatures not to exceed 70° C (158° F) and show no significant change in shape nor general appearance, nor cracks, delaminations or other distortions when subjected to the following high temperature test. The test shall consist of placing a Reflector in an oven with circulating air at 70° Celsius +/- 2° Celsius (158° Fahrenheit +/- 3° Fahrenheit). After an exposure period of five hours, the Reflector shall be removed from the oven and permitted to air cool to 23° C (73° F) temperature.

2. Low Temperature Resistance:

The Reflector shall withstand temperatures not lower than -35° +/- 2° C (-30° +/- 2° F) and show no significant changes in shape nor general appearance, nor cracks, delaminations or other distortions when subjected to the following cold test.

The cold test shall consist of placing the Reflector in an appropriate freezer at -35° +/- 2° C (-30° +/- 2° F). After an exposure period of 5 days, the sample shall be removed from the freezer and permitted to warm up to room temperature.

3. **Impact Resistance:**

   The Reflector shall not break, chip or crack when subjected to the impact of a steel ball, 32 mm (1.25") in diameter, falling freely from a height of 1 meter. The impact test shall be performed at room temperature (23° Celsius +/- 2° Celsius i.e. 73° Fahrenheit +/- 3° Fahrenheit).

The Reflector shall rest, base side down, on a steel plate not less than 15 mm thick. The steel ball shall strike the Reflector at the approximate center of the small identification mark side.

III. DETAILED INSTALLATION

The design is a single, multi-purpose reflector. Properly installed, it provides complete reflective light cover for any roadside terrain to warn wild animals against crossing at night. Considerable savings are achieved compared with other reflectors requiring separate models for sloping and level terrain. Also, less maintenance is required.

A. Reflector spacing longitudinally shall be equal to the distance between reflector lines latitudinally. (Spacing may vary up to 125 feet.)
B. Reflectors are to be directed across the highway and staggered, thus providing complete coverage on the road and roadsides.
C. The maximum permissible offset shall be 40 feet.
D. Roadway need not be centered between reflector lines.
E. In down slope areas, reflectors are to be installed on the same posts as the primary reflectors back-to-back, directed away from the highway at the shoulder break.
F. Where the spacing of the downslope reflectors is 100 feet or greater, install a single interim reflector on a post halfway between the two primary reflectors.