FINAL REPORT OF THE SUFFOLK COUNTY TICK MANAGEMENT TASK FORCE

Resolution # 1123 – 2006

May 7, 2008

Assessment and Management of Vector Tick Populations

Suffolk County Dept. of Health Services

Public Health

Dr. Salvatore Scarpitta, Chair
225 Rabro Drive East
Hauppauge, NY 11788

Phone (631) 853-3196
Cell (631) 840-7373
Fax 1 (631) 853-3073

COUNTY OF SUFFOLK

Steve Levy
SUFFOLK COUNTY EXECUTIVE

DEPARTMENT OF HEALTH SERVICES **Humayun J. Chaudhry, D.O., M.S.**
COMMISSIONER

May 15, 2008

Dear Interested Party,

The enclosed Report of the Suffolk County Tick Management Task Force (TMTF) provides recommendations and strategies to reduce the tick population and therefore, tick related diseases in Suffolk County. The *Task Force* was created by the Suffolk County Legislature as Resolution #1123-2006 to "*study the effects of the tick population and the spread of tick-related diseases, and to develop a comprehensive needs assessment for the County's approach to this public health and safety issue*".

The *Task Force* realizes that ticks cannot be eradicated from Long Island and that cases of tick-borne disease will always exist. The Task Force embraced an "integrated approach" for tick management, which involves a combination of methodologies with the overall intent of reducing the **risk** of tick-borne diseases. The integrated approach involves consideration of the full range of available educational, cultural, biological, chemical and legal controls that would minimize unnecessary health and environmental side-effects of vector-control activities while assuring maximum protection of the public and the environment.

Several Sub-Committees explored various practices that are available for tick control and the related political, industrial and environmental factors. The most effective combination of control strategies and techniques could be applied County-wide while specific locations with serious tick infestations might require specific targeted treatment.

The Chair acknowledges and thanks the 11 members of the TMTF who met frequently and diligently, beginning in March 2007. A stand-alone Executive Summary Section of the Final Report was also produced for possible public distribution.

Dr. Salvatore C. Scarpitta
SCDHS, Chair of TMTF

DIVISION OF PUBLIC HEALTH
225 RABRO DRIVE EAST
HAUPPAUGE, NY 11788-4290
(631) 853-3055 FAX (631)853-3073

TASK FORCE MEMBERS

Voting Members

Salvatore C. Scarpitta, PhD, Suffolk County Department of Health Services, Chair

Laura Bavaro, The Nature Conservancy, Co-Chair

Dominick Ninivaggi,,Suffolk County Department of Public Works

Timothy Green, Ph. D., Brookhaven National Laboratory

Fernando Villalba, National Parks Service

Amy Juchatz, MPH, Suffolk County Department of Environment and Energy

Eva Haughie, President, Empire State Lyme Disease Association

Rae Lapides, Shelter Island Deer and Tick Committee

Deborah Long, U.S. Fish and Wildlife Service

Non-Voting Members

Vincent Palmer, NY State Department of Environmental Conservation

Invited Members

Scott Campbell, Ph. D., Suffolk County Department of Health Services

Kristy Cimaglia, Suffolk County Department of Health Services

Ilia Rochlin, Suffolk County Department of Public Works

Note: Dr Parkinson attended one meeting in Sept. 2007 but was unable to attend future meetings do to physical limitations that he communicated to the Chair, via E-Mail, on Dec. 3, 2007. Deborah Long stopped attending Meetings around Sept. 2007 without notifying the Chair.

All voting, non-voting and invited TMTF members accepted this version of the Final Report. E-Mail communications stating this were sent to the Chair and appear on the accompanying CD-ROM in the Correspondences Folder.

TABLE OF CONTENTS

COVER LETTER 1

TASK FORCE MEMBERS 2

TABLE OF CONTENTS 3

LIST OF ACRYNOMS 7

REPORT EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS 8

Section 1: Tick Biology and Ecology *8*
Section 2: Incidence of Tick Borne Diseases in Suffolk County *8*
Section 3: Pesticide Related Tick Management *10*
Section 4: Host and Habitat Management *11*
Section 5: Public Education *12*
Section 6: Options for Tick Control in Suffolk County *13*
Section 7: Unresolved Task Force Issues *14*

TASK FORCE SUMMARY AND CONCLUSIONS 15

FULL REPORT

SECTION 1: TICK BIOLOGY AND ECOLOGY - EXECUTIVE SUMMARY 16

I - INTRODUCTION: TICK SPECIES OF MEDICAL IMPORTANCE IN SUFFOLK COUNTY 17

II – TICK BIOLOGY AND LIFE CYCLE 19

III – TICK ECOLOGY : HOST, HABITAT, DISTRIBUTION AND DISEASE TRANSMISSION 20

IV – CONCLUSIONS 23

V – REFERENCES 24

SECTION 2 - INCIDENCE OF TICK-BORNE DISEASES - PREFACE 26

EXECUTIVE SUMMARY 27

I - SUFFOLK COUNTY FACTS AND POPULATION DEMOGRAPHICS 29

A. BASIC STATISTICS 29
B. SUFFOLK COUNTY POPULATION DENSITY MAPS BY LAND AREA AND ZIP CODE\ 30

II - BACKGROUND 31

A. SUMMARY OF TICK-BORNE DISEASES, ORGANISMS AND VECTORS 31

III - CDC TICK-BORNE DISEASE CRITERIA AND NATIONAL PICTURE 32

A. NOTIFIABLE DISEASES, CDESS AND NEDESS 32

B. Disease Incidence in the Fifty States 33

IV - CONFIRMED CASES OF TICK DISEASES IN SUFFOLK COUNTY 34

A. Summary of Five Tick-Borne Diseases in Suffolk Reported to CDESS 34
B. Comparison of Tick-borne Diseases in Suffolk with Other CDC Reportable Diseases 35
C. Con firmed Cases of Lyme Disease, Babesiosis, RMSF and Ehrlichiosis in Suffolk County . 36
D. Relative Risk of Tick-Borne Diseases by Sex and Age Group 38
E. Data for Five Tick-Borne Diseases in Nassau, Suffolk and NYS from 2003 to 2006 39
F. Tick Borne Disease Cases in Suffolk County - 2006 40

V - REFERENCES 41

SECTION 3 - PESTICIDE RELATED TICK MANAGEMENT - EXECUTIVE SUMMARY 42

I - INTRODUCTION: 44

II - HUMAN AND PET PROTECTION 44

III – OUTDOOR BROADCAST SPRAYS 47

IV – HOST TARGETED TECHNOLOGIES 47

V – REGISTERED PESTICIDE PRODUCTS 52

VI – MINIMUM RISK PESTICIDES AND BIO-PESTICIDES 55

VII – LAWS, RULES AND REGULATIONS 57

VIII – REFERENCES 58

SECTION 4 - HOST AND HABITAT MANAGEMENT - EXECUTIVE SUMMARY 60

I - INTRODUCTION 62

II – DEER 62

A. Deer, ticks, tick-borne diseases 62
B. Deer Biology 62
C. Deer and vehicle accidents 64
D. Deer and ecosystem effects 64
E. Deer and agriculture 64
F. Hunting 65
G. Increasing available hunting areas 65
H. Increasing Hunter Participation 66
I. Improve Meat Donation Programs 66
J. Legal Sale of Meat 66
K. Revised Hunting Seasons 66
L. Culling Deer 67
M. Fencing to Limit Range of Deer 67
N. Contraceptives 68
O. Use of Predators 69

III – MICE AND OTHER SMALL MAMMALS 69

A. WILD TURKEY AND MIGRATORY BIRDS 70

IV – RECOMMENDATIONS 70

V – REFERENCES 71

SECTION 5 - PUBLIC EDUCATION - EXECUTIVE SUMMARY 73

I - INTRODUCTION: 74

II – SIGNIFICANCE OF TICK-BORNE DISEASES 74

III - PUBLIC HEALTH EDUCATION PROGRAM 75

IV – TICK MANAGEMENT OPTIONS 76

V - RECOMMENDATIONS FOR EDUCATION ON TICKS AND TICK-BORNE DISEASE PREVENTION MATERIALS AND EVENTS 76

VI – RESOURCES 77

SECTION 6 - OPTIONS FOR TICK CONTROL

I –INSTITUTIONAL CONSIDERATIONS 80

II – APPROPRIATE TECHNOLOGIES FOR COUNTY USE 81

III – PRACTICAL CONSIDERATIONS 81

IV – TICK CONTROL OPTIONS – SUMMARY 84

SECTION 7 - UNRESOLVED TASK FORCE ISSUES

I - MEDICAL 84

A. NEW EMERGING TICK DISEASES –BARTONELLA AND STARI 85
B. LYME DISEASE VACCINE 86
C. OTHER MEDICAL ISSUES 86

II – PROFESSIONAL PEST CONTROL AND EXTERMINATORS 87

APPENDICES USED IN THIS REPORT 88

APP I - DEMOGRAPHIC INFORMATION ON SUFFOLK COUNTY- 2000 89

APP II - MAJOR TICK BORNE DISEASES OF THE WORLD 90

APP III - DEMOGRAPHICS BY TOWNSHIP AND ZIP-CODE 92

APP IV – CDC CASE DEFINITIONS 93

List of Acronyms

ABDL - Arthropod-Borne Disease Laboratory (Suffolk County)

ASPCA - American Society for the Prevention of Cruelty to Animals

BNL - Brookhaven National Laboratory

CDESS - Communicable Disease Electronic Surveillance System

CDC - Centers for Diseas Control

CFR - Code of Federal Regulations

DFW&MR - New York State Department of Environmental Conservation, Division of Fish, Wildlife, and Marine Resources

DPW Suffolk County Department of Public Works

DS&HM - New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials

ECL - Environmental Conservation Law of New York State

EIS - Environmental Impact Statement

FDA - US Food and Drug Administration

FIFRA - Federal insecticide, Fungicide, and Rodenticide Act

GIS - Geographical Information System

HGA - Human Granulocytic Anaplasmosis (formerly Human Granulocytic Ehrlichiosis)

HGE - Human Granylocytic Ehrichiosis - see HGA

HME Human Monocytic Ehrlichiosis

IPM - Integrated Pest Management

KBUSLIRL - Knipling-Bushland U.S. Livestock insects Research Laboratory

NPIC - National Pesticide Information Center

PHIN - Public Health Information Network

NIH - National Institute of Health

NYCRR - New York Codes, Rules and Regulations

NYSDEC - New York State Department of Environmental Conservation

NYSDOT - New York State Department of Transportation

NYSDOH: New York State Department of Health

NYSOPRHP - New York State Office of Parks, Recreation and Historic Preservation PR Notice: Pesticide Registration Notice

PZP - porcine zona pellucida

RMSF - Rocky Mountain Spotted Fever

SCDHS - Suffolk County Department of Health Services,

SCDPW-DVC: Suffolk County Department of Public Works, Division of Vector Control

SEQRA - State Environmental Quality Review Act

SLN - Special Local Need Registration

STARI - Southern Tick-Associated Rash Illness

TESS - Toxic Exposure Surveillance System

USDA-ARS - US Department of Agriculture, Agricultural Research Service

USDI-NPS-FINS - United States Department of the Interior, National Park Service, Fire Island National Seashore

USEPA - United States Environmental Protection Agency

WNV - West Nile Virus

EXECUTIVE SUMMARY

The Tick Management Task Force, created by the Suffolk County Legislature, worked from March 2007 through mid-May 2008 to study the effects of the tick population and the spread of tick-related diseases in Suffolk County. This report is a comprehensive needs assessment for the County's approach to this public health and safety issue. To address its objective, the Task Force created four subcommittees:

(A) Tick Control, (B) Host Management, (C) Surveillance & GIS Mapping and (D) Public Education.

The approach of the *Task Force* was to develop an integrated management strategy by examining the options listed below. Two additional sections were added to this report that address: (1) Options for Tick Control in Suffolk County and (2) Unresolved Task Force Issues. A summary of each report section is provided along with several recommendations from each section. Lastly, the Task Force Summary and Conclusions are presented. The Executive Summary Section is a stand-alone document that may be distributed to the general public. It can be found on the attached CD-ROM as well as in this report.

Integrated Tick Management Strategies

A. TICK CONTROL	B. HOST MANAGEMENT	C. SURVEILLANCE & GIS MAPING	D. PUBLIC EDUCATION
Pesticides – Chemical	Deer Populations	Tick Ecology and Biology	Use of Safe Repellents
Commercial Products	Fencing	Analyze NYS DOH and Centers for Disease Control (CDC) Data	Brochures
Host Targeted Chemicals 4-Poster Project	Hunting	Deer Population Survey	Behavior Modification
Use of Natural Repellents	Deer resistant plants	Map Human Cases of Tick Diseases	Pet Management (Frontline)
Biological Tick Control (Parasites)	Natural Predators	Identify Tick Species by Township	Landscape Management
Habitat Targeted Acaricides	Rodents and Birds	Human Vaccine Efficacy	Safe Chemical Repellents

Report Summary and Key Recommendations

Section 1: Tick Biology and Ecology

This report reviews the biology and ecology of three medically important tick species in Suffolk County: American dog tick (*Dermacentor variabilis*), the lone star tick (*Amblyomma americanum*), and the blacklegged tick (*Ixodes scapularis*) using peer reviewed articles published in scientific journals, major textbooks in tick biology, and government publications. The environment affects tick populations through habitat and host species. These interactions, in turn, drive the dynamics of tick- borne diseases, several of which are present in Suffolk County. Although considerable knowledge on ticks and tick-borne diseases has been accumulated in the scientific literature, location specific data for this county are scarce or non-existent underscoring the need for a long term tick research and surveillance program of medically important tick species of Suffolk County.

Recommendations:

- Suffolk County should consider establishing a countywide tick surveillance program by utilizing and augmenting existing expertise and capabilities in the Dept. of Health Services' (DHS) Arthropod-Borne Disease Laboratory and DPW Division of Vector Control.
- Suffolk Country should promote further examination on the local tick biology, ecology, distribution, and disease transmission by the relevant State (Arthropod Borne Disease Program) and Federal (the Centers for Disease Control and Prevention) agencies as well as other interested parties such as educational institutions.
- A tick management program should be based on the need for tick control and the surveillance results of tick populations and associated tick-borne pathogens.

Section 2: Incidence of Tick Borne Diseases in Suffolk County

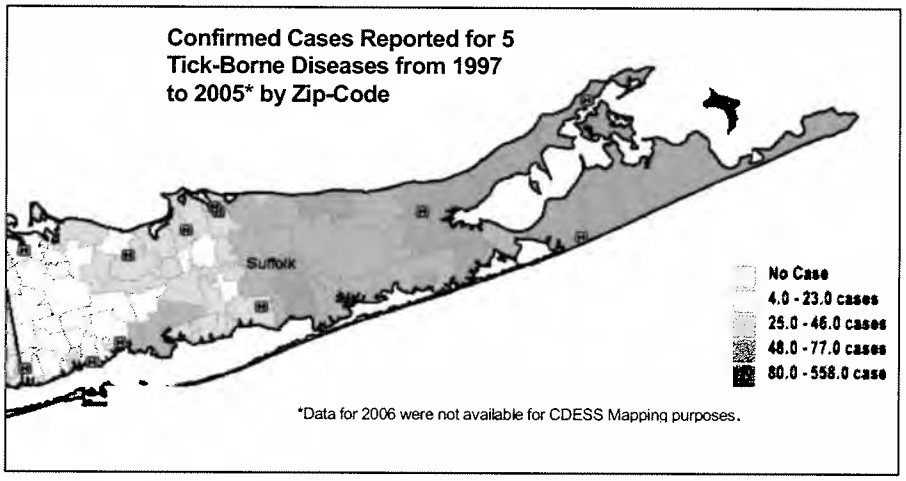
This section summarizes ten (10) years of data (from 1997 to 2006) on the incidence of five tick-borne diseases in Suffolk County for which a confirmed diagnosis exists. While there are many tick-borne diseases (See Appendix - II), the five tick-borne diseases that are tracked in all Public Health Databases, nation-wide, are:

Lyme Disease,, Babesiosis, Ehrlichiosis (HGA & HME), Tularemia and Rocky Mountain Spotted Fever

Data relating to the confirmed number of specific tick-borne cases in Suffolk County was obtained from the New York State Department of Health's (NYS DOH) Communicable Disease Electronic Surveillance System (CDESS) database. Data were also obtained from the Centers for Disease Control (CDC) regarding reported tick-borne disease cases in other states, including New York State.

The CDC has defined three classifications (See Appendix IV) for data that are maintained for disease tracking purposes in Public Health databases such as CDESS. They are: *Confirmed, Probable, and Suspected.* Only confirmed cases were used in this analysis which means that the total numbers of reported (i.e., confirmed + probable + suspected) cases for tick-borne diseases in Suffolk are higher than the confirmed cases presented.

For mapping purposes, Suffolk County data were only available from CDESS over a nine year period (1997 – 2005). Data that could be queried from 1997 to 2006 for the 5 most common tick-borne diseases showed that there were a total of 6,472 confirmed tick-borne disease cases reported in Suffolk County over that 10 year period, with Lyme disease as the primary contributor. For all 5 reportable tick disease cases combined, higher than average incidence rates are observed in many east-end hamlets with an apparent decline in the incidence rates for the western portion of the County (See figure below). This is attributable to higher population densities on the western end of the county where deer and other vector habitats would seem to be lower. About 15% of the Suffolk population lives in 17 east-end villages or hamlets.



New York State (NYS) has one of the highest incidence rates for tick-borne diseases in the nation. In NYS, over a ten year period (1997 to 2006), there were 23,290 cases for all CDC notifiable communicable diseases (for which there are about 80). Approximately 24% of the total number of communicable diseases that were reported to NY State DOH by Suffolk County was Lyme disease cases in those 10 years. Babesiosis comprised 3% of the NYS total, followed by Ehrlichiosis (0.4%), RMSF (0.1%) and Tularemia (0.01%). Suffolk County data over the last 10 years show that 45% of all 662 confirmed cases for Babesiosis and 40% of all 92 cases of Ehrlichiosis reported were in the 65 or older age-group. For Lyme disease, 24% of the 5,690 total cases reported in Suffolk over a 10 year period were in the 65 year and older age-group, with 15% of the total Lyme cases in the 50 to 59 year-old group.

Other Summary Data: Summary maps are also presented, separately, for each of the 5 most common tick-borne diseases, to show recent reportable cases by geographic (zip-code) areas within Suffolk County from 2000 to 2005. Those maps also confirm that Lyme disease, Babesiosis and Ehrlichiosis are endemic in the eastern half of the County, more so on the South Fork.

CDESS allowed Suffolk County data to be compared with Nassau County data but only over a 4 year period. From 2003 to 2006, the total number of confirmed Lyme disease cases in Suffolk County was 5 times higher that that in Nassau County whereas for the confirmed cases of Ehrlichiosis, it was about 13 times higher than Nassau County. Over those 4 years, the total number of confirmed cases of Babesiosis in Suffolk County was almost 23 times higher than Nassau County and constituted 75% of all confirmed cases reported in NY State

Data for the five tick-borne diseases in 2006, mapped separately, are consistent with the 6 year summary map shown above.

Recommendations:

- Establish a tick surveillance program, whereby ticks can be collected and tested for specific tick-borne diseases throughout the County. GIS maps should be prepared as this analysis is performed and correlated (i.e., map overlaid) with current human tick-borne disease cases. Funding would probably be required for large scale tick testing.

- Enhance Public Education. Target seniors and children for enhanced Public Education, especially on the East End of the County. Include newly emerging tick-borne diseases, such as *Bartonellosis* and STARI in that education process and for all Suffolk County citizens (see **Section 8**).

- After a preliminary tick surveillance and human disease case surveys are completed, consider targeted treatment (with EPA approved minimum risk pesticides or bio-pesticides) in specific villages or hamlets where Lyme disease, Ehrlichiosis and Babesiosis are higher than the County-wide average (i.e., the west end of Suffolk). Use licensed and trained commercial exterminators affiliated with the Long Island Pest Control Association (see **Section 6**).

Section 3: Pesticide Related Tick Management

Pesticides are routinely used throughout Suffolk County to protect people and their pets from ticks and tick-borne diseases. For more than two decades, people living and working in tick-infested areas of Suffolk County have increasingly applied pesticides as a safeguard against ticks and the debilitating diseases they carry and transmit to humans. A reflection of the widespread concern about the public health threat posed by ticks in Suffolk County is contained in a letter dated 1987, in which the Regional Chief Scientist for the United States Department of the Interior, National Park Service, North Atlantic Region, requested permission of the NYS Department of Environmental Conservation to apply *DAMMINIX® Tick Tubes* on Fire Island. That letter states, in pertinent part, "Although we normally avoid pesticide use, the high incidence of Lyme disease among our employees and the families there makes such use necessary in selected areas for the safety of employees and visitors" (Soukup 1987). More than 20 years later finds that Fire Island and other areas of Suffolk County continue to be infested with blacklegged (deer) ticks (*Ixodes scapularis*) and lone star ticks (*Amblyomma americanum*), and that they continue to pose a serious public health threat to Suffolk County residents.

Tick densities are recognized as being high enough to provide optimal conditions for conducting tick management research. Fire Island, for example, has served as a testing site for all three of the host-targeted tick management technologies that have been developed to date - *DAMMINIX® Tick Tubes/A Tick Toxicant*, *MAXFORCE TICK SYSTEM™*, and *Y-TEX 4-Poste's Tickicide*. However, the broadcast spraying of relatively large volumes of liquid tickicides over entire properties throughout Suffolk County remains the prime control option selected to manage ticks. While the use of personal and companion animal repellents, and other tickicides designed for use on pets may offer some level of safeguard against ticks and the associated tick-borne diseases, they do not address the underlying problem of tick abundance in the outdoor environment.

Pesticide-related tick management activities should focus on supporting judicious use of the most effective and least toxic tickicides in a manner which minimizes exposure to nontarget organism (humans, wildlife, and pets) to the greatest extent possible. These efforts should be used in combination with control strategies that reflect a conformance to the principles and practices of Integrated Pest Management (IPM).\

Recommendations:

- Support funding for the '4-Poster' Tick Management Technology Study which is being conducted in only two areas of New York State – Fire Island and Shelter Island, both of which are in Suffolk County . This host-targeted technology holds promise of reducing the density of ticks, the human incidence of tick-borne diseases, and Furthermore, it is expected that this technology will reduce human and other non-target animal exposure to pesticides since the '4-Poster' system provides less opportunity for exposure than broadcast spraying and personal repellents and uses less pesticides than presently being used to combat tick populations in Suffolk County.

- Arrange for the Suffolk County Department of Public Works' Division of Vector Control (SCDPW-DVC) to contribute manpower and other resources to assist with the '4-Poster' Tick Management Technology Study. Such involvement would provide the County with first-hand experience relating to a new technology that may prove to be an environmentally-preferable and effective means of controlling ticks. It would also be consistent with the Suffolk County Charter, which states that the SCDPW-DVC is responsible for the suppression of mosquitoes, ticks and other arthropods which are vectors of human disease and require public health action for control.

Section 4: Host and Habitat Management

Measures to reduce tick populations over a large geographic area are not currently practicable or safe. Individual homeowners can use several measures to reduce tick numbers in the vicinity of their homes. Discouraging hosts by practicing cleanliness, debris removal, and not feeding wildlife can all help to reduce hosts near homes. Deer fencing may be also be used to discourage hosts. Fencing may be also be used to discourage hosts. However, fencing that prevents deer from accessing a yard or garden area forces deer into smaller areas potentially resulting in other problems such as greater damage to the forest ecosystem or increase deer/vehicle accidents. Landscaping with deer resistant plants is a more effective mechanism at preventing deer from entering the area around homes.

Home owners interested in reducing ticks around their homes should refer to the *Tick Management Handbook* prepared by the Connecticut Agricultural Experiment Station in New Haven, CT. This handbook provides practical tips for the home owner to manage their landscapes in order to reduce tick populations on their property. The Handbook suggests the following approaches:

- Keep grass mowed
- Remove leaf litter, brush and weeds at the edge of the lawn.
- Restrict the use of groundcover, such as pachysandra in areas frequented by family and roaming pets.
- Remove brush and leaves around stonewalls and wood piles.
- Discourage rodent activity. Cleanup and seal stonewalls and small openings around the home.
- Move firewood piles and bird feeders away from the house.

- Manage pet activity; keep dogs and cats out of the woods to reduce ticks brought back into the home.
- Use plantings that do not attract deer or exclude deer through various types of fencing.
- Move children's swings sets and sand boxes away from the woodland edge and place them on a wood chip or mulch foundation.
- Trim tree branches and shrubs around the lawn edge to let in more sunlight.
- Adopt hardscape and xeriscape (dryer or less water demanding) landscaping techniques with gravel pathways and mulches. Create a 3-foot or wider wood chip mulch, or gravel border between lawn and woods or stonewalls.
- Consider areas with decking, tile, gravel and border or container plantings in areas by the house or frequently traveled.
- Widen woodland trails.
- Consider host products to kill ticks on deer or rodent hosts.
- Consider a pesticide application as a targeted barrier treatment.

The above techniques serve more at modifying human behavior and the human environment in order to lessen its ability to for survival of ticks and serving as home for various tick hosts.

Recommendations:

- Work to establish county-wide deer management to a sustainable ecological carrying capacity
- Encourage more hunters
- Maximize the amount of County-owned property open and available to hunters
- Work with other local, state, federal land owners to open lands to hunting
- Develop a location for donating deer for butchering and subsequent transfer to homeless shelters
- Continually review research and opportunities for using new technology that allows host management for purposes of tick reduction
- Adopt or adapt *Connecticut's Tick Management Handbook* and encourage homeowners to manage their landscape to reduce the presence of ticks around their homes. It may be obtained at:

http://www.ct.gov/caes/lib/caes/documents/special_features/TickHandbook.pdf

Section 5: Public Education

From its inception, the Tick Management Task Force (TMTF) realized that education is the most effective strategy to prevent and control tick-borne diseases in Suffolk County. The Suffolk County Department of Health Services has a Public Education professional who speaks to various groups about Lyme disease, Rabies, West Nile Virus and other CDC

communicable diseases. The Education Sub-Committee believes that those efforts should be escalated, especially for tick-borne diseases. Other strategies to enhance public education regarding tick-borne diseases are listed below.

Recommendations:

- Enhance Public Education County-wide using the existing SCDHS Public Health Educator. Target groups where tick-borne diseases are higher than the County-wide average, especially the Senior Citizen Population and children on the East End of the County (See **Section 2**).

- Update the Public Health Website for Tick Diseases to include information on prevention, disease awareness, tick identification and other general information. Provide links to other websites and resources listed at the end of this section. A link to the TMTF standalone Booklet (i.e., the Executive Summary of this report) should also be available.

- Update the SCDHS Lyme Disease brochure to include new information on emerging tick-borne diseases, the (to be developed) PH Website Link and the existing Public Health Hot-line.

- Prepare or use an existing Video on tick Disease Prevention for Suffolk Local Access Channel 18.

- For Items 2, 3 and 4 above, include information on how to secure the *Connecticut Tick Management Handbook* which encourages homeowners to manage ticks using an integrated approach, while being environmentally responsible.

Section 6: Options for Tick Control in Suffolk County

Under the County Charter, the Suffolk County Department of Public Work's Division of Vector Control is "*responsible for the suppression of mosquitoes, ticks and other arthropods which are vectors of human disease and require public action for control*". Ticks are unquestionably "*vectors of human disease*". It is a matter for elected County officials to determine if "public action for control" is required.

At present, Vector Control normally limits its control activities to mosquitoes. The fundamental reason Vector Control has not undertaken tick control is that, to this point, it has not appeared that cost-effective and environmentally sound technologies were available to suppress ticks on a landscape basis. However, mosquito control and tick control both represent problems in Integrated Pest Management (IPM). Provided that the appropriate resources are made available, Vector Control is organized in a manner that would allow the addition of certain tick control activities. The Department of Health Services would have to play an important role in tick surveillance and direction of the control program(s) through its Arthropod Borne Disease Laboratory.

Any County-wide program implemented by Vector Control would probably focus on the control of ticks themselves, as part of an overall County IPM effort. Vector Control lacks the authority and expertise to implement important IPM measures related to host management and education. Host management relates to wildlife issues such as deer population control that are clearly within the mission and authority of natural resource agencies such as NYS DEC

and the various Town conservation agencies, and it would not be appropriate for Vector Control to operate in this area.

While Vector Control operates in the area of habitat management for mosquito control, by participating in wetlands management activities, there seems little opportunity for similar work in tick control. Education and public outreach activities, including encouraging the proper use of repellents and other personal protection, are a Department of Health Services responsibility, although, as in mosquito control, Vector Control could assist in this effort.

Recommendations:

- Implement a comprehensive survey of the abundance and species composition of ticks on a County-wide scale that could be used to identify with precision the areas where control might be needed. While we generally know East End areas, especially Shelter Island, have the highest incidence of tick-borne disease, far more precision is needed to design control measures.

- Data is lacking on the infection rates of ticks, and the extent to which that might vary over time and space.

- Deer are a critical part of the picture, but again, precise information is lacking in time and space. The same can be said about other vectors of tick diseases such as rodents and birds.

- Continue with the 4-Poster Project in order to acquire necessary data.

Section 7: Unresolved Task Force Issues and Path Forward

This Section addresses four (4) unresolved issues that were beyond the scope of the Task Force. They are: (1) the emergence of new tick-borne diseases such as Bartonella and STARI (Southern Tick Associated Rash Sickness) that are not yet tracked in CDC or Public Health databases, (2) a new Lyme vaccine that is being developed, (3) several medial issues that are listed below and , (4) working with reputable groups in the future such as the Long Island Pest Control Association, the Nassau-Suffolk Landscape Gardeners Association, professional exterminators and the Cornell Cooperative Extension. The Medical Issues that emerged from Public Hearings were as follows:

- Establish a public health position to examine misdiagnosis and treatment of patients with Lyme and other tick diseases.

- Future Committees need to look at other medical issues such as long-term care, psychiatric issues and pediatric cases.

- The need for better diagnostic tools (as cases often go undiagnosed). Enhanced education for medical providers and health insurers is needed.

- It is likely that the treatment duration needs to be re-examined. Antibiotic treatment for Lyme is 28 days but each person is different – maybe the duration needs to be longer for some individuals.

- Persons getting yearly physicals should ask for a Lyme disease test.

TASK FORCE SUMMARY AND CONCLUSIONS

The TMTF reached the following major conclusions:

- The incidence of tick-borne disease in Suffolk County is far higher than in most jurisdictions in New York State, especially for Lyme disease.
- The disease burden imposed by tick-borne disease in Suffolk County is comparable to many other serious public health threats.
- While there are some uncertainties, the incidence of tick-borne disease is clearly higher in eastern Suffolk, particularly on the South Fork.
- Deer represent a key host for the ticks of greatest public health importance. Ticks that are feeding on deer are at the point in their life cycle at which they are most susceptible to control. The issue of tick-borne disease is inextricably linked to deer overpopulation, among other factors.
- Any strategy for tick control must reduce the number of deer and/or the number of ticks on deer to have any chance of success.
- Any efforts directed at tick control must be part of an integrated program that includes personal protection, public education, including habitat and host management.
- Encouraging the use of personal protection and improved landscape practices is part of the traditional missions of the NY State Department of Health and the Suffolk County Department of Health Services. This education must be escalated.
- Host *management* (deer population control) is within the jurisdiction of the NY State Department of Environmental Conservation and other natural resources agencies.
- Tick *control* is within the mission of Suffolk County Department of Public Work's Division of Vector Control, as outlined in the County Charter.
- While Vector Control has the organizational structure and facilities suitable for conducting a tick control program, technology and resources for the effort are currently lacking.
- Current literature and the experience of other jurisdictions suggest that the 4-Poster system may be a viable technology for tick control under some circumstances. However uncertainties exist as to its likely effectiveness and acceptability under Suffolk County conditions.
- The study of the 4-Poster system that is currently underway should provide most of the necessary answers as to the practicality and acceptability of using this system in Suffolk County.
- There is sufficient information to document severe tick problems in some parts of the County. More detailed and comprehensive surveys of tick populations in the County are needed to design an appropriate, County-wide program, should one be implemented.

Section

1

Ilia Rochlin (Lead Author) and Dr. Scott Campbell

TICK BIOLOGY AND ECOLOGY WITH SPECIAL REFERENCE TO SUFFOLK COUNTY

EXECUTIVE SUMMARY

This report reviews the biology and ecology of three medically important tick species in Suffolk County: American dog tick (*Dermacentor variabilis*), the lone star tick (*Amblyomma americanum*), and the blacklegged tick (*Ixodes scapularis*) using peer reviewed articles published in scientific journals, major textbooks in tick biology, and government publications. The environment affects tick populations through habitat and host species. These interactions, in turn, drive the dynamics of tick- borne diseases, several of which are present in Suffolk County. Although considerable knowledge on ticks and tick-borne diseases has been accumulated in the scientific literature, location specific data for this county are scarce or non- existent underscoring the need for a long term tick research and surveillance program of medically important tick species of Suffolk County.

Recommendations:

- Suffolk County should consider establishing a countywide tick surveillance program by utilizing and augmenting existing expertise and capabilities in the DHS Arthropod-Borne Disease Laboratory and DPW Division of Vector Control.

- Suffolk Country should promote further examination on the local tick biology, ecology, distribution, and disease transmission by the relevant State (Arthropod Borne Disease Program) and Federal (the Centers for Disease Control and Prevention) agencies as well as other interested parties such as educational institutions.

- A tick management program should be based on the need for tick control and the surveillance results of tick populations and associated tick-borne pathogens.

I - Introduction: Tick Species of Medical Importance in Suffolk County

Ticks, mites, and spiders comprise the class Arachnidae which, together with their more distant relatives, insects and crustaceans is included in the phylum Arthropoda. Ticks and mites are distinguished from each other primarily by their size and form a unique group, Acari. All tick species need blood meals for development and reproduction, and thus are classified as external parasites of mammals, birds, reptiles, and amphibians. In Suffolk County, all tick species of public health importance belong to the family Ixodidae, or hard ticks, named after the tough outer shell (or exoskeleton). To date, the three medically important species are the American dog tick (*Dermacentor variabilis*), the lone star tick (*Amblyomma americanum*), and the blacklegged tick (*Ixodes scapularis*). The deer tick (*Ixodes dammini)* of the northeastern US had been described in the scientific literature predominantly between 1979 and 1993; however, it was shown genetically to be the same species as the blacklegged tick (*Ixodes scapularis*; Oliver et al., 1993). Due to this scientific evidence, the Entomological Society of America (the leading scientific authority on entomological classification) determined blacklegged tick (*Ixodes scapularis*) to be the correct classification, and therefore it will be used in this document. The biology, ecology, and disease transmission by these three tick species are summarized in Table 1.

Table 1. Tick species of medical importance in Suffolk County, NY: summary of the basic ecology and the associated tick-borne diseases

	American Dog Tick	Lone Star Tick	Blacklegged Tick
Primary habitat	Old field, grassy, brush	Disturbed/second growth woodland, shrubs	Forest edge, woodland, shrubs
Key hosts:			
-larvae/nymphs	Meadow vole	Deer, turkey	White-footed mouse
-adults	Raccoons, opossums, foxes	Deer	Deer
Alternative hosts:			
-larvae/nymphs	Rodents	Many	Many
-adults	Medium-sized mammals	Many	Medium-sized mammals
Main tick-borne disease/*wildlife reservoir*	Rocky Mountain spotted fever (RMSF)/*rodents, rabbits, transovarial transmission*	Ehrlichiosis (HME)/*Deer*	Lyme disease/ *White-footed mouse*
Other tick-borne diseases/*wildlife reservoir*	Tularemia/*Rabbits*	Southern Tick Associated Rash Illness (STARI)?/Deer?	Babesiosis and Anaplasmosis (HGA)/*White-footed mouse*

II – Tick Biology and Life Cycle

Ticks can be a vector, or an organism capable of transmitting pathogens, such as viruses, bacteria, or protozoans while feeding on an animal species or a host. A host, in which a pathogen is maintained in nature, is called a reservoir for that particular pathogen. Each tick species has a particular host or host species, and this host range defines the host specificity of the tick species.

All ticks go through four stages in their life cycle (Fig.1), the egg, the larva (plural larvae), the nymph, and the adult (Sonenshine, 1991). The three active stages seek out a host, feed, and drop off to develop or lay eggs in the case of an adult female. This pattern is known as a 3-host life cycle. Under Suffolk County's climatic conditions, the life cycle is usually completed within a 2- year period.

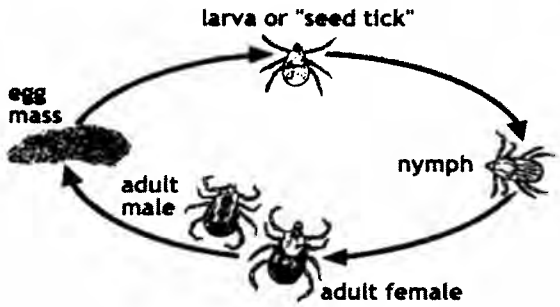


Figure 1. Generalized life cycle of ixodid tick

Tick species and their stages have typical seasonal periods when they search for hosts in order to obtain a blood meal. For dog ticks (Fig. 2A), the overwintered and newly emerged adults often overlap in the spring resulting in a continued host seeking behavior in late spring to summer in the southeastern US (Sonenshine, 1993). Although no published information is available on the seasonal activity of the lone star ticks in our region, it is presumed similar to that of the more southern locations (Fig. 2B). In Missouri, adult lone star ticks reach their peak in late spring, followed by nymphs in early to mid summer, and larvae in late summer through mid fall (Kollars et al., 2000). Adult blacklegged ticks in Westchester Co., NY begin their feeding activity in fall (Sonenshine, 1993) and will continually seek host throughout the winter when the daily temperatures are above 40^{0}F (Duffy & Campbell, 1994). After a period of limited activity, the feeding is resumed in the spring producing a typical bimodal pattern. Blacklegged tick nymphs are typically active between May and August followed by larvae in August and September (Fig. 2C).

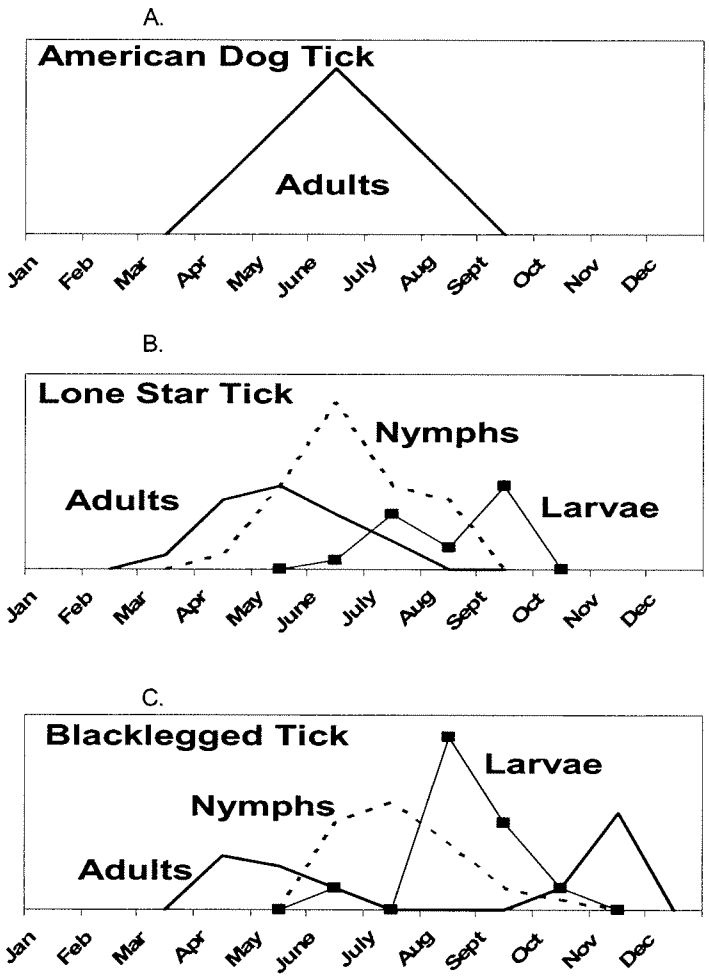


Figure 2. Seasonal activity of different tick stages. (A) American Dog Tick (*Dermacentor variabilis*) in Virginia (Sonenshine, 1993), (B) the Lone Star Tick (*Amblyomma americanum*) in Missouri (Kollars et al., 2000), and (C) the Blacklegged Tick (*Ixodes scapularis*) in Westchester Co., NY (Sonenshine, 1993).

III – Tick Ecology : Host, Habitat, Distribution and Disease Transmission

The ability of each tick species to effectively transmit pathogens depends largely on their physiology and ecology. Tick physiology and genetics govern vector competence, i.e. whether a particular tick species or population can acquire, maintain and transmit the pathogen (listed in Table 1). Ecological factors, such as host preferences, tick and host abundance and activity, habitat, and other environmental factors are important for determining the role of each tick species in the transmission of pathogens. Since each tick species has unique ecological requirements, these will be described separately for each of the three medically important species (the summary is provided in Table 1).

A. The American Dog Tick (*Dermacentor variabilis*)

Larvae and nymphs of the American dog tick are not commonly collected apart from their rodent hosts - meadow voles, white-footed mice, and Norway rats implicated as an important host in Suffolk County (Good, 1973; Sonenshine, 1993). Medium-sized wild mammals such as raccoons, opossums, and foxes serve as the main host species for adult dog ticks in Westchester County, NY (Fish & Dowler, 1989). The adults also readily feed on humans and domestic animals. Before the proliferation of the blacklegged tick in the 1970s, the American dog tick was regarded as "the only New York State species… that commonly attacks man" (Jamnback, 1969). In 1971, this species was also the most abundant of the three tick species; (Good, 1973) collected approximately 4 times more dog ticks than blacklegged ticks during a survey near Montauk. In the last three decades, only scant surveillance and research data on the American dog tick in Suffolk County have been accrued, due possibly to a perceived or actual decline in the dog tick populations, decline in incidence of Rocky Mountain spotted fever, and the rise of Lyme disease. The American dog tick is found in more open areas such as old overgrown fields, forest edge, margins of forest trails, and grasslands along the coast in Suffolk County (Benach et al., 1977). The significant environmental change as result of rapid urbanization and reforestation of the open areas in Suffolk County may have reduced the type of habitat and other ecological components suitable for dog tick populations, although lack of surveillance data makes it impossible to validate this assertion. The causative agent of Rocky Mountain spotted fever, *Rickettsia rickettsii*, the most common pathogen transmitted by the American dog tick, is maintained in nature by a wide variety of mammalian host species, as well as by transovarial transmission (i.e. from an infected female tick to the eggs in the ovary, thus passing it on to next generation).

B. The Lone Star Tick (*Amblyomma americanum*)

The first published record of the lone star tick (an established southern US species) in Suffolk County was a 1971 survey done near Montauk, where 16 adults and 3 nymphs were collected during one season (Good, 1973), although this tick species may have been present on Long Island as early as 1954 (Jamnback, 1969). The previous and the earliest available survey from 1947 did not find the lone star tick in the same general area (Anastos, 1947). By late 1980s, the lone star tick was widespread in the eastern part of Suffolk County and on Fire Island (Ginsberg et al., 1991). White-tailed deer are the most important host for all stages of lone star ticks (Childs & Paddock, 2003; Kollars et al., 2000; Means & White, 1997). The primary hosts of lone star larvae and nymphs also include turkeys, but not rodents (Kollars et al., 2000); wild turkey may be another key host species for the lone star ticks in New York State (Means & White, 1997). The adults feed on a wide variety of birds, mammals, and even reptiles (Goddard & Norment, 1985).

The lone star tick is a woodland species adapted to forested habitat, especially second growth forest of a "scrub-brush" type such as pine barrens (Childs & Paddock, 2003; Sonenshine, 1993). However, they can survive and thrive under different environmental conditions as long as their hosts (white-tailed deer) and protective vegetation are present (Sonenshine, 1993). This tick species employs both "ambushing" and "hunting" modes for finding its hosts, reportedly crawling as far as 70 feet in the process (Sonenshine, 1993) thus making it possible for 4 men to collect 4086 lone star ticks without moving during a period of one day (Childs & Paddock, 2003). Not surprisingly, the lone star tick is the most common tick species found attached to humans in southeastern and mid-Atlantic US (Merten & Durden, 2000) and is considered the most important tick species affecting the quality of life in much of its range (Childs & Paddock, 2003).

Despite ample anecdotal evidence suggesting a rapidly expanding range and increasing population levels of the lone star tick in eastern and southern Suffolk County, there is dearth of recent scientific studies and surveillance data on this species. The surveys done on Fire Island between mid-1980s and mid-1990s indicated a dramatic increase in the tick's density attributed to increasing deer abundance and high survival of lone star ticks in various habitats (Ginsberg & Zhioua, 1996). White-tailed deer is also currently recognized as the only competent and sufficient reservoir for *Ehrlichia chaffeensis*, the causative agent of human monocytic ehrlichiosis, or HME (Childs & Paddock, 2003), which may explain the prevalence of this pathogen in Suffolk County lone star tick populations. The infection rate of adult ticks with *Ehrlichia chaffeensis* averaged 12.5% with a range of 5.4% on Fire Island to 27% on Shelter Island (Mixson et al., 2004), which was similar or higher than the infection rate in other endemic areas where the disease was present (Childs & Paddock, 2003). Also, deer appear to be a reservoir for another pathogen (*Borrelia lonestari*) thought to cause human disease - Southern Tick Associated Rash Illness or STARI (Moore et al., 2003).

C. The Blacklegged Tick (*Ixodes scapularis*)

In New York State, the blacklegged tick was not considered a serious threat to public health or a medically important species before the discovery of Lyme disease in 1970s (Jamnback, 1969). In Montauk area, only about 15 blacklegged ticks were collected in the summer of 1947 (Anastos, 1947), while the species represented only about 6% (n=244) of the total catch in 1971 survey (Good, 1973); however, an incorrect identification could not be ruled out (Sonenshine, 1993). The blacklegged ticks are found at forest edge (most notably in residential woodlots), woodlands, especially along trails, and shrubby areas (Sonenshine, 1993). On Fire Island, adult ticks were collected most often in the woods and from shrubs, especially along the trails, while larvae and nymphal ticks occurred most often in woodland leaf litter (Ginsberg & Ewing, 1989). Similarly, the abundance of nymphal stages was greatest in woodlands and forest edge followed by vegetation located near freshwater on Shelter Island; grassy areas and yards contained few tick, while none were collected on beaches and salt marsh (Duffy et al., 1994b). In terms of geographic distribution in Suffolk County the blacklegged tick population is presumed to increase from west to east, although studies suggested that the tick abundance was rather related to the size of a natural area, i.e. large parks tend to have proportionately more ticks (Duffy et al., 1994a). Clearly, more current tick surveillance information is needed to map the blacklegged tick density and population range in Suffolk County.

One of the most prominent aspects of the blacklegged tick ecology is the broad range of host species attacked by larvae and nymphs: at least 31 mammalian species and 49 bird species have been recorded; both stages readily feed on humans (Anderson, 1989). The importance of host species is usually proportionate to their numbers. Thus, white-footed mouse is considered the principal host of larval and nymphal blacklegged ticks in northeastern US due

to its great abundance in the tick's habitat (Piesman & Spielman, 1979), which certainly appeared to be the case on Fire Island (Ginsberg & Ewing, 1989). Unlike the larvae and the nymphs, adult blacklegged ticks parasitize a more limited range of host species, mostly large to medium sized mammals, rarely birds, and almost never rodents (Anderson, 1989). White-tailed deer is considered an essential host in the northeastern US (Anderson, 1989; Piesman et al., 1979), while horses, dogs, raccoons, and opossums can also harbor blacklegged ticks (Fish & Dowler, 1989; Good, 1973). On average, female adult blacklegged ticks in Seatuck preserve (Islip) were found in much greater numbers on deer (n=38.3), compared to cats (n=8.1), opossums (n=1.2), or raccoons – the most abundant host (n=0.7); white-tailed deer also hosted about 94% of all the ticks collected demonstrating its preeminence for the tick's reproduction (Wilson et al, 1990). To further support this assertion, (Duffy et al., 1994a) compared 22 Long Island sites with and without deer and found a 93% reduction for nymphs and 98% reduction for larvae in areas where deer were absent.

Tick-host relationship of this species largely governs the ecology of Lyme disease. The prime reservoir for the causative agent, *Borrelia burgdorferi*, is white- footed mouse (Anderson, 1989). Other competent host species including rodents, rabbits, and raccoons are likely to play only a minor role (Anderson, 1989; Sonenshine, 1993), while white-tailed deer are incapable of transmitting *Borrelia burgdorferi* to blacklegged ticks (Telford et al., 1988). Increased prevalence of *Borrelia burgdorferi* in white-footed mice is due to the emergence of nymphal ticks prior to that of larval ticks (Fig. 2C). Nymphs, which are already carrying *Borrelia burgdorferi*, infect white-footed mice that, subsequently, are fed upon by larval ticks resulting in a large proportion of infected larvae. In turn, these larvae molt into nymphs that are primarily responsible for Lyme disease transmission to both man and animals (Sonenshine, 1993).

Two additional human pathogens are transmitted by blacklegged ticks in a cycle similar to that of Lyme disease (Barbour, 1998). Rodents, such as white footed mice, serve as the primary reservoirs for a parasite, *Babesia microti*, which causes babesiosis. Another disease previously known as human granulocytic ehrlichiosis (HGE) was shown to be caused by *Anaplasma phagocytophilum* and thus recently renamed human granulocytic anaplasmosis (HGA). White-footed mice are the major wildlife reservoir for this pathogen, although other mammals including deer can be infected (Dumler et al., 2005).

The increase in Lyme disease and other infections transmitted by blacklegged ticks has paralleled the explosive growth of deer population in North America (Barbour, 1998). White-tailed deer serves as an amplifier host responsible for the blacklegged tick's high population levels, dispersal, and intensified spread in recent decades (Sonenshine, 1993).

IV – Conclusions

Three tick species of medical importance in Suffolk County have unique habitat requirements, host associations, and public health impacts. Knowledge and understanding of these factors are essential for a successful campaign aimed at reduction of human tick-borne infections. Currently, only very limited or no surveillance data are available for most localities in Suffolk County. There is also a dearth of recent studies on the ecology of ticks and tick-borne diseases in this county. Surveillance and monitoring are a central part of Integrated Pest Management (IPM) approach, the modern method of vector control emphasizing a combination of different practices to achieve this goal with a minimum environmental impact. . More resources are urgently needed to implement a tick surveillance program in order to monitor short and long term changes in tick populations, pathogen prevalence, and the public health risk to county residents, as well as to adequately assess the outcome of any tick management measures.

V – References

Anastos, G. (1947). Hosts of certain New York ticks. *Psyche, 54,* 178-180.

Anderson, J. F. (1989). Ecology of Lyme disease. *Connecticut Medicine, 53,* 343-346.

Barbour, A. G. (1998). Fall and rise of Lyme disease and other Ixodes tick-borne infections in North America and Europe. *British Medical Bulletin, 54,* 647-658.

Benach, J. L., White, D. J., Burgdorfer, W., Keelan, T., Guirgis, S., & Altieri, R. H. (1977). Changing patterns in the incidence of Rocky Mountain spotted fever on Long Island (1971-1976). *American Journal of Epidemiology, 106,* 380-387.

Childs, J. E. & Paddock, C. D. (2003). The ascendancy of *Amblyomma americanum* as a vector of pathogens affecting humans in the United States. *Annual Review of Entomology, 48,* 307-337.

Duffy, D. C. & Campbell, S. R. (1994). Ambient air temperature as a predictor of activity of adult *Ixodes scapularis* (Acari: Ixodidae). *Journal of Medical Entomology, 31,* 178-180.

Duffy, D. C., Campbell, S. R., Clark, D., DiMotta, C., & Gurney, S. (1994a). *Ixodes scapularis* (Acari: Ixodidae) deer tick mesoscale populations in natural areas: effects of deer, area, and location. *Journal of Medical Entomology, 31,* 152-158.

Duffy, D. C., Clark, D. D., Campbell, S. R., Gurney, S., Perello, R., & Simon, N. (1994b). Landscape patterns of abundance of *Ixodes scapularis* (Acari: Ixodidae) on Shelter Island, New York. *Journal of Medical Entomology, 31,* 875-879.

Dumler, J. S., Choi, K., Garcia-Garcia, J. C., Barat, N. S., Scorpio, D. G., Garyu, J. W. et al. (2005). Human granulocytic anaplasmosis and *Anaplasma phagocytophilum. Emerging Infectious Diseases, 11,* 1828-1834.

Fish, D. & Dowler, R. C. (1989). Host associations of ticks (Acari: Ixodidae) parasitizing medium-sized mammals in a Lyme disease endemic area of southern New York. *Journal of Medical Entomology, 26,* 200-209.

Ginsberg, H. S. & Ewing, C. P. (1989). Habitat distribution of *Ixodes dammini* (Acari: Ixodidae) and Lyme disease spirochetes on Fire Island, New York. *Journal of Medical Entomology, 26,* 183-189.

Ginsberg, H. S., Ewing, C. P., O'Connell, A. F. Jr., Bosler, E. M., Daley, J. G., & Sayre, M. W. (1991). Increased population densities of *Amblyomma americanum* (Acari: Ixodidae) on Long Island, New York. *Journal of Parasitology, 77,* 493-495.

Ginsberg, H. S. & Zhioua, E. (1996). Nymphal survival and habitat distribution of *Ixodes scapularis* and *Ambylomma americanum* ticks (Acari: Ixodidae) on Fire Island, New York, USA. *Experimental & Applied Acarology, 20,* 533-544.

Goddard, J. & Norment, B. R. (1985). A guide to the ticks of Mississippi. Bulletin No.935, Mississippi Agricultural and Forestry Experimental Station.

Good, N. E. (1973). Ticks of eastern Long Island: notes on host relations and seasonal distribution. *Annals of the Entomological Society of America, 66,* 240-243.

Jamnback, H. (1969). Bloodsucking flies and other outdoor nuisance arthropods of New York State. Memoir No.19, State Museum and Science Service, The State Education Department, Albany, NY.

Kollars, T. M., Oliver, J. H. Jr., Durden, L. A., & Kollars, P. G. (2000). Host associations and seasonal activity of *Amblyomma americanum* (Acari: Ixodidae) in Missouri. *Journal of Parasitology, 86,* 1156-1159.

Means, R. G. & White, D. J. (1997). New distribution records of *Amblyomma americanum* (Acari: Ixodidae) in New York State. *Journal of Vector Ecology, 22,* 133-145.

Merten, H. A. & Durden, L. A. (2000). A state-by-state survey of ticks recorded from humans in the United States. *Journal of Vector Ecology, 25,* 102-113.

Mixson, T. R., Ginsberg, H. S., Campbell, S. R., Sumner, J. W., & Paddock, C. D. (2004). Detection of *Ehrlichia chaffeensis* in adult and nymphal *Amblyomma americanum* (Acari: Ixodidae) ticks from Long Island, New York. *Journal of Medical Entomology, 41,* 1104-1110.

Moore, V. A., Varela, A. S., Yabsley, M. J., Davidson, W. R., & Little, S. E. (2003). Detection of Borrelia lonestari, putative agent of southern tick-associated rash illness, in white-tailed deer (Odocoileus virginianus) from the southeastern United States. *Journal of Clinical Microbiology, 41,* 424-427.

Oliver, J. H. Jr., Owsley, M. R., Hutcheson, H. J., James, A. M., Chen, C., Irby, W. S. et al. (1993). Conspecificity of the ticks *Ixodes scapularis* and *I. dammini* (Acari: ixodidae). *Journal of Medical Entomology, 30,* 54-63.

Piesman, J. & Spielman, A. (1979). Host-associations and seasonal abundance of immature *Ixodes dammini* in southeastern Massachusetts. *Annals of the Entomological Society of America, 72,* 829-832.

Piesman, J., Spielman, A., Etkind, P., Ruebush, T. K., & Juranek, D. D. (1979). Role of deer in the epizootiology of *Babesia microti* in Massachusetts, USA. *Journal of Medical Entomology, 15,* 537-540.

Sonenshine, D. E. (1991). *Biology of Ticks.* (Volume 1 ed.) Oxford University Press, Inc.

Sonenshine, D. E. (1993). *Biology of Ticks.* (Volume 2 ed.) Oxford University Press, Inc.

Telford, S. R., Mather, T. N., Moore, S. I., Wilson, M. L., & Spielman, A. (1988). Incompetence of deer as reserviors of the Lyme disease spirochete. *American Journal of Tropical Medicine and Hygiene, 39,* 105-109.

Section

2

Dr. Sal Scarpitta, Author

Incidence of Tick-Borne Diseases in Suffolk County

PREFACE

This Section summarizes the incidence of confirmed tick-borne disease **cases** over a ten year period in Suffolk County. Confirmed cases of tick-borne diseases that are maintained on a New York State Department of Health database were used to generate color coded case-rate maps, by zip-code. There are 93 unique zip-code locations in Suffolk County.

Incidence **rates** (i.e., number of cases divided by the population size) are not calculated in this report. This is because population sizes of selected zip-code regions are not equivalent or large enough to assure a statistical level of confidence in the incidence rates that one is investigating and comparing. For example, there are 8 hamlets in Suffolk County with populations less than 1,400 person and their combined population is 5,494 persons which comprise 0.4% of the total Suffolk County population*. If there were 55 confirmed tick-borne disease cases in this sub-population, then the incidence rate would correspond to about 1% (high) whereas if there were 55 cases elsewhere in the County with a sub- population of 54,940 persons, then the incidence rate would be 0.1% (moderately low). If the County population of 1.42M persons were used to calculate annual incidence rates for the same 55 tick-borne disease cases, then the county-wide annual incidence rate would be even smaller, on the order of 0.004%. The typical annual range of confirmed tick-borne disease cases in Suffolk is currently between 50 and 500.

Color coded zip-code mapping allows for the rapid visualization of aggregate areas within the County with either *high, moderate or low* number of cases for each of the 5 common tick-borne diseases. As this report will show the incidence of tick-borne disease cases is higher on the east-end of Suffolk where about 15% of the Suffolk County population lives.

Other Geographic Areas in Suffolk County with Small Populations

Tick-borne disease cases for Gardiner's Island and Plum Island were not examined in this study because neither census tract (zip-code) data nor confirmed number of cases existed for these locations. Case rates for Fisher's Island and the two incorporated villages on Fire Island were included in this study. Fisher's Island, with a total population of 289 persons, has its own unique zip-code. For Fire Island, with a total population of 491 persons, the village of Ocean Beach has its own unique zip-code, whereas the village of Saltaire has a zip-code associated with Bay Shore.

The 2 Native American Indian tribes, the Shinnecocks and the Poospatucks, were included in this study because their geographic areas occur naturally within Southampton and Mastic hamlets, respectively. The combined populations for the 2 Indian groups are 787 persons.

*US Census 2000 data are used in this report where the Suffolk County Population = 1.42 million persons (See **Appendix-1**).

EXECUTIVE SUMMARY

Ten years of data (1997-2006) are graphically presented to show the incidence of five tick-borne diseases in Suffolk County for which a confirmed diagnosis exists. The five tick-borne diseases are:

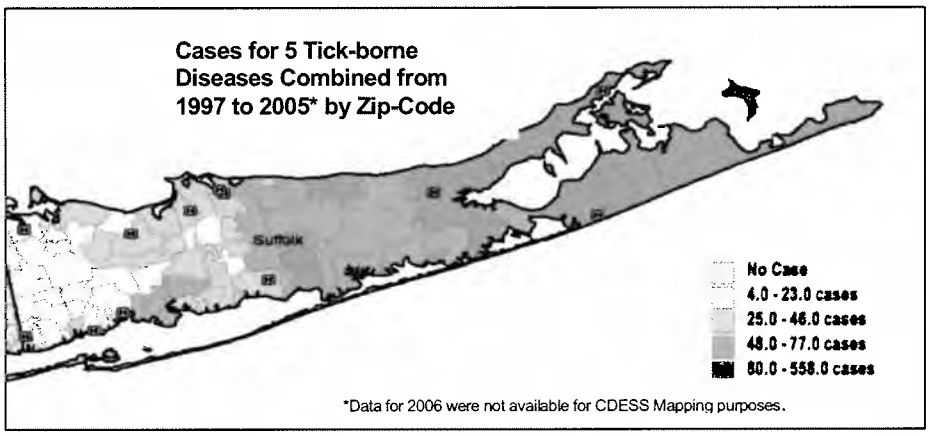
Lyme Disease, Babesiosis, Ehrlichiosis (HGA and HME), Tularemia and Rocky Mountain Spotted Fever

Data relating to the confirmed number of specific tick-borne disease cases in Suffolk County was obtained from the New York State Department of Health's (NYS DOH) Communicable Disease Electronic Surveillance System (CDESS) database. Data were also obtained from the Centers for Disease Control (CDC) regarding the incidence of tick-borne diseases in other states, including New York State.

The CDC has defined three classifications for data that are maintained in Public Health databases, such as CDESS, for disease tracking purposes. They are: Confirmed, Probable, and Suspected (See **Appendix IV**). Only confirmed cases were used in this analysis. This means that the total numbers of confirmed, probable and suspected cases for tick-borne diseases in Suffolk are higher than the confirmed cases presented.

CDESS uses color coded zip-code maps to visualize aggregate areas where confirmed disease cases appear. In Suffolk County, there are 10 towns that are comprised of 93 hamlets and/or villages, each of which has a unique zip-code.

Nine -Year Summary Data: For mapping purposes, Suffolk County data were only available from CDESS over a nine year period (1997 – 2005). Tabulated data that could be queried from 1997 to 2006 for the 5 most common tick-borne diseases showed that there were a total of 6,472 confirmed tick-borne disease cases reported in Suffolk County over that 10 year period, with Lyme disease as the primary contributor. For all 5 reportable tick disease cases combined, higher than average cases are observed in many east-end hamlets with an apparent decline in the number of cases for the western portion of the County (See figure below). This is attributable to higher population densities on the western end of the county where deer animal habitats would seem to be lower. About 15% of the Suffolk population lives in 17 east-end villages or hamlets.



New York State (NYS) has one of the highest incidence rates for tick-borne diseases in the nation. In NYS, over a ten year period (1997 to 2006), there were 23,290 cases for 80 CDC notifiable communicable diseases. Approximately 24% of the total number of all communicable diseases that were reported to NY State DOH by Suffolk County were Lyme disease cases. Babesiosis comprised 3% of the NYS total, followed by Ehrlichiosis (0.4%), RMSF (0.1%) and Tularemia (0.01%). Suffolk County data over the 10 year period that was analyzed show that 45% of all 662 confirmed cases for Babeseosis and 40% of all 92 cases of Ehrlichiosis reported were in the 60 or older age-group. For Lyme disease, 24% of the 5,690 total cases reported in Suffolk over a 10 year period were in the 60 year and older age-group, with 15% of the total Lyme disease cases in the 50 to 59 year-old group.

Other Summary Data: Maps are also presented separately, for each of the 5 most common tick-borne diseases, to show reportable cases by geographic (zip-code) areas within Suffolk County from 2000 to 2005. Those maps also confirm that Lyme disease, Babesiosis and Ehrlichiosis are endemic in the eastern half of the County, more so on the South Fork.

CDESS allowed Suffolk County data to be compared with Nassau County data but only over a 4 year period. For the years 2003 to 2006, the total number of confirmed Lyme disease cases in Suffolk County (1,569) was 5 times higher that that in Nassau County whereas for the 90 confirmed cases of Ehrlichiosis, it was about 13 times higher than Nassau County's 7 total cases. Over those 4 years, the total number of confirmed cases of Babesiosis (340) in Suffolk County was almost 23 times higher than Nassau's 15 cases and constituted 75% of all 451 confirmed cases reported in NY State

Data for the five tick-borne diseases in 2006 are consistent with the 6 year summary maps.

Recommendations

- Establish a tick surveillance program, whereby ticks can be collected and tested for specific tick -borne infectious agents throughout the County. GIS maps should be prepared as this analysis is performed and correlated (i.e., map overlaid) with human tick-borne disease cases for the new years examined Funding would be probably be required for large scale tick testing.

- After preliminary tick surveillance and human tick-borne disease case surveys are completed, consider targeted treatment (with EPA approved minimum risk pesticides or bio-pesticides) in specific villages or hamlets where Lyme disease, Ehrlichiosis and Babesiosis (and other tick-borne diseases) are higher than the County-wide average (i.e., the east end townships). Use licensed and trained commercial exterminators affiliated with the Long Island Pest Control Association (see **Section 6**).

- Enhance Public Education. Target seniors and children for enhanced Public Education, especially on the East End of the County. Include newly emerging tick-borne diseases, such as Bartonellosis and STARI in that education process and for all Suffolk County citizens (see **Section 8**).

Incidence of Tick-Borne Diseases in Suffolk County

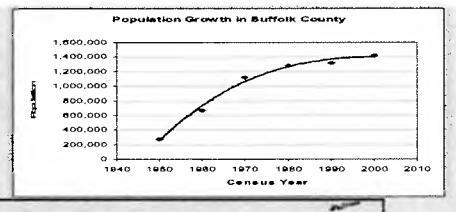
I. SUFFOLK COUNTY FACTS AND POPULATION DEMOGRAPHICS

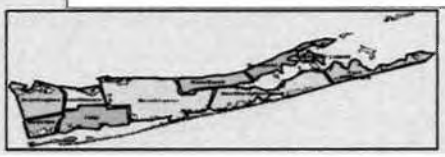
According to 2000 U.S. Census Bureau, Suffolk County has a total area of 6,146 km² (2,373 mi²) with a population of 1.42M persons. The population was projected to increase by 2% by 2004 to about 1.45M. About 38% of the total area is land (2,363 km² or 912 mi²) and 62% is water (3,784 km² or 1,461 mi²).

Suffolk County occupies the easternmost portion of Long Island, in the southeastern portion of New York State. The eastern end of the county splits into two peninsulas known as the North Fork and the South Fork. The county is surrounded by water on three sides, including the Atlantic Ocean and the Long Island Sound. The eastern end contains large bays. Suffolk County is divided into 10 towns: *Babylon, Brookhaven, East Hampton, Huntington, Islip, Riverhead, Shelter Island, Smithtown, Southampton, and Southold.* There are 93 hamlets and villages in Suffolk, with unique zip codes (**See Appendix - III**).

The population density is highest in the western most portion of the County, near Nassau, with 3,000 to 4,000 persons per square mile (See next page). It is lowest in the easternmost portion of the county (east of the William Floyd Parkway, with about 300 to 400 persons per square mile.

A. Basic Statistics



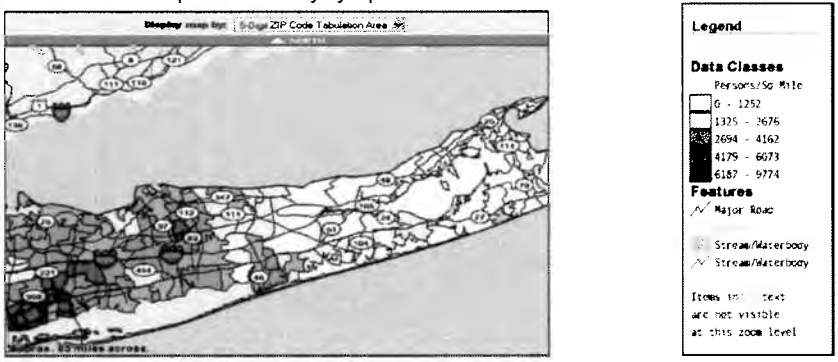


Area	
- Total	6,146 km² (2,373 mi²)
- Land	38% or 2,363 km² (912 mi²)
- Water	62% or 3,784 km² (1,461 mi²)
Population	
- (Year 2000)	1,419,369
- Avg Density	600 per km² or 1,560 per mi²

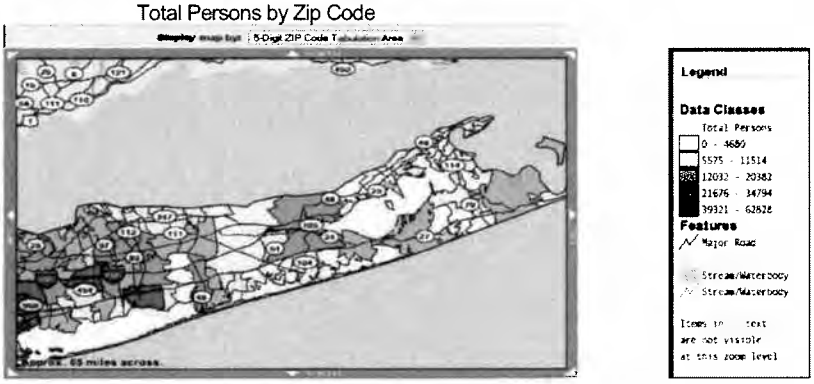
Website:
www.co.suffolk.ny.us

B. Suffolk County Population Density Maps by Land Area and Zip Code\

Population Density by Zip Code



Total Persons by Zip Code



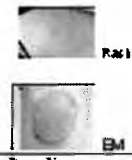
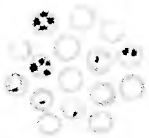
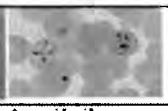
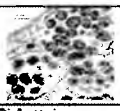
*See **Appendix-III** for all hamlet/village populations*

Incidence of Tick-Borne Diseases in Suffolk County

II. BACKGROUND

Tick physiology, biology and disease morphology were covered in Section 1 of the TMTF Final Report. **Appendix-II** lists the major tick-borne diseases and their vectors. The summary Table, below, is for the 5 tick-borne diseases examined in this report for which case data exists in the NY State 'Communicable Disease Electronic Surveillance System' (CDESS) database.

A. Summary of Tick-borne Diseases, Organisms and Vectors

Disease	Lyme Disease	Babesiosis	Ehrlichiosis Monocytic (HME)	Anaplasmosis (HGA)	Tularemia	Rocky Mountain Spotted Fever
						
Organism	*Borrelia burgdorferi*	*Babesia microti*	*Ehrlichia chaffeensis*	*Anaplasma phagocytophilum*	*Francisella tularensis*	*Rickettsia rickettsii*
Organism Photo						
Class (Group)	Spirochaetes (Bacteria)	Aconoidasida (Protists, unicellular parasite)	Rickettsias (Bacteria)	Rickettsias (Bacteria)	Gram-Negative Aerobic Rods (Bacteria)	Rickettsias (Bacteria)
Vectors	Blacklegged tick (*I scapularis*) Western blacklegged tick (*I pacificus*)	Blacklegged tick (*I scapularis*,	Lone star tick (*Amblyomma americanum*)	Blacklegged tick (*I scapularis*)	American dog tick (*D. variabilis*)	American dog tick (*D. variabilis*)
Vector Photos	Blacklegged Tick (female)		Lone Star Tick (female)			American Dog Tick(female)

Incidence of Tick-Borne Diseases in Suffolk County

III. CDC TICK-BORNE DISEASE CRITERIA AND NATIONAL PICTURE

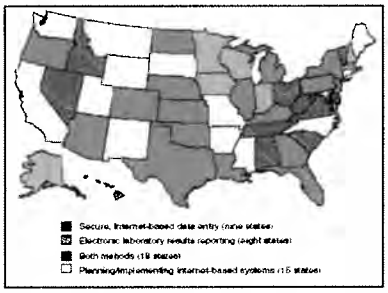
A. Notifiable Diseases, CDESS and NEDESS

In September 2000, states began receiving federal funding to plan and implement integrated electronic systems for disease surveillance. CDC, state and local health departments had recognized the importance of such systems and of uniform standards to improve the usefulness of public health surveillance and the timeliness of response to outbreaks of disease. Previously, state health departments received most case-report forms by mail and then entered the data into computer systems, sometimes weeks after the cases of notifiable disease had occurred, including cases that warranted immediate public health investigation or intervention.

Since 2000, there has been progress in improving state and local disease surveillance through secure, Internet-based data entry and automated electronic laboratory results (ELR) reporting. Both are components of the National Electronic Disease Surveillance System (NEDSS), the surveillance and monitoring component of the broader Public Health Information Network (PHIN) initiative.

A CDC notifiable disease is one for which regular, frequent, and timely information regarding individual cases is considered necessary for the prevention and control of the disease. A brief history of the reporting of nationally notifiable infectious diseases in the United States is available at: http://www.cdc.gov/epo/dphsi/nndsshis.htm. The list of nationally notifiable diseases is revised periodically. A disease might be added to the list as a new pathogen emerges, or a disease might be deleted as its incidence declines. Public health officials at state health departments and CDC collaborate in determining which diseases should be nationally notifiable. Thus, the list of diseases considered notifiable varies slightly by state. A summary of notifiable disease cases, nationally for years prior to 2004 can be found at: http://www.cdc.gov/mmwr/summary.html. The method of disease surveillance by state in 2005 is shown below. **Suffolk County** has been electronically transmitting communicable disease surveillance data directly to the NY State CDESS database since 2001. Prior to 2001, data were sent to Albany on paper or other types of electronic media and loaded into the database.

Disease surveillance, by state and method — National Electronic Disease Surveillance System, United States, April 2006



Note: See Appendix IV for CDC case definitions. Human granulocytic anaplasmosis is (HGA) and human granulocytic ehrlichiosis is (HGE).

B. Disease Incidence in the Fifty States

According to the Centers of Disease and Control (CDC), the east coast states of New York, New Jersey, Pennsylvania and Connecticut had the highest incidences of Lyme disease, nationally, over the past decade. The maps below show the geographical locations where the most common tick-borne disease cases are observed.

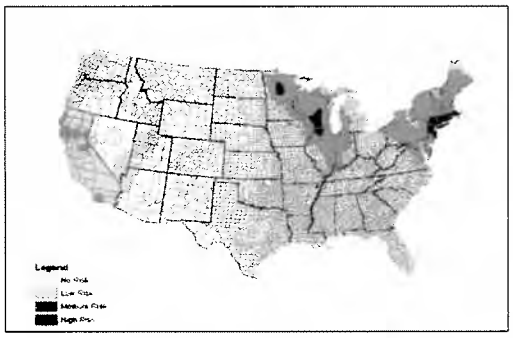
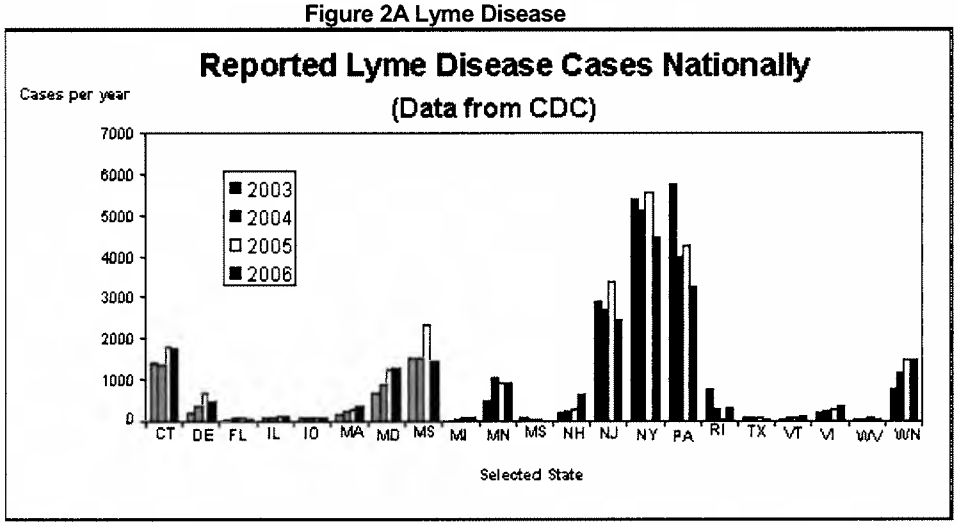
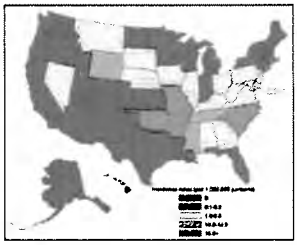
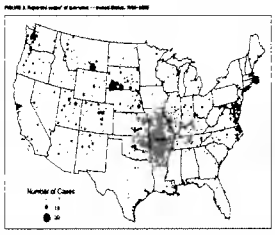


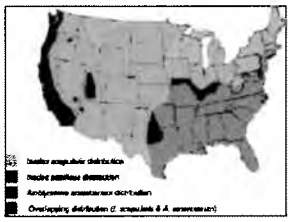
Figure 2A Lyme Disease





Incidence rates for RMSF





Distribution of tick species for Tularemia & Ehrlichiosis

Figures 2B, 2C and 2D

Incidence of Tick Borne-Diseases in Suffolk County

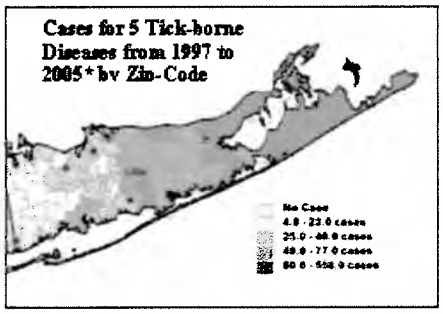
IV. CONFIRMED CASES OF TICK DISEASES IN SUFFOLK COUNTY

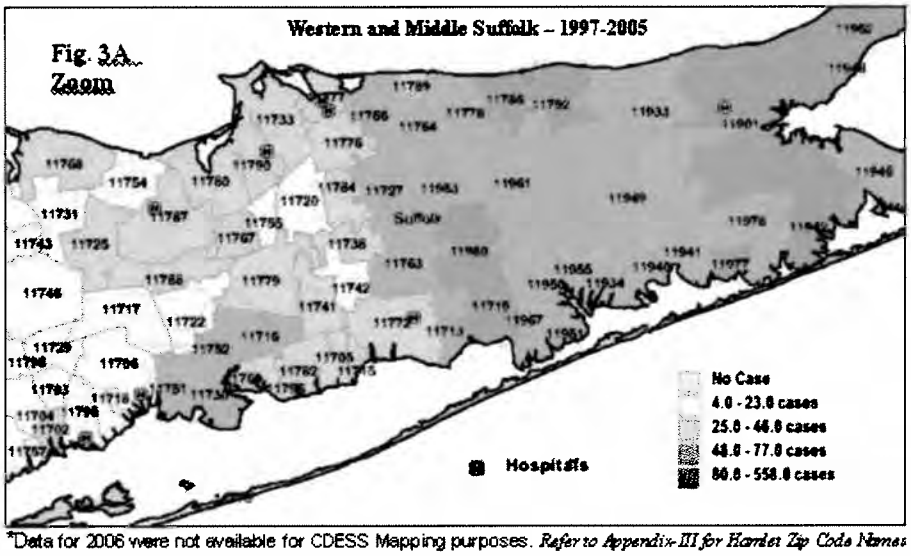
The maps in this section summarize all 5 tick-borne cases in Suffolk County reported to the NYS DOH CDESS, from 1997 to 2005. CDESS data for 2006 were not available for mapping purposes. Color-coded areas show the range of confirmed cases within a given zip-code region. The data table below (Section 4-A) is for the ten year period 1997 to 2006.

A. Summary of Five Tick-Borne Diseases in Suffolk Reported to CDESS

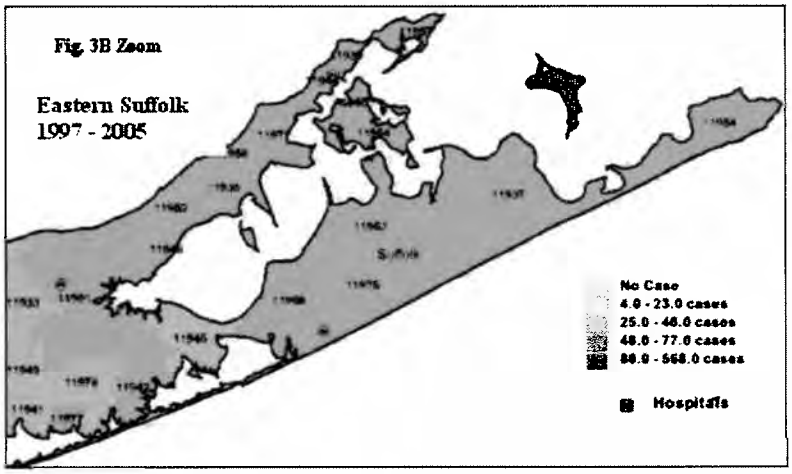
6,472 Confirmed Cases from 1997-2006

Lyme disease	= 5,690 (88% of Total)
Babesiosis	= 662 (10.2%)
Ehrlichiosis	= 92 (1.4%)
RMSF	= 25 (0.4%)
Tularemia	= 3 (0.05%)





*Data for 2006 were not available for CDESS Mapping purposes. *Refer to Appendix-III for Hamlet Zip Code Names*



B. Comparison of Tick-borne Diseases in Suffolk with Other CDC Reportable Diseases

Table 1 shows the number of confirmed cases of CDC reportable diseases in Suffolk County obtained from the NYS DOH CDESS from 1997 to 2006. The total number of cases in Suffolk, for 80 communicable diseases, was 23,290 over that 10 year period.

Table 1

Disease	Number of Cases In Suffolk (1997 – 2006)	% of NYSTotal
Lyme Disease	5,690	24.3
Hepatitis-C, Chronic	4,368	18.8
Salmonella	2,202	9.5
Campylobacter	1,817	7.8
Giardia	1,328	5.7
Babesiosis	662	2.8
Shigella	461	2.0
Influenza-A	397	1.7
Strep-A	281	1.2
Escherichia. coli	181	0.8
Ehrlichiosis (HGA&HME)	92	0.4
Listeria	81	0.3
RMSF	25	0.1
West Nile Virus, Neuro-Inv	23	0.1
Tularemia	3	0.01

Approximately 80 diseases are listed in NYS DOH CDESS. Tick-borne diseases are highlighted

C. Con firmed Cases of Lyme Disease, Babesiosis, RMSF and Ehrlichiosis in Suffolk County

- Since 1994, confirmed cases of Lyme disease in Suffolk County appears to have decreased by a factor of 5 (See Fig. 4).

- This may be attributable in part to effective Public Education programs enacted in the mid 1990s. Other explanations are: (a) stricter CDC reporting guidelines, (b) changes in human behavior due to a perceived risk or (c) habitat modifications making the western more populous portion of the County less hospitable to ticks.

- Figure 5 shows the number of Lyme disease cases, by zip-code, over a 6 year period (2000 – 2005).

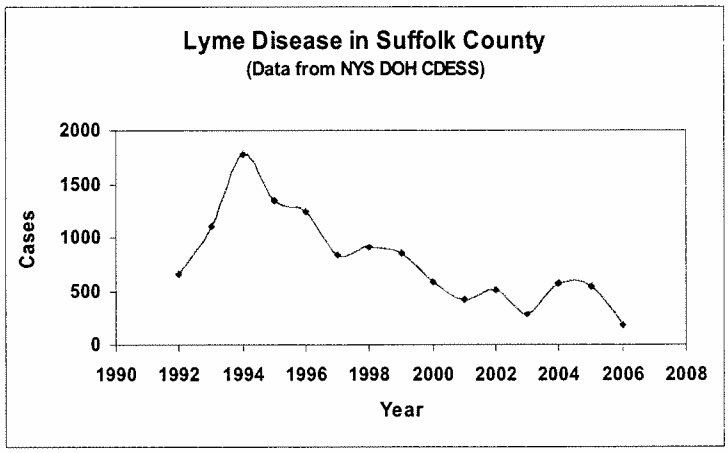


Figure 4. Confirmed Cases of Lyme Disease

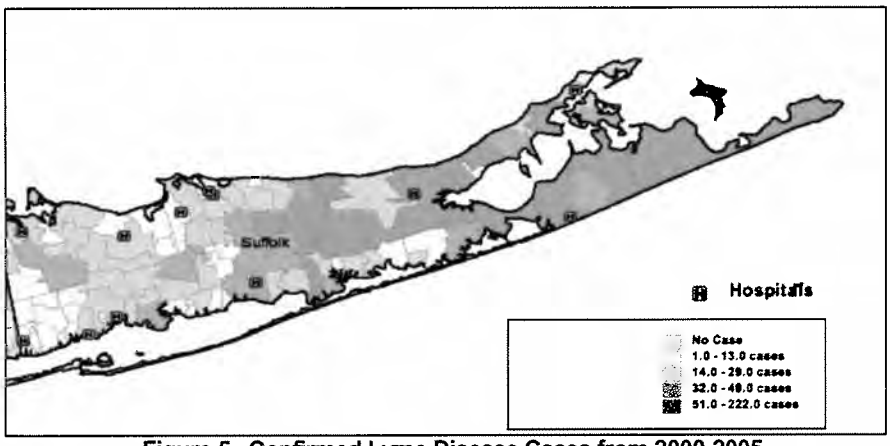


Figure 5. Confirmed Lyme Disease Cases from 2000-2005

- The number of confirmed cases of Babesiosis in Suffolk County appears to have risen by a factor of three since 1994 (See Fig. 6). For Ehrlichiosis , the average number of confirmed cases in Suffolk County over the past 10 years was about 20 cases per year

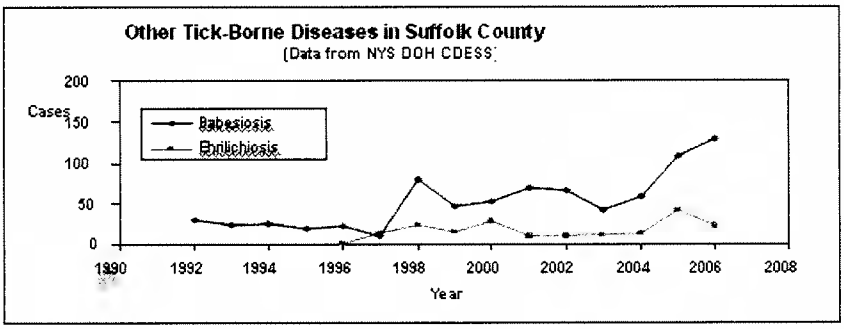


Figure 6. Babesiosis and Ehrlichiosis, Confirmed Cases

- Figure 7 shows the number of confirmed cases of RMSF over a 6 year period, whereas Figures 8 and Figure 9 show the confirmed cases of Babesiosis and Ehrlichiosis, respectively, in the same time period.

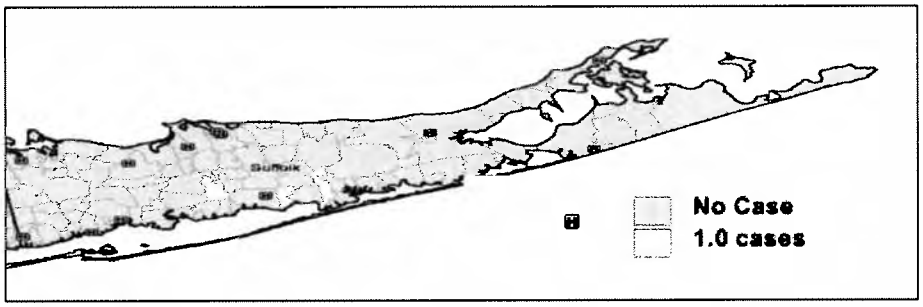


Figure 7. Rocky Mountain SF 2000- 2005

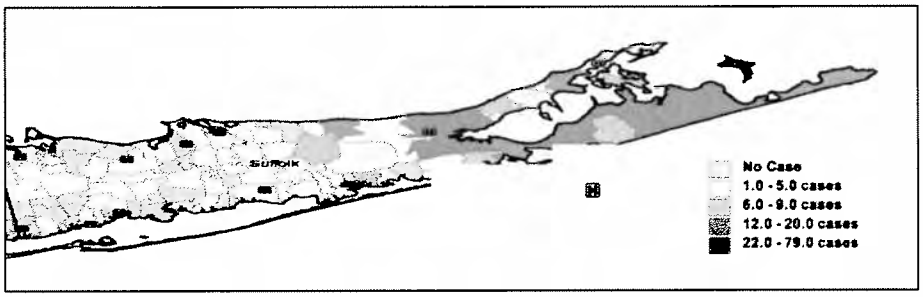


Figure 8. Babesiosis Cases 2000-2005

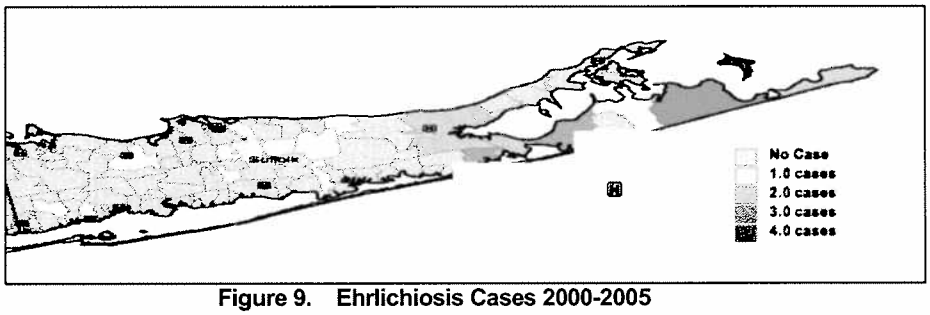


Figure 9. Ehrlichiosis Cases 2000-2005

D. Relative Risk of Tick-Borne Diseases by Sex and Age Group

- In 2000, the Suffolk County population was comprised of 51% Females and 49% Males.

- The age distributions in the Suffolk County population were: (**See Appendices I and III**).

  12% for the 65 years and older group,
  74% for the 18 years-old to 65 years-old group,
  7% for 6 years-old to 18 years old group and
  7% for the younger than 5 years-old group.

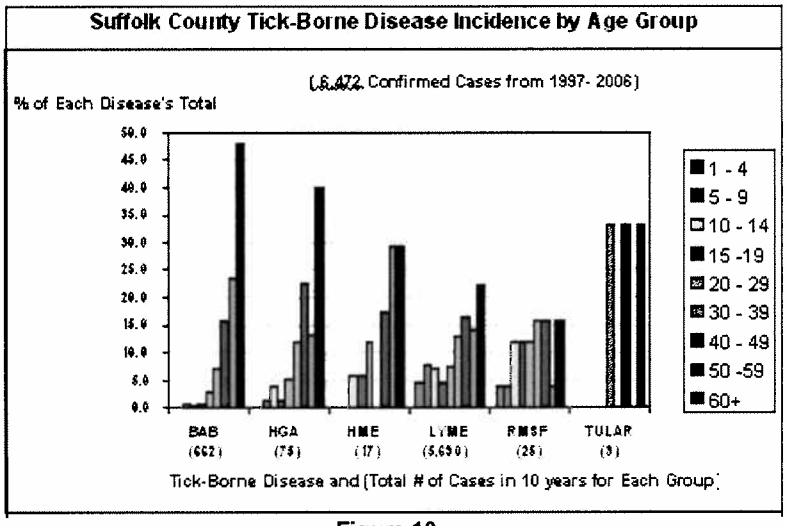


Figure 10

- Figure 10. Over a 10 year period and regardless of sex, the percentage of cases for Babesiosis, Ehrlichiosis (HGA & HME) and Lyme disease was highest for Senior Citizens who were 60 years or older (black bar).

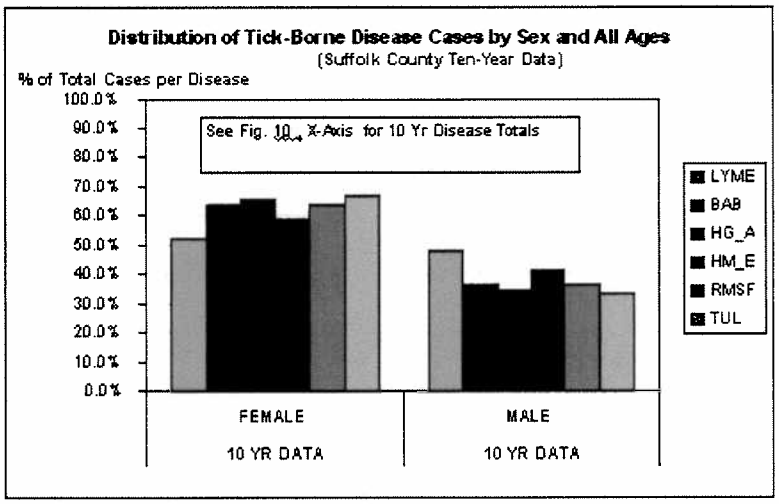


Figure 11

- Figure 11. The 10 year data show that, regardless of age, females appear twice as likely as males to contract a tick-borne disease in Suffolk County. The exception is Lyme disease.

E. Data for Five Tick-Borne Diseases in Nassau, Suffolk and NYS from 2003 to 2006

Table 2 (Confirmed Cases from NYS DOH CDESS: SC is Suffolk County; NC is Nassau County)

		2006 Cases	2005 Cases	2004 Cases	2003 Cases	Total 4 Yrs	% of NYS Cases
	NYS	3780	5165	4744	5179	18,868	
LYME DISEASE	SC	178	542	561	288	1,569	8.3%
	NC	107	122	59	75	363	1.9%
	NYS	145	160	79	67	451	
BABESIOSIS	SC	130	109	59	42	340	75%
	NC	8	3	2	2	15	3.3%
	NYS	244	308	104	79	735	
EHRLICHIOSIS	SC	23	42	13	12	90	12.2%
	NC	5	2	0	0	7	1.0%
	NYS	1	2	0	1	4	
TULAREMIA	SC	1	2	0	0	3	75.0%
	NC	0	0	0	0	0	0.0%
	NYS	5	2	1	0	8	
ROCKY MTN S F	SC	2	0	0	0	2	25.0%
	NC	0	0	1	0	1	12.5%
	NYS Population = 19.3M			*SC Population = 1.42M*		*NC Population = 1.34M*	

From 2003 to 2006, the total number of Lyme disease cases in Suffolk County (1,569) was 5 times higher that that in Nassau County.

From 2003 to 2006, the total number of Suffolk County cases of Ehrlichiosis (90) was about 13 times higher than Nassau County's 7 total cases.

From 2003 to 2006, the total number of Suffolk County cases of Babesiosis (340) was almost 23 times higher than Nassau's 15 cases and constituted **75%** of all 451 cases reported in NY State.

F. Tick Borne Disease Cases in Suffolk County - 2006

Data for 2006 were not available for CDESS mapping.

- There were 334 confirmed tick cases in 2006 for all of Suffolk County for the 5 CDC reportable tick- borne diseases. See **Table 2** above and **Appendix-IV** for CDC case definitions. .
- In 2006, 178 Lyme disease cases accounted for **53%** of all 334 reportable tick-borne disease cases in Suffolk County.
- The 130 Babesiosis cases accounted for **39%** of all 334 reportable tick-borne disease cases in Suffolk County.
- Both Lyme disease and Babesiosis combined account for 92% of all confirmed tick cases in 2006.
- The geographical locations (zip codes) with higher than average number of confirmed cases was consistent with the 6 year summary maps presented previously.

V. REFERENCES

- Control of Communicable Diseases Manual, 18th Edition, 2004. David Heymann, MD, Editor. American Public Health Association, 800 I Street, NW, Washington, DC, 20001.

- The Clinical Treatment, Assessment and Prevention of Lyme disease, Human Granulocytic Anaplasmosis and Babesiosis: Clinical Practice Guidelines by Infectious Diseases Society of America. **Clinical Infectious Diseases (2006):43:1089-134.**

  - **Electronic Links**

- US Census Bureau Data: US Census 2000

- Suffolk County Wikipedia. http://en.wikipedia.org/wiki/Suffolk_County,_New_York

- New York State Department of Health, Division of Epidemiology, Communicable Disease Electronic Surveillance System (CDESS). *Requires permissions to access database.*

  - https://commerce.health.state.ny.us/hin/

    https://commerce.health.state.ny.us/doh3/applinks/cdess/mainMenu.do

- Centers For Disease Control (CDC)

  - Infectious Diseases. http://www.cdc.gov/ncidod/diseases/insects/index.htm
  - Lyme Disease: http://www.cdc.gov/ncidod/dvbid/lyme/index.htm
  - Babesiosis : http://www.cdc.gov/ncidod/dpd/parasites/babesia/default.htm
  - Ehrlichiosis: http://www.cdc.gov/ncidod/dvrd/ehrlichia/Index.htm
  - Rocky Mountain Spotted Fever: http://www.cdc.gov/ncidod/dvrd/rmsf/index.htm
  - Tularemia: http://www.cdc.gov/ncidod/dvbid/tularemia.htm

Section

3

Vincent Palmer (Lead Author) and Amy Juchatz

PESTICIDE-RELATED TICK MANAGEMENT

EXECUTIVE SUMMARY

Pesticides are routinely used throughout Suffolk County to protect people and their pets from ticks and tick-borne diseases. For more than two decades, people living and working in tick-infested areas of Suffolk County have increasingly applied pesticides as a safeguard against ticks and the debilitating diseases they carry and transmit to humans. A reflection of the widespread concern about the public health threat posed by ticks in Suffolk County is contained in a letter dated 1987, in which the Regional Chief Scientist for the United States Department of the Interior, National Park Service, North Atlantic Region, requested permission of the NYS Department of Environmental Conservation to apply *DAMMINIX® Tick Tubes* on Fire Island. That letter states, in pertinent part, "Although we normally avoid pesticide use, the high incidence of Lyme disease among our employees and the families there makes such use necessary in selected areas for the safety of employees and visitors" (Soukup 1987). More than 20 years later finds that Fire Island and other areas of Suffolk County continue to be infested with blacklegged ticks (*Ixodes scapularis*) and lone star ticks (*Amblyomma americanum*), and that they continue to pose a serious public health threat to Suffolk County residents.

Tick densities are recognized as being high enough to provide optimal conditions for conducting tick management research. Fire Island, for example, has served as a testing site for all three of the host-targeted tick management technologies that have been developed to date

- *DAMMINIX® Tick Tubes/A Tick Toxicant*
- *MAXFORCE TICK SYSTEM™*
- *Y-TEX 4-Poster = Tickicide.*

However, the broadcast spraying of relatively large volumes of liquid tickicides over entire properties throughout Suffolk County remains the primary control option selected to manage ticks. While the use of personal and companion animal repellents, and other tickicides designed for use on pets may offer some level of safeguard against ticks and the diseases they carry, they do not address the underlying problem of tick abundance in the outdoor environment.

Pesticide-related tick management activities should focus on supporting judicious use of the most effective and least toxic tickicides in a manner which minimizes exposure to non-target organism (humans, wildlife, and pets) to the greatest extent possible. These pesticides should be used in combination with control strategies that conform to the principles and practices of

Integrated Pest Management (IPM), and are protective of human health and environmental quality.

Recommendations:

- Support funding for the '4-Poster' Tick Management Technology Study which is being conducted in only two areas of New York State – Fire Island and Shelter Island, both of which are located in Suffolk County. This host-targeted technology holds promise of reducing the density of ticks, and the human incidence of tick-borne diseases. Furthermore, it is expected that this technology will reduce human and other non-target animal exposure to pesticides since the '4-Poster' system provides less opportunity for exposure than broadcast spraying and personal repellents and uses substantially less pesticides than are presently being used to combat tick populations in Suffolk County.

- Arrange for the Suffolk County Department of Public Works' Division of Vector Control (SCDPW-DVC) and Suffolk County Department of Health Services' Arthropod-Borne Disease Laboratory (SCDHS-ADL) to contribute manpower and other resources to assist with the '4-Poster' Tick Management Technology Study. Such involvement would provide the County with first-hand experience relating to a new technology that may prove to be an environmentally-preferable and effective means of controlling ticks. It would also be consistent with the Suffolk County Charter, which states that the SCDPW-DVC is responsible for the suppression of mosquitoes, ticks and other arthropods which are vectors of human disease and require public health action for control.

- Support investigation into new tick management strategies and technologies as they emerge.

I - Introduction:

This Section provides information about pesticide-related tick management options that are presently available to the residents of Suffolk County, and the '4-Poster' host-targeted technology that is being studied in Suffolk County. Pesticides are available to repel ticks, and to reduce their numbers and thus the associated human incidence of tick-borne diseases. The following discussion reports on these pesticide-related mitigation strategies.

Generally speaking, ticks do not infest the interior of structures. Therefore, pesticide-related risk mitigation strategies primarily focus on personal protection, and applying repellents and contact pesticides in outdoor environments. Outdoor treatment strategies rely on broadcast spraying pesticides to vegetation, and host-targeted systems such as the 4-Poster' Deer Treatment Device which uses a synthetic pyrethroid pesticide known as permethrin: *Y-Tex' 4-POSTER' TICKICIDE* (EPA Reg. No. 39039-12).

II - Human and Pet Protection

A. Personal Protection

Pesticide-related personal protection for people involves the use of a variety of repellents. These pesticide products can be effective at reducing insect bites. However, their use is not without risk and it is especially important that they are used appropriately. Based on data reported to the national Poison Control Centers Toxic Exposure Surveillance System (TESS), insect repellents were ranked the fourth most frequently reported pesticide involved in poisonings (Litovitz et al., 1999). Similarly, in New York State, repellents are the fifth most frequently reported, representing 6.3 percent of the reported poisonings (NYSDOH, 1998).

The New York State Department of Health (NYSDOH) has published material, available on their website, to guide individuals on the proper use of repellents and factors to consider before choosing to use a repellent. The NYSDOH points out that children may be at greater risk of adverse effects from the use of repellents and therefore, specific recommendations when considering using repellents on children are made which include:

- Keep repellents out of the reach of children
- Do not allow children to apply repellents to themselves
- Use only a small amount of repellent on children
- Do not apply repellents to the hands of young children because this may result in accidental eye contact or ingestion
- Try to reduce the use or repellents by dressing children in long sleeves and long pants tucked into boots or socks whenever possible. Use netting over strollers and playpens
- Pregnant women should also be cautious and avoid the use of repellents when practical since the fetus may be particularly vulnerable.

Though repellents are a tool for protection against ticks, they do not provide complete protection (NYSDOH, 2004a). Avoidance of tick infested areas when possible and "tick checks" are still important even when repellents are used. Therefore, it is important that

individuals who use repellents do not feel a false sense of security in the protection that is offered by the repellent.

A significant amount of information from qualified government sources has been developed and posted on the websites listed in the outline below.

Repellents

Conventional Repellents

The Insect Repellent DEET
http://www.epa.gov/pesticides/factsheets/chemicals/deet.htm

New York State Department of Health: "Health Advisory: Tick and Insect Repellent"
http://www.health.state.ny.us/nysdoh/westnile/education/2737.htm

New York State Department of Health: Brochure "Tick and Insect Repellents: Deciding on Their Use"
http://www.health.state.ny.us/publications/2749/index.htm

EPA New Pesticide Fact Sheet - Picaridin
http://www.epa.gov/opprd001/factsheets/picaridin.pdf

Repellents Used on Clothing

http://www.epa.gov/pesticides/health/mosquitoes/ai_insectrp.htm
Active Ingredients Found in Insect Repellents
http://www.epa.gov/pesticides/health/mosquitoes/ai_insectrp.htm

Insect Repellent use and Safety in Children
http://www.fda.gov/cder/emergency/repellants.htm

Protection Against Mosquitoes, Ticks, Fleas and Other Insects and Arthropods
http://wwwn.cdc.gov/travel/yellowBookCh2-InsectsArthropods.aspx

Tick Repelling Devices

Pest Control Devices
http://www.epa.gov/pesticides/factsheets/devices.htm
electronic devices (EPA warning)

FTC Warns Manufacturers and Retailers of Ultrasonic Pest Control Devices
http://www.ftc.gov/opa/2001/05/fyi0128.shtm

Tick Repelling Clothing

Permethrin-treated articles of clothing repel ticks and other insects. Since treated with permethrin and designed to protect the wearer from ticks, these articles of clothing are considered to be pesticides that must be registered with the United States Environmental Protection Agency (USEPA) and the New York State Department of Environmental Conservation (NYSDEC). Examples of articles of clothing registered for distribution and use in New York State include the following products that contain permethrin as the active ingredient at a concentration of 0.52 percent:

BUZZ OFF™ insect shield insect repellent apparel (EPA Reg. No. 74843-2)
Insect shield repellent apparel (EPA Reg. No. 74843-2)
Perimeter Insect Guard Insect Repellent (EPA Reg. No. 82392-1)
Skintex® MR III Insect Repellent Apparel (EPA Reg. No. 53263-31)

These articles of tick-repellent clothing must be washed separately from other clothing, and cannot by dry cleaned. Label directions for the first two products listed above indicate that the repellency remains effective for 70 washings, while the last two products indicate that their repellency remains effective for 25 washings.

The National Pesticide Information Center (NPIC) (http://npic.orst.edu) is a source of objective, science based information about pesticides and pesticide-related topics that enable people to make informed decisions about pesticides and their use. NPIC is a cooperative agreement between Oregon State University and the USEPA. NPIC posts information about "Permethrin-Treated Clothes" as one of their "Hot Topics" at the following website: http://npic.orst.edu/hottopic/PermethrinTreatedClothes.pdf

B. Companion Animal Protection

Pesticide-related protection for companion animals (pets) involves the use of repellents, and tick-controlling substances that include "flea and tick collars," shampoos, dusts, and dips. A significant amount of information from qualified government sources has been developed and posted on the websites listed in the outline below. Available resources include fact sheets for common flea and tick active ingredients, such as carbaryl, cypermethrin, fipronil, imidacloprid, methoprene, permethrin, phenothrin and pyrethrum. These resources contain information about each of these pesticides and the risks they may pose. Insect growth regulators and d-Limonene are also available in pet protection products.

Questions & Answers: Label Instructions Tightened on Flea & Tick Control
http://www.epa.gov/pesticides/factsheets/hartzq_a.htm

Protecting Pets

- *Taking Care of Fleas and Ticks on Your Pet*
- *Counterfeit Pesticide Products for Dogs and Cats*
- *Read the Label First: Protect Your Pet*
  http://www.epa.gov/opp00001/health/pets.htm

As with personal repellents, the use of pet flea and tick products is not without risk and it is important that the product instructions are followed carefully. In July of 2003, the ASPCA Animal Poison Control Center received 3,100 cases of poisoning related to the use of flea and tick control products (ASPCA, 2004). Some products are labeled for dogs and should not be used on cats, and those that are labeled for adult cats or dogs should not be used on kittens or puppies. It is also very important that certain flea and tick products not be used on very old or debilitated animals since they may also be more susceptible. Permethrin products have caused toxicity in cats when products listed for use on dogs are inadvertently used on cats. Permethrin "spot-on" products for dogs can contain between 45-65 percent permethrin. Even small amounts of these products can cause symptoms in cats (Richardson, 2000). Symptoms that are most often seen in cats from permethrin toxicosis include tremors, muscle twitching and seizures. These symptoms usually occur within hours to days following treatment and may last up to three days. In addition, there is potential for exposure to pet owners when flea and tick products are used on their pets.

III – Outdoor Broadcast Sprays

When pesticides are applied to residential lawns and landscaping, exposure to humans, pets and wildlife can occur. Exposures may result during outdoor activities in treated areas. Less obvious are the exposures that can also occur to the indoor environment when yards are treated. The pesticide registration process also takes into account indoor exposures to these pesticides, which are often considered potentially more significant than outdoor exposures, according to Dr. Robert Lewis of the USEPA's National Exposure Research Laboratory (Lewis, 2005). Indoor exposures to pesticides applied to lawns and landscaping occur when these chemicals are resuspended by winds and are carried into houses through open windows or doors, or through cracks and crevices, or are tracked into houses on shoes, clothing, and pets (Nishioka, 2001). The likelihood and significance of such exposures will vary depending upon the pesticide product used, its environmental fate and persistence characteristics, and the application method used.

Infants and toddlers represent a particularly vulnerable population in terms of lawn and landscaping pesticide exposure, since they can have significant direct dermal contact with soils and dust, and may frequently engage in mouthing activities (involving contaminated hands, toys, furniture, etc.).

As with small children, pets are more likely to be exposed to pesticides and receive a higher dose since they are lower to the ground, can track pesticide residues indoors from outside, and their grooming habits can lead to oral ingestion of pesticide residues on their fur and paws.

In addition to potential exposures to people and their pets, broadcast applications also have the potential to result in exposure to wildlife, such as grazing deer, and may result in environmental contamination. There is a growing body of evidence that sediments from agricultural and suburban areas may contain pyrethroids at concentrations that are toxic to aquatic organisms (Amweg et al., 2005 and Weston et al., 2005).

In conclusion, outdoor broadcast sprays for the control of ticks has the potential to result in exposures to residents, particularly young children, from outdoor as well as indoor activities. In addition, because such applications may occur to a wide area in suburban residential areas, there is concern for potential environmental contamination.

IV – Host Targeted Technologies

A. Mice:

***DAMMINIX® Tick Tubes (6 to 24 tubes)* (EPA Reg. No. 56783-1)**
***DAMMINIX® A TICK TOXICANT (96 tubes)* (EPA Reg. No. 56783-1)**

DAMMINIX® Tick Tubes (6 to 24 tubes) (EPA Reg. No. 56783-1) was first registered for use in New York State more than 20 years ago, on July 16, 1987. *DAMMINIX® A TICK TOXICANT (96 tubes)* (EPA Reg. No. 56783-1) was first registered for use in New York State nearly ten years later on March 22, 1996. Both products remain currently registered as general use

pesticides (available to the general public and pest management professionals), and are marketed by EcoHealth, Inc., 33 Mount Vernon Street, Boston, Massachusetts 02108.

The manufacturer indicates that a mouse habitat measuring ⅛ acre would involve the use of six tubes, a ½ acre habitat would involve the use of 24 tubes, and a two-acre habitat would involve the use of 96 tubes.

This pesticide is registered for use only in outdoor areas inhabited by mice. Label directions instruct the user to apply *DAMMINIX®* tick tubes between April 01 and mid-September, and at least twice a year. Label directions also state that best results are obtained when DAMMINIX® Tick Tubes are applied immediately prior to the feeding activity periods for nymphal (May-June) and larval (August-September) blacklegged ticks. Tubes may also be replaced when nesting material is completely removed.

The product consists of a cardboard tube that contains cotton balls impregnated with 7.4 percent permethrin, a synthetic pyrethroid. The ends of these cylindrical tubes are open, allowing mice to remove cotton for use in building nests. The control strategy relies on mice collecting the pesticide-treated cotton, and using it to build their nests. Therefore, the effectiveness of this tick management strategy relies on mice using the cotton to line their nests; however, if there is an abundance of natural nest-building materials in the treatment zone mice may not use the cotton. It has also been reported that other small mammals such as shrews, voles and chipmunks may remove permethrin-treated cotton, and that birds may pick up cotton that mice remove from the tubes but do not bring to their nest.

Ticks on the mice and in the nests are exposed to the permethrin on the cotton available in the *DAMMINIX® Tick Tubes*. This product is intended to aid in the control of ticks that infest mice and nests of mice found around yards, play areas, parks, brush, paths, and in woodlands.

The Environmental Hazards section of both *DAMMINIX®* labels warns: "This product is extremely toxic to fish and other aquatic organisms. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark."

One important consideration is the fact that *DAMMINIX® Tick Tubes (6 to 24 tubes)* (EPA Reg. No. 56783-1) and *DAMMINIX® A TICK TOXICANT (96 tubes)* (EPA Reg. No. 56783-1) are only registered for the control of the blacklegged tick, and not the lone star tick which is a growing concern in Suffolk County. The manufacturer states the following on a "Frequently Asked Questions" section that is posted at their website: "Damminix Tick Tubes are targeted to the life cycle of disease-carrying black legged ticks (deer ticks) in the Eastern United States." Further information can be found on the registered pesticide labels and the EcoHealth website at: http://www.ticktubes.com/index.html.

Detailed information concerning the pesticide permethrin can be found in the USEPA's "Reregistration Eligibility Decision (RED) for Permethrin," dated December 2007. A copy of this document is available at the following website:
http://www.epa.gov/oppsrrd1/REDs/permethrin_amended_red.pdf

***MAXFORCE TICK MANAGEMENT SYSTEM™* (EPA Reg. No. 432-1248):**

MAXFORCE TICK MANAGEMENT SYSTEM™ (EPA Reg. No. 432-1248) was first registered for use in New York State on March 25, 2005. It is currently registered as a restricted use pesticide. Since it is classified as a restricted use pesticide, it is not available to the general public. In New York State, it can only be sold to and used by certified commercial pesticide applicators.

The product contains 0.7 percent fipronil, a phenylpyrazole insecticide. It is labeled for use as a rodent bait station for the control of ticks that may carry Lyme disease. Small rodents, such as mice and chipmunks, are attracted to the stations by the use of a lure. The active ingredient, fipronil, is incorporated into a fluid that saturates a wick which is suspended inside the bait station. Rodents that enter the bait station to examine the food odor attractant come into contact with the fipronil-impregnated wick, thus self-applying the tickicide.

Since aquatic organisms, as a group, are the most sensitive to fipronil, particularly marine/estuarine species, the Environmental Hazards section of the label warns: "This product is toxic to birds, fish, and aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark."

This tick management tool was manufactured by Bayer Environmental Science, 2 T.W. Alexander Drive, P.O. Box 12014, Research Triangle Park, North Carolina 27709. Since March 2006, the *MAXFORCE TICK MANAGEMENT SYSTEM*™ is no longer being produced by the manufacturer. In a letter dated March 09, 2006, Bayer Environmental Science indicated that the *MAXFORCE TICK MANAGEMENT SYSTEM*™ "will no longer be available for sale by Bayer until this problem is resolved" (Morrison 2006). The problem referred to in the letter relates to the incidence of squirrels compromising the child resistant characteristics of the bait station. Production was discontinued in response to reports of grey squirrels "chewing" into some of the plastic bait stations in areas of the Northeastern United States, thus compromising the child resistant characteristics of the station. A single pest management business purchased the remaining stock of the *MAXFORCE TICK MANAGEMENT SYSTEM*™ bait stations and has retrofitted the stations by installing a metal shroud in accordance with a request by the USEPA to prevent squirrel damage.

B. Deer

Y-TEX 4-Poster = Tickicide (EPA Reg. No. 39039-12/SLN No. NY-070005)

The ever-increasing human incidence of Lyme disease, babesiosis, human granulocytic anaplasmosis, human monocytic ehrlichiosis, southern tick-associated rash illness (STARI), and other tick-borne diseases has drawn considerable attention to the overpopulation of blacklegged ticks (*Ixodes scapularis*) and lone star ticks (*Amblyomma americanum* L.) in several areas of New York State. The overpopulation of ticks in Suffolk County led to the study of a host-targeted tick management technology a system that involves the use of *4-Poster' Deer Treatment Devices* charged with a pesticide known as *Y-Tex' 4-POSTER' TICKICIDE* (EPA Reg. No. 39039-12). This pesticide contains the active ingredient permethrin.

The 4-Poster' system is the first topical self-treatment technology developed for deer. This system relies on an environmentally-preferable host-targeted passive application process. The technology is based on the fact that white-tailed deer serve as keystone hosts for the blacklegged tick and lone star tick, and the fact that control of ticks while they are on deer can limit the number of ticks on the entire landscape. The 4-Poster' system is designed to attract deer to small gravity fed, corn-filled troughs. As the deer reach into the trough to obtain corn, their head, neck and ears come into contact with vertically stationed paint rollers that are treated with tickicide. The deer then act as vacuums that collect ticks as they travel about their home range. The ticks that attach to the deer are then exposed to a lethal dose of

tickicide. By killing those adult ticks, no eggs are laid, and the life cycle of the tick is interrupted. Eventually, this leads to a decline in the tick population in areas where the devices are deployed. Studies have demonstrated reductions in the population of free-living ticks as much as 91 to 100 percent (see discussion of studies that follows).

The '4-Poster' system was developed at the Knipling-Bushland U.S. Livestock insects Research Laboratory (KBUSLIRL), and patented by the US Department of Agriculture's Agricultural Research Service (USDA-ARS) in 1994 (Pound et al. 1994, 2000a). A field trial designed to evaluate efficacy against lone star ticks on white-tailed deer using an oily formulation of amitraz as the acaricide proved the technology to be highly efficacious against ticks feeding on deer (ca. 97 percent control), (Pound et al. 2000a). Efficacy after the third year of treatment was 91.9 and 93.7 percent against free-living nymphs and adults, respectively (Pound, et al. 2000b). This was quite similar to efficacy demonstrated in the previous and similar three-year trial of systemic ivermectin-medicated bait technology (Pound et al. 1996).

From 1997 to 2004, the USDA Northeast Area-wide Tick Control Project (NEATCP)

conducted a major field trial of 4-Poster= Deer Treatment Bait Stations in two square mile test plots each at seven research sites in five northeastern states (CT, MD, NJ, NY, and RI) to control ticks feeding on white-tailed deer (Pound et al. 2008a, 2008b). These two manuscripts have been peer reviewed, edited, and submitted to the journal entitled Vector-Borne and Zoonotic Diseases. The objective was to reduce free-living blacklegged and lone star tick populations throughout the plots, thereby reducing the risk of tick-borne disease. Data were collected and compiled and deployment, operational, and maintenance procedures were compared among the sites. Subsequently, major factors that influenced efficacy were extrapolated to better understand and improve the technology. Treatments utilized a 2 percent oily formulation of the acaricide amitraz and resulted in significant reductions in free-living populations of nymphal blacklegged ticks at all seven sites and lone star ticks at the three sites where these ticks also were present. Maximal efficacy against nymphal blacklegged and lone star ticks was 81.7 and 99.5 percent, respectively. Although the technology is labor intensive and requires two or more years to show efficacy, it was considerably more economical and environmentally friendly than spraying residential vegetation to control ticks. The major environmental factor that interfered with treatment was the sporadic occurrence of heavy acorn masts. These alternative food sources minimized the use of treatment devices by deer and reduced the control of ticks feeding on them. The NEATCP demonstrated that if

properly deployed and maintained, the 4-Poster= technology is an efficacious, economical, safe, and environmentally friendly alternative to area-wide spraying to reduce the risk of transmitting the agents causing Lyme disease, human ehrlichiosis, southern tick-associated rash illness (STARI), and other tick-borne diseases to humans, livestock, pets and wildlife (Pound et al. 2008b).

A second major field trial of the 4-Poster= technology sought to reduce tick abundance at the

Goddard Space Flight Center at Greenbelt, Maryland. This trial used four, 4-Poster= devices in an area of over 600 acres and treated with an oily 10 percent formulation of permethrin. In this study the "treatment resulted in elimination of adult *I. scapularis* on sampled deer (100% control) by the 2nd y of treatment and reductions of immature tick stages on mice. During the 3rd y of treatment, adult, nymphal, and larval questing ticks were reduced by 91-100% from sampled plots, and nymphal and larval ticks were reduced by 70-95% on sampled mice" (Solberg et al. 2003). The '4-Poster' Tickicide is a similar oily 10 percent formulation of

permethrin that was labeled in 2003 by the EPA for use only on 4-Poster' Deer Treatment Bait Stations.

In a letter dated March 18, 2006, former NYS Governor Hugh L. Carey asked then NYS Governor George E. Pataki to endorse a pilot program to establish the 4-Poster= tick management system on Shelter Island. In a letter of reply dated July 19, 2006, Governor Pataki informed Governor Carey that the NYSDEC would undertake a comprehensive scientific study to address the currently unanswered questions about the efficacy of the 4-Poster Tickicide system in reducing human incidence of Lyme disease and other tick-borne diseases . . . and document impacts on deer populations and behavior.

This exchange of letters is reflective of the growing concern about this public health threat a concern that finds New York State lawmakers and other elected officials, activists, the health care and medical communities, public interest and environmental organizations, academia, and others joining forces to combat this problem. The Suffolk County Tick Management Task Force is one example of that widespread attention to this public health problem.

The NYSDEC facilitated the preparation and submission of application for the necessary registration and permit that would be needed to conduct the research. The application was required to be accompanied by a scope of study designed to answer outstanding technical concerns expressed by the NYSDEC=s Division of Solid and Hazardous Materials (DS&HM), and Division of Fish, Wildlife, and Marine Resources (DFW&MR), as well as the New York State Department of Health. This required the coordination of a unified approach to the problem by focusing the energies, expertise and financial support of a diverse group of stakeholders on the goal of designing a study that would address outstanding technical concerns of the NYSDEC and NYSDOH relative to a promising tick control technology that is registered in 48 other states. The technology consists of a *4-Poster' Deer Treatment Device* charged with *Y-TEX® 4-Poster' Tickicide* (EPA Reg. No. 39039-12). The tickicide and technology associated with this tick control system offers a potential dramatic reduction in ticks, the human incidence of diseases they transmit, and the amount of pesticides presently used to control ticks by broadcast spraying large outdoor areas.

To address the technical concerns through a comprehensive study, the NYSDEC organized a consortium of federal [United States Department of Agriculture, Agricultural Research Service (USDA-ARS), United States Department of the Interior, National Park Service, Fire Island National Seashore (USDI-NPS-FINS), United States Geological Services (USGS), and United States Public Health Service (USPHS)], New York State [NYSDEC, New York State Department of Health (NYSDOH), and New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP)], local agencies (Towns of Islip and Shelter Island, Incorporated Villages of Dering Harbor, North Haven, and Saltaire, and the Fire Island communities of Kismet, Fair Harbor, Dunewood, and Atlantique Beach), academia (Cornell University and Yale University), and private interests (Fire Island Wildlife Foundation, Shelter Island Deer and Tick Committee/Deer Management Foundation, Fire Island Association, Inc., and The Humane Society of the United States).

A study was needed to address technical concerns associated with the proposed use of this system. One technical concern related to the effectiveness of 4-Poster= tick management

technology in reducing tick densities and the associated human incidence of such tick-borne diseases as Lyme disease, babesiosis, human granulocytic anaplasmosis, human monocytic ehrlichiosis, tularemia, Rocky Mountain spotted fever, tick paralysis, and southern tick-associated rash illness (STARI). Another technical concern related to the influence 4-Poster deer treatment devices would have on the population and behavior of white-tailed deer, and any impact tickicide residue on deer hides and in deer flesh could have on hunters and others handling deer and eating venison.

The study required that two essential authorizations be issued by the NYSDEC a Special Local Need (SLN) registration to allow the commercial application of *Y-TEX 4-Poster = Tickicide* (EPA Reg. No. 39039-12/SLN No. NY-070005) to roller posts on deer treatment devices, and a Special License to Collect and Possess to allow the feeding and taking of deer in connection with the study. The process required a comprehensive review, analysis, and arranged compliance with an array of federal and State regulatory concerns that included freshwater and tidal wetland permit requirements; the provisions of the State Environmental Quality Review Act (SEQRA); commercial pesticide applicator certification and pesticide business registration requirements; riparian property owner consent; Special Local Need pesticide product registration; and Special License to Collect and Possess.

A kick-off meeting at NYSDEC Region One Headquarters (Stony Brook University) during October 2006 started the collaborative effort that led to the Fall 2007 start of the study. That initial meeting was attended by 52 key potential participants. That meeting was then followed by many other meetings and communications that led, one year later, to the issuance of both the SLN registration and Special License. A copy of the SLN can be found at the following website under Special/Pending Registrations: http://magritte.psur.cornell.edu/pims/.

On October 22, 2007, the first corn-filled, tickicide-charged deer treatment devices were deployed. That first deployment revealed a need for the NYSDEC to issue another authorization in the form of a FIFRA 2(ee) Recommendation to allow the preconditioning of rollers with the tickicide using a zippered plastic bag. That third form of regulatory authorization was issued.

This specialized tick management technology holds promise of providing an effective tool to combat the overpopulation of ticks affecting people living in, working in, and visiting Suffolk County. That tick reduction is expected to translate into a reduction of the human incidence of tick-borne diseases. In addition, it is expected that this host-targeted passive topical application technology will lead to a significant reduction in the overall dependence on pesticides broadcast sprayed on entire properties on a repeated basis.

V – Registered Pesticide Products

In part, Section 2(u) of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and Section 33-0101(35) of the Environmental Conservation Law of New York State (ECL) defines a pesticide as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, such as a tick. Except in very limited circumstances, any substance falling within this definition of a pesticide must be registered by USEPA and the NYSDEC before it can be legally offered for sale, sold, distributed, or used in New York State. One such exception to the registration requirement pertains to those

pesticides that the USEPA, under Section 25(b) of FIFRA, has determined to be of a character which is unnecessary to be subject to this Act, such as minimum risk pesticides discussed below.

The New York State registration status of a pesticide product can be checked by searching the *New York State Pesticide Product, Ingredient, and Manufacturer System* (PIMS) computer database. The database can be accessed at the following website: http://magritte.psur.cornell.edu/pims. Products can be searched by entering a product EPA Registration Number, a product label name, trade name, or brand name - or a portion thereof. They can also be found by entering an active ingredient, or a company or distributor name. Custom searches are also available, as are searches of special and pending registrations.

For example, there are hundreds of pesticide products registered for use in New York State to repel and control ticks. They contain the following active ingredients:

(1) Abamectin;
(2) .beta.-Alanine, N-acetyl-N-butyl-, ethyl ester;
(3) Aliphatic petroleum solvent;
(4) Alkyl* dimethyl benzyl ammonium chloride *(50%C14, 40%C12, 10%C16);
(5) d-Allethrin;
(6) d-trans-Allethrin;
(7) Amitraz;
(8) 4-tert-Amylphenol;
(9) 2-Benzyl-4-chlorophenol;
(10) Bifenthrin;
(11) Butoxypolypropylene glycol;
(12) Calcium polysulfide;
(13) Carbaryl;
(14) Chlorpyrifos;
(15) d-trans-Chrysanthemum monocarboxylic acid ester of d-2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one;
(16) Clarified hydrophobic neem oil;
(17) Coumaphos;
(18) Cube Resins other than rotenone;
(19) (R+S)-alpha-Cyano-3-phenoxybenzyl (1S+1R)-cis-3-(Z-2-chloro-3,3,3-trifluoroprop-1-enyl)-(19) 2, 2-dimethylcyclopropanecarboxylate (128 897);
(20) Cyclohexene, 1-methyl-4-(1-methylethenyl)-;
(21) Cyfluthrin;
(22) Cypermethrin;
(23) Cyphenothrin;
(24) Deltamethrin;
(25) Diazinon;
(26) Dichlorvos;
(27) Dicofol;
(28) Didecyl dimethyl ammonium chloride;
(29) N,N-Diethyl-meta-toluamide and other isomers;
(30) Diflubenzuron;
(31) Dihydro-5-pentyl-2(3H)-furanone;
(32) Diisobutylphenoxyethoxyethyl dimethyl benzyl ammonium chloride;
(33) Dimethoate;
(33) Dioctyl sodium sulfosuccinate;
(34) Dipropyl isocinchomeronate;

(35) 2,4-Dodecadienoic acid, 11-methoxy-3,7,11-trimethyl-, 1-methylethyl ester, (2E, 4E, 7S)-
(36) Endosulfan;
(37) Esfenvalerate;
(38) Ethion;
(39) Ethofenprox;
(40) Fenvalerate;
(41) Fipronil;
(42) Fluvalinate;
(43) Formetanate hydrochloride;
(44) Glyphosate, isopropylamine salt; 5-Heptyldihydro-2(3H)-furanone;
(45) (7S)-Hydroprene;
(46) Imidacloprid;
(47) Imiprothrin;
(48) Isopropanol;
(49) Linalool;
(50) Malathion;
(51) p-Menthane-3,8-diol;
(52) N-(Mercaptomethyl)phthalimide S-(O,O-dimethyl phosphorodithioate);
(53) 2-(1-Methyl-2-(4-phenoxyphenoxy)ethoxy)pyridine;
(54) Milbemectin (A mixture of >=70% Milbemcin A4, & <=30% Milbemycin A3;
(55) Mineral oil - includes paraffin oil from 063503;
(56) 2 Myclobutanil;
(57) N-Octyl bicycloheptene dicarboximide;
(58) Oil of eucalyptus;
(59) Permethrin, mixed cis,trans;
(60) D-Phenothrin;
(61) 2-Phenylethyl propionate;
(62) o-Phenylphenol;
(63) Picaridin;
(64) Piperonyl butoxide;
(65) Potassium salts of fatty acids;
(66) Prallethrin;
(67) Propoxur;
(68) Pyrethrins;
(69) 1H-Pyrrole-3-carbonitrile, 4-bromo-2-(4-chlorophenyl)-1-(ethoxymethyl)-5;
(70) Resmethrin;
(71) Rotenone;
(72) Silica gel;
(73) Silicon dioxide;
(74) Sodium o-phenylphenate;
(75) Sulfur;
(76) Tetrachlorvinphos ((Z)-isomer);
(77) Tetramethrin;
(78) Tralomethrin;
(79) Triethylene glycol;
(80) Undecylenic acid;
(81) Zeta-Cypermethrin;
(82) beta-cyfluthrin;
(83) gamma-cyhalothrin

VI – Minimum Risk Pesticides and Bio-Pesticides

A. Minimum Risk Pesticides-FIFRA 25(b), 40 CFR 152.25(f) (Pesticide registration exempt)

Minimum risk pesticides are exempt from federal and New York State pesticide registration. They must meet specific labeling and composition criteria to be eligible for the registration exemption assigned to this type of pesticide. The USEPA regards these products as posing little or no risk to the public.

To qualify for an exemption as a minimum risk pesticide, each active ingredient in the pesticide product must be listed in Part 152.25(g)(1) of Title 40 of the Code of Federal Regulations (40 CFR). Appendix A of Pesticide Registration (PR) Notice 2000-6 is a list of acceptable active ingredients. Currently, this list contains more than 30 active ingredients. In addition, 40 CFR 152.25(g)(2) provides that these pesticide products may only contain minimal risk inert ingredients listed in the most current List 4A. Appendix B to PR Notice 2000-6 identifies the most current acceptable inert ingredients. Additionally, to be exempted and remain exempted, products must also meet a series of exemption conditions described in 40 CFR 152.25(g)(3).

Neither the USEPA, nor the NYSDEC reviews or issue notices of exemption for products which meet the conditions for exemption. Offer for sale, sale, distribution, and use of a pesticide product meeting all the criteria in 40 CFR 152.25(g) without a federal or New York State registration is not a violation of federal and New York State laws, rules or regulations. However, if a product fails to meet all exemption criteria, the product is not exempt from federal and New York State pesticide product registration, and its offer for sale, sale, distribution or use would be a violation of registration requirements if it was not registered.

For further information, review *Pesticide Registration (PR) Notice 2000-6, Minimum Risk Pesticides Exempted from FIFRA Section 25(b), Clarification of Issues* and *List 4A - Minimal Risk Inert Ingredients* (Updated August 2004). A copy is available at the following website: http://www.epa.gov/PR_Notices/

NOTE: A *Petition to Amend Certain FIFRA Section 25(b) Pesticide Products* has been developed to challenge claims of effectiveness associated with using certain minimum risk pesticides. This is based on the fact that neither the USEPA, nor the NYSDEC require that efficacy data be developed and submitted for review where minimum risk pesticides are concerned. Therefore, unlike the situation involving registered pesticides, claims of effectiveness for a minimum risk pesticide are not presently supported by efficacy data that has been reviewed by the USEPA or NYSDEC. For additional details, see the information posted at the following website: http://www.epa.gov/EPA-PEST/2006/September/Day-13/p15204.htm.

Relatively recently, the USEPA concluded that products being distributed for the intended control of public health pests, such as ticks known to carry Lyme disease and other vector-borne public health threats, must be supported by evidence that they are indeed effective against the target pest. This stems from a petition filed by the Consumer Specialty Products Association in request that the USEPA exclude from the minimum risk pesticide exemption under FIFRA 25(b), those pesticides that claim to control pests of significant public health importance, and that the USEPA require an abbreviated registration for minimum risk pesticide products that are intended to be used for the control of public health pests. This attention may result in minimum risk pesticides marketed for the intended control of ticks to be supported by efficacy data, and to be registered with the USEPA and NYSDEC prior to their marketing and use.

Since minimum risk pesticides are presently not registered with the USEPA or NYSDEC, a list of minimum risk products is not available. Any minimum risk pesticide considered for use should be carefully evaluated prior to, and during use to determine its effectiveness.

B. Bio-pesticides (Biological Pesticides)

As of December 2007, NYSDEC-registered tick management pesticide products contain only one bio-pesticide active ingredient the plant oil known as oil of eucalyptus. Oil of eucalyptus is contained in personal repellent products. Bio-pesticides are derived from such natural materials as animals, plants, bacteria, and certain minerals. There are three classifications of bio-pesticides biochemical pesticides, microbial pesticides, and plant protectants. Where tick management is concerned, only biochemical and microbial agents are considered because plant protectants play no role in this area of public health pest control.

Biochemical pesticides consist of naturally occurring substances that control pests by non-toxic mechanisms. Conventional pesticides, by contrast, are generally synthetic materials that directly kill or inactivate the pest. Biochemical pesticides include substances, such as insect sex pheromones, that interfere with mating, as well as various scented plant extracts such as oil of eucalyptus that is registered for use to repel ticks in New York State.

Microbial pesticides consist of a microorganism (e.g., a bacterium, fungus, virus or protozoan) as the active ingredient. The feasibility of using the entomogenous fungi *Beauveria bassiana* and *Metarizium anisopliae* to control ticks is currently being researched. If found to be effective and registered for use in New York State, such products would meet the classification criteria of a bio-pesticide. At present, there are no microbial pesticides registered for tick control in New York State.

There are advantages to using bio-pesticides. They are usually inherently less toxic than conventional pesticides. Bio-pesticides generally affect only the target pest and closely related organisms, in contrast to broad spectrum, conventional pesticides that may affect organisms as different as birds, insects, and mammals. They often are effective in very small quantities and often decompose quickly, thereby resulting in lower exposures and largely avoiding the negative impact to environmental resources sometimes caused by conventional pesticides. With most pest management strategies, when bio-pesticides are used as a component of an Integrated Pest Management (IPM) program, environmentally-preferable bio-pesticides have the potential to greatly decrease the use of conventional pesticides needed to gain control. However, with such limited availability of bio-pesticides where tick management is concerned, options involving bio-pesticide control agents are extremely limited.

For a complete list of bio-pesticides, see the following EPA website:
http://www.epa.gov/oppbppd1/biopesticides/index.htm

See also:
EPA Fact Sheet - 3-[N-Butyl-N-acetyl]-aminopropionic acid, ethyl ester
http://www.epa.gov/oppbppd1/biopesticides/ingredients/factsheets/factsheet_113509.htm

VII – Laws, Rules and Regulations

Pesticide Laws, Rules and Regulations Relating to Tickicide Manufacturer, Distribution and Use

The following discussion draws attention to a variety of key regulatory considerations that must be taken into account in connection with the use of pesticides in New York State. All "tickicides" are "pesticides." Tickicides represent one type of pesticide, as do, for example, herbicides, insecticides, fungicides, rodenticides and antimicrobial agents.

Pesticide Product Registration

As discussed in the section captioned Registered Pesticide Products above, pesticide products, with very limited and conditioned exception, must be registered with the NYSDEC prior to offer for sale, sale, distribution, and use in New York State. See additional details in that earlier section.

Applicator Certification

Individuals engaging in the commercial application of any pesticide for the intended control of ticks or other pests must be certified with the NYSDEC as a Commercial Pesticide Applicator or Technician. Uncertified individuals may engage in the commercial application of pesticides under the direct supervision of a Certified Commercial Pesticide Applicator. That supervision may be required to be on-site direct supervision, depending on project-specific circumstances. In addition, the certified individual must be certified in a category or subcategory of certification that authorizes the particular pesticide use activity they are engaged in.

The general public (homeowners) is not required to be certified to use over-the-counter pesticides for tick control. Unless certified, an individual cannot engage in the use of any pesticide classified as Restricted Use.

Environmental Conservation Law (ECL) Title 10 Commercial Lawn Application

Individuals engaging in the commercial lawn application of pesticides for the targeted control of ticks and other pests must comply with requirements that relate to contracts, posting treated areas, and notifying adjoining property owners. The phrase commercial lawn application is used to describe the application of any pesticide to the ground, shrubs and trees.

Label Information Notification

Pursuant to the provisions of ECL 33-0905(5), commercial pesticide applicators must supply occupants of dwellings, and the owner or agent of multiple dwellings and other structures with a copy of the label of the pesticide being applied. This information must be provided prior to application of the pesticide, thus affording New York State residents with the opportunity to review the label and to make an informed decision with respect to whether they want to proceed with the application.

Pesticide Misuse

READ THE LABEL. All pesticides, including registration exempt minimum risk pesticides, must be used in strict accordance with all label directions. The use of any pesticide inconsistent with label directions violates the provisions of Part 325.2(b) of the New York Codes, Rules and Regulations (6 NYCRR).

National Pesticide Information Center

Before deciding on a pesticiderelated tick management strategy, Suffolk County residents can review the pesticide label and contact the National Pesticide Information Center (NPIC), a cooperative agreement between Oregon State University and the U.S. Environmental Protection Agency. They provide objective, science-based information about pesticides and pesticide-related topics to enable people to make informed decisions about pesticides and their use. The NPIC can be contacted at the following website: http://npic.orst.edu/. They are open from 6:30 a.m. to 4:30 p.m. Pacific time, daily. They can also be reached by toll-free telephone at 1.800.858.7378, and via e-mail at npic@ace.orst.edu.

Integrated Pest Management (IPM)

The Suffolk County Tick Management Task Force recommends that all pesticide-related tick management strategies and technologies be designed and executed in conformance with the principles and practices of Integrated Pest Management (IPM).

VIII – References

American Society for the Prevention of Cruelty to Animals (ASPCA). 2004. ASPCA Animal Poison Control Center Warns Pet Owners: Summer is the Deadliest Time of Year for Companion Animals. Press Release May 3.

Amweg, E. L., Weston, D.P. and N.M. Ureda. 2005. Use and Toxicity of Pyrethroid Pesticides in the Central Valley, California, USA. Environmental Toxicology and Chemistry. 24 (4) 966-972.

Morrison, Gordon. 2006. Dear Bayer Environmental Science Distributors letter

Lewis, R. G. 2005. Human Exposure Analysis Chapter 4: Exposure to Pesticides. W. Ott and A. Steinmann, eds. CRC Press, Boca Raton, Fla. (in press).

Litovitz, T. L., Klein-Schwartz, W., Cavavati, E. M., et al. 1998. Annual Report of the American Association of Poison Control Centers Toxic Exposure Surveillance System. American Journal of Emergency Medicine, 17(5): 434-487, 1999. As cited in NYSDOH, 1998.

New York State Department of Health (NYSDOH). 1998. New York State Pesticide Poisoning Registry Report 1998. Bureau of Occupational Health.

New York State Department of Health (NYSDOH). 2004a. Health Advisory: Tick and Insect Repellents. http://www.health.state.ny.us/nysdoh/westnile/education/2737.htm

New York State Department of Health (NYSDOH). 2004b. Tick and Insect Repellents: Deciding on Their Use. March 2004. http://www.health.state.ny.us/publications/2749/

Nishioka, M. G., H. M. Burkholder, M. C. Brinkman, S. M. Gordon and R. G. Lewis. 1996. Measuring transport of lawn-applied herbicide acids from turf to home: Correlation of dislodgeable 2,4-D turf residues with carpet dust and carpet surface residues. Environ. Sci. Tech. 30:3313-3320.

Pound, J.M., J.A. Miller, J.E. George, and D. Fish. 2008a. Introduction to the USDA Northeast Area-wide Tick Control Project. Vector-Borne Zoonotic Dis. In press.

Pound, J.M., J.A. Miller, J.E. George, and D. Fish. 2008b. The USDA Northeast Area-wide Tick Control Project – Summary and Conclusions. Vector-Borne Zoonotic Dis. In press

Pound, J.M., J.A. Miller, and C.A. LeMeilleur. 1994. Device and Method for Its Use as an Aid in Control of Ticks and Other Ectoparasites on Wildlife. U.S. Patent #5,367,983 dated 29 November 1994 assigned to the United States of America as represented by the Secretary of Agriculture, Washington, DC.

Pound, J.M., J.A. Miller, J.E. George, D.D. Oehler, and D.E. Harmel. 1996. Systemic Treatment of White-tailed Deer with Ivermectin-Medicated Bait To Control Free-Living Populations of Lone Star Ticks (Acari: Ixodidae). J. Med. Entomol. 33(3): 385-394.

Pound, J.M., J.A. Miller, J.E. George, and C.A. LeMeilleur. 2000a. The '4-Poster' Passive Topical Treatment Device to Apply Acaricide for Controlling Ticks (Acari: Ixodidae) Feeding on White-tailed Deer. J. Med. Entomol. 37: 588-594.

Pound, J.M., J.A. Miller, and J.E. George. 2000b. Efficacy of Amitraz Applied to White-tailed Deer by the '4-Poster' Topical Treatment Device in Controlling Free-Living Lone Star Ticks (Acari: Ixodidae). J. Med. Entomol. 37: 878-884.

Richardson, J. 2000.Permethrin Spot-On Toxicosis in Cats. The Journal of Veterinary Emergency and Critical Care. April-June.

Solberg, V.B., J.A. Miller, T. Hadfield, R. Burgie, J.M. Smith, and J.M. Pound. 2003. Control of Ixodes scapularis (Acari: Ixodidae) with Topical Self-Application of Permethrin By White-tailed Deer Inhabiting NASA, Beltsville, Maryland. J. Vector Ecol. 28: 117-134.

Soukup, M., USDI, National Park Service, North Atlantic Region. Personal communication to Frank Hegener, NYSDEC, Bureau of Pesticide Management. June 23, 1987.

Weston, D. P., Holmes, R.W., You, J. and M.J. Lydy. 2005. Aquatic Toxicity Due to Residential Use of Pyrethroid Insecticides. Environmental Science and Technology. 39 (24), 9778-9784.

Section

4

Dr. Timothy Green, Lead Author & Laura Bavaro

HOST AND HABITAT MANAGEMENT

EXECUTIVE SUMMARY

Measures to reduce tick populations over a large geographic area are not currently practicable or safe. Individual homeowners can use several measures to reduce tick numbers in the vicinity of their homes.

Discouraging hosts by practicing cleanliness, debris removal, and not feeding wildlife can all help to reduce hosts near homes. Deer fencing may be also be used to discourage hosts. However, fencing that prevents deer from accessing a yard or garden area forces deer into smaller areas potentially resulting in other problems such as greater damage to the forest ecosystem or increase deer/vehicle accidents. Landscaping with deer resistant plants is a more effective mechanism at preventing deer from entering the area around homes.

Home owners interested in reducing ticks around their homes should reference the *Tick Management Handbook* prepared by the Connecticut Agricultural Experiment Station in New Haven, CT, available at:
http://www.ct.gov/caes/lib/caes/documents/special_features/TickHandbook.pdf

This handbook provides practical tips for the home owner to manage their landscapes in order to reduce tick populations on their property. The Handbook suggests the following approaches:

- Keep grass mowed
- Remove leaf litter, brush and weeds at the edge of the lawn.
- Restrict the use of groundcover, such as pachysandra in areas frequented by family and roaming pets.
- Remove brush and leaves around stonewalls and wood piles.
- Discourage rodent activity. Cleanup and seal stonewalls and small openings around the home.
- Move firewood piles and bird feeders away from the house.
- Manage pet activity; keep dogs and cats out of the woods to reduce ticks brought back into the home.
- Use plantings that do not attract deer or exclude deer through various types of fencing.
- Move children's swings sets and sand boxes away from the woodland edge and place them on a wood chip or mulch foundation.
- Trim tree branches and shrubs around the lawn edge to let in more sunlight.

- Adopt hardscape and xeriscape (dryer or less water demanding) landscaping techniques with gravel pathways and mulches. Create a 3-foot or wider wood chip mulch, or gravel border between lawn and woods or stonewalls.
- Consider areas with decking, tile, gravel and border or container plantings in areas by the house or frequently traveled.
- Widen woodland trails.
- Consider host products to kill ticks on deer or rodent hosts.
- Consider a pesticide application as a targeted barrier treatment.

The above techniques serve more at modifying human behavior and the human environment in order to lessen its ability to for survival of ticks and serving as home for various tick hosts.

Recommendations:

- Work to establish county-wide deer management to a sustainable ecological carrying capacity;
- Obtain a county-wide estimate of deer populations and encourage more hunters, if necessary
- Work to change hunting regulations to allow most efficient method of hunting at peak behavioral periods.
- Work with other local, state, federal land owners to open lands to hunting;
- Develop a location for donating deer for butchering and subsequent transfer to homeless shelters;
- Continually review research and opportunities for using new technology that allows host management for purposes of tick reduction; and
- Adopt or adapt Connecticut's *Tick Management Handbook* and encourage homeowners to manage their landscape to reduce the presence of ticks around their homes.

I - Introduction

Medically important ticks of Suffolk County utilize a variety of hosts to complete their life cycles. In general at least two host species are utilized. The first host is typically a small mammal like a mouse, vole, or other rodent that is used by larvae. The second host for subsequent stages may be a small mammal to a large mammal. In many instances the white-tailed deer (*Odocoileus virginianus*) is the host. Other hosts of ticks include small and medium sized mammals (mice, voles, chipmunks, and squirrels), turkey, geese, and migratory birds. Because ticks do utilize a variety of hosts, this chapter discusses issues and potential management options starting with deer then moving on to other hosts

II – Deer

A. Deer, ticks, tick-borne diseases

White-tailed deer (*Odocoileus virginianus*) are found across Long Island's natural areas but also throughout a majority of our residential communities, sometimes in large numbers. White-tailed deer are often reported as the primary host for several species of ticks, including the lone star tick (*Amblyomma americanum*) and the blacklegged tick (*Ixodes scapularis*). Hence, Long Island's burgeoning populations of deer have greatly contributed to increased abundance and geographic distribution of ticks (Means and White, 1997; Wilson et al., 1990).

Studies have also documented that deer can serve as a reservoir for disease-causing agents. Specifically, white tailed deer serve as a reservoir for *Ehrlichia chaffeensis* (Lockhart *et al.*, 1997), the etiologic agent of human monocytic ehrlichiosis. Thus, deer provide a way of maintaining and spreading ehrlichiosis, a now relatively common disease, throughout Long Island. Deer apparently play no role in infecting the tick *I. scapularis* with *Borrelia burgdorferi* (Lyme disease) or *Babesia microti* Franca (human babesiosis) (Piesman al., 1979; Levine et al., 1985; Telford al., 1988).

B. Deer Biology

Deer are prolific breeders. Each adult female (doe) can begin reproducing when they are only one year old, normally having two fawns a year. Deer are also indiscriminate breeders. A

single male, given the opportunity, will breed with all available females. On Long Island, deer rut (breed) twice – in the beginning of November and again 28 days later. If only male deer (bucks) are taken from the resident population, deer numbers will continue to grow. Unchecked, wild deer populations can double in size every two years. In order to control deer population numbers, female as well as male deer must be removed from the population. It is widely reported that about 40% of the adult does must be taken each year to keep deer numbers stable in most of southern and western New York. Conservatively there are between 15 – 20,000 deer in Suffolk County. Approximately 2,000 deer are currently taken by recreational hunters each year in Suffolk County. Several thousand additional deer are taken through nuisance permits issued under the NY State Department of Environmental Conservation's Deer Management Assistance Program. At the upper end of the population estimate at least 8,000 deer per year must be taken to maintain a static population and a higher number must be taken to begin reducing the population. Certain communities on the eastern end of Suffolk County are being successful at population reductions through long term efforts. In order to make deer population management effective a good understanding of the number of deer in Suffolk County would be needed. This could be achieved through an aerial assessment of the deer population using Forward Looking Infrared Radar (FLIR).

Several studies suggest that the size of the tick population is a function of the size of white tailed deer population, that reducing deer densities could be a method of tick control (Wilson et al., 1990). Wilson et al. (1990) specifically stated that locally intensive removal of deer, deer fencing, or repellants could feasibly be used to reduce the number of vector ticks in suburban yards, parks and recreational sites, hence reducing the public's risk of associated disease. Ginsburg and Zhioua (1999) suggest that simply lowering deer populations will only result in more ticks on fewer deer. Ticks have been nearly eliminated on Monhegan Island off the coast of Maine through elimination of the deer population (Rand, P.W. et al., 2004). However, this would be a near impossible feat for Long Island and is neither desirable nor achievable. Data and evidence suggests that large scale reduction in deer populations to less than 10 per square mile over extended periods of time is likely necessary to effect significant tick reduction. However deer population management concurrent with localized tick management may be affective. The Task Force agrees that some form of management is needed to stabilize Long Island's deer populations. Several options were discussed by the Task Force Subcommittee:

C. Deer and vehicle accidents

It seems that car accidents with deer are becoming common in areas with large deer populations, although there is no clear link between deer population numbers and vehicle damage. According to the Department of Motor Vehicles (2002-2006), there have been approximately 10,000 deer-related accidents per year in New York where damage exceeds $1,000 or an accident resulted in serious injury or death. Since 1990, an average of three people dies each year in New York due to deer-vehicle collisions (54 people since 1990). One-third of the deaths were those on motorcycles. Accidents are more likely from mid-September to late November and a smaller spike occurs in May-June. Deer are most active during dawn and dusk and have predictable daily routines to and from feeding and bedding areas. The NYSDOT and some towns and counties keeps records of the carcasses collected.

D. Deer and ecosystem effects

Deer overpopulation harms natural ecosystems. Deer are selective browsers, targeting specific plant species to eat. In high deer density areas, deer browsing prevents the regeneration of forests as deer eat nearly all the tree seedlings, destroy forest understory plants, and reduce overall species richness. For example, studies have shown that the 2,039 acre-Mashomack Preserve on Shelter Island is changing from an oak-dominated forest to favoring more maples. In some natural areas, the understory of the forest is almost nonexistent due to over browse, negatively affecting birds and other animals that used that vegetation for food and cover. Several studies found that deer browsing significantly reduces songbird numbers by destroying their habitats.

E. Deer and agriculture

Growers on Long Island continue to be concerned with agricultural damage due to deer. According to a report by the Human Dimensions Research Unit, statewide agricultural damage by deer is estimated to be $58.8 million. The highest per acre damage estimate was documented on Long Island followed by Southeastern New York. According to the New York Farm Bureau, most damage takes place in late July to early September. To further illustrate the damage that can be caused, one deer can kick open 30 pumpkins in a single night (Chris Kelder, 2006).

F. Hunting

Hunting is considered an important component to deer manangement, but current restrictions on buffer areas around occupied buildings and other perceived safety issues limit where this tool can be used. In addition the number of hunters is steadily decreasing. For hunting to continue to be an effective tool several actions must be taken including: Increasing the available areas for hunting; Encouraging increased hunter participation; Extending or altering hunting seasons; and reducing buffer areas for archery only hunts.

Hunting is regulated by the NYSDEC with seasons and bag limits established on a Regional Basis. On Long Island the current hunting season is as follows:

- Archery – October 1 through December 31
- Shotgun – Start - 1st Monday following 1st Saturday in January; Finish Last weekday of January
- Monday – Friday only – other limitations included.

The six east end towns have established quotas that amount to permits available for up to 6,950 deer combined during the shotgun season.

G. Increasing available hunting areas

Most lands currently available for hunting are owned by various levels of government. Large tracks of land either government or privately owned are not available for hunting and current limitations with regard to discharge of firearms (including archery) within 500ft of an occupied structure decrease the available space for hunting. Concerted effort to increase the available private and publicly available lands for hunting would significantly increase lands available for hunter access as would reducing required offsets from occupied structures.

It is currently illegal to discharge a firearm or bow in New York State

- so that the load or arrow passes over any part of a public highway,
- within 500 feet of any school, playground, or an occupied factory or church,
- within 500 feet of a dwelling, farm building or structure in occupation or use unless you own it, lease it, are an immediate member of the family, an employee, or have the owner's consent.

In the highly urbanized areas of New York these limitations severely restrict where hunters may hunt. To enhance ability to control deer populations, the State of Pennsylvania has reduced the minimum archery shooting distance from a residence from 500 ft to 150 ft

(Pennsylvania Game Commission Codes Title 34, Chapter 25, Sec. 2505). New York should consider modifying distance restrictions to 250ft or less from residences to increase areas accessible for hunter harvest.

H. Increasing Hunter Participation

With consistent reductions in the number of hunters across the nation, hunting as a tool for managing game populations is being greatly hindered. To combat this, various programs have been established such as special youth hunts, Becoming an Outdoors Woman, among others. While these programs introduce hunting to new hunters, none of the programs seem to be effective at increasing the number of hunters by large numbers. A better understanding why hunting is declining and why people do not consider becoming hunters needs to be determined. Based on this information programs should be developed that specifically targets new hunters and encourage life time hunters. Suffolk County should consider special hunter programs within the county to encourage hunter recruitment.

I. Improve Meat Donation Programs

In most states, including New York, programs called "Hunters for the Hungry" exist to provide a mechanism that allows hunters to donate deer and other wildlife to prisons, shelters and soup kitchens. These programs are supplemented by the state, but typically also result in an expense to the hunter of between $50 and $100 dollars. Many hunters would take additional deer for the sport if there was an inexpensive mechanism for meat donation. Suffolk County has a butchering facility in Yaphank for training butcher trades. This facility currently does not have a dedicated portion that would allow butchering deer for donation purposes. Establishing such a facility for fee-free processing would allow deer taken through nuisance permits, and deer taken under routine hunting to be donated and put to beneficial use.

J. Legal Sale of Meat

New opportunities for exotic meats and exotic food restaurants are emerging. To support this market, legalized sale of hunter harvested deer could facilitate population reductions. However, should this mechanism be established, it would require new regulations for legal sale, quality control, and permits.

K. Revised Hunting Seasons

Deer are most easily hunted during the peak of the rutting season from November through early December. In Suffolk County deer hunting is restricted to archery only during this period.

While this maximizes opportunities for bow hunters it may effectively reduce the number of animals taken. A revised shotgun season to coincide with the peak rutting period of Nov. 15 to Dec. 15 should be considered to increase potential harvest.
Bow season would therefore have to be modified to extend from Oct. 1 through Nov. 14 and would open again from Dec. 16 and could extend to the end of January.

L. Culling Deer

Reducing the population of the deer herd in Suffolk County is a viable, although expensive option. Culling operations would need to be carried out by licensed individuals under contract to Suffolk County and/or various land managing agencies. Typically culling costs are between $60 and $150 per animal. If deer are to be beneficially used, many culling operations will also butcher and refrigerate the meat. This service adds approximately $100 to the cost per animal. Culling would necessarily target areas of high deer density. This then requires having a solid understanding of the deer population and its distribution. Other issues related to culling are the same as those associated with hunting, i.e. discharge of fire arms and archery equipment near structures, etc. These and other restrictions decrease the affective area for conducting culling operations.

M. Fencing to Limit Range of Deer

Fencing is an effective tool to prevent deer from either entering or leaving an area. This tool, although expensive, could be used to establish "deer free zones." Without deer the number of ticks present in an area would theoretically decline to manageable or tolerable levels. The biggest problem with this concept is the resulting displacement of large numbers of deer.

Fencing as it is currently practiced has been implemented by individual land owners. Many east end farmers have installed deer fences that are 8-12' in height to prevent deer from entering their farm fields and/or orchards. These fences seem to be fairly effective at preventing deer from accessing the agricultural areas. The key draw back to fencing is it then forces deer in to smaller and smaller areas where their density then creates increased problems. Or, it forces deer into neighborhoods where they cause damage to horticultural and landscape plantings, thus becoming an increased nuisance to the home owner. Whether this higher density of deer has resulted in higher tick populations is unknown as is the potential ecological damage.

As currently used, the installation of fences is targeted more toward the preservation of property from deer damage than for tick population reduction and management.

N. Contraceptives

There are currently two options available for contraceptive control of wildlife; porcine zona pellucida (PZP) or gonadotropic hormones (GH or GonaCon™). Both are considered experimental and are not commercially available for use. The use of PZP has historically been labor intensive and costly. PZP treatment of deer requires a dual treatment the first year and re-treatment every year there after. This requirement results in added requirements for the identification of individuals and the need to trap individuals to apply some marking mechanism, typically ear tags. Once individuals are marked, they may be treated using dart rifles. The use of PZP has been shown to be effective in the western Fire Island communities on Long Island where special care has been taken to ensure all requirements are completed on an annual basis. One typical drawback to the use of PZP is the limitations placed on consumption of deer meat that may contain the contraceptive.

The use of gonadotropic hormones is a relatively new technique that has been tested over the past several years resulting in the development of a treatment called GonaCon™ which is currently seeking licensing through the FDA and EPA. GonaCon™ is a vaccine that stimulates antibodies that bind gonadotropic releasing hormone (GnRH). GnRH stimulates the production of sex hormones. When antibodies bind to GnRH the normal production of sex hormones is inhibited substantially reducing fertility. GonaCon™ can be used on both male and female deer effectively reducing fertility in both sexes and the population as a whole. Although, recent research suggests not using it on bucks due to negative health affects (Curtis, et al 2008). A single treatment is typically effective for 2-4 years making treatment necessary only two to three times during the life of a deer. Deer treated with GonaCon™ may be consumed. Drawback – GonaCon™ is not currently available for widespread use. (USDA-APHIS-WS-NWRC)

Should the commercial sale of GonaCon™ be approved, the cost of treatment would still be fairly high. A large portion of the deer population would have to be treated. With approximately 20,000 deer in Suffolk County, the treatment would require 10,000 or more individual deer to be treated. The cost of treating the deer population would likely be in the millions of dollars.

O. Use of Predators

There are currently no large predators on Long Island that can substantially control the white-tailed deer population. Historically, there were likely to have been mountain lion or cougar on Long Island but those were eradicated either prior to western man arriving or shortly there after. There are incidental observations that fox (red and grey) working in packs may take fawns. Observations at several dens at BNL have indicated that fox bring in parts of deer. There has been no direct observation of fox taking deer.

Packs of wild dogs have likely taken deer on Long Island. Packs of dogs have been observed chasing deer, and several deer carcasses with evidence of heavy predation have been seen primarily at BNL. When dog packs have been removed, no additional deer carcasses with evidence of predation have been found.

The coyote (*Canis latrans*) does not currently exist on Long Island. According to Audubon, the Smithsonian and other organizations, Long Island is the largest land mass in North America that does not have coyotes. Coyotes have been observed within NY City and they are present in Connecticut and Rhode Island. There is a fairly high likelihood that coyotes will eventually arrive on Long Island. Should this occur, the question becomes whether they should be allowed to establish themselves or should they be eliminated. The presence of coyotes would provide a medium sized predator to reduce deer populations, but the same predator would also attack domestic pets and feral animals.

III – Mice and Other Small Mammals

Small mammals like mice, voles, chipmunks and squirrels usually serve as the first host for larval ticks, and may be used as second and third hosts for the nymph and adult tick. These hosts also serve as the reservoirs for *Borrelia burgdorferi* and other tick-borne infectious agents.

Managing these hosts usually involves managing the habitat that they need to survive. This includes keeping areas in and around house holds free of excess debris and managing landscape to reduce habitats that serve as areas for breeding, feeding, and shelter. The State of Connecticut has published a document titled the Tick Management Handbook prepared by the Connecticut Agricultural Experiment Station in New Haven, CT. available at: http://www.ct.gov/caes/lib/caes/documents/special_features/TickHandbook.pdf
This handbook provides practical tips for the home owner to manage their landscapes in order to reduce tick populations on their property. The Handbook suggests the following approaches:

- Keep grass mowed
- Remove leaf litter, brush and weeds at the edge of the lawn.
- Restrict the use of groundcover, such as pachysandra in areas frequented by family and roaming pets.
- Remove brush and leaves around stonewalls and wood piles.
- Discourage rodent activity. Cleanup and seal stonewalls and small openings around the home.
- Move firewood piles and bird feeders away from the house.
- Manage pet activity; keep dogs and cats out of the woods to reduce ticks brought back into the home.
- Use plantings that do not attract deer or exclude deer through various types of fencing.
- Move children's swings sets and sand boxes away from the woodland edge and place them on a wood chip or mulch foundation.
- Trim tree branches and shrubs around the lawn edge to let in more sunlight.
- Adopt hardscape and xeriscape (dryer or less water demanding) landscaping techniques with gravel pathways and mulches. Create a 3-foot or wider wood chip mulch, or gravel border between lawn and woods or stonewalls.
- Consider areas with decking, tile, gravel and border or container plantings in areas by the house or frequently traveled.
- Widen woodland trails.
- Consider host products to kill ticks on deer or rodent hosts.
- Consider a pesticide application as a targeted barrier treatment.

The above techniques serve more at modifying human behavior and the human environment in order to lessen its ability to for survival of ticks and serving as home for various tick hosts.

A. Wild Turkey and Migratory Birds

The wild turkey (*Meleagris galopavo*) is growing in number in Suffolk County. Reintroduced to Long Island in 1992, this large game bird's population has steadily increased. There are now several thousand wild turkeys in the county. Because of there habit of roaming between forest and field, this bird may play a role in dispersal and survival of ticks, especially the lone star tick. Observations of wild turkey poults on Brookhaven National Laboratory suggest that poults, and likely adults, may harbor hundreds of larval ticks during the late summer and early fall months (Green personal communication). These larvae may then be spread to other areas as the turkeys roam from place to place.

To reduce the likelihood of wild turkeys carrying ticks into an area the area should be modified to reduce the chance of turkeys using it. Around the home the suggestions provided above will also serve to protect the home from turkeys.

Migratory birds are known to provide mechanisms for the dispersal of ticks. While not considered a major host of ticks, migratory birds do harbor sufficient numbers of ticks to effectively disperse them from place to place. Therefore if ticks are eradicated or greatly reduced in an area, migratory birds may be responsible for bringing ticks back into that area. Positioning bird feeders away from the house and frequented areas of yards will lessen the likelihood of ticks being introduced to the landscape.

IV – Recommendations

Measures to reduce tick populations over a large geographic area are not currently practicable or safe. Individual homeowners can use several measures to reduce tick numbers in the vicinity of their homes.

Discouraging hosts by practicing cleanliness, debris removal, and not feeding wildlife during the tick season can all help reduce hosts near homes. Fencing may be also be used to discourage hosts. However, fencing that prevents deer from accessing a yard or garden area forces deer into smaller areas potentially resulting in other problems such as greater damage to the forest ecosystem or increase deer/vehicle accidents. Landscaping with deer resistant plants is a more effective mechanism at preventing deer from entering the area around homes.

Home owners interested in reducing ticks around their homes should reference the Tick Management Handbook prepared by the Connecticut Agricultural Experiment Station in New Haven, CT. available at: http://www.ct.gov/caes/lib/caes/documents/special_features/TickHandbook.pdf

On a County wide basis Suffolk County should be working to:

- Work to establish county wide deer management;
- Obtain a county-wide estimate of deer population;
- Work to change hunting regulations to allow most efficient method of hunting at peak behavioral periods;
- Encourage more hunters;
- Maximize the amount of County owned property open and available to hunters;
- Work with other local, state, federal land owners to open lands to hunting;
- Develop a location for donating deer for butchering and subsequent transfer to homeless shelters;
- Continually review research and opportunities for using new technology that allows host management for purposes of tick reduction; and
- Adopt or adapt Connecticut's Tick Management Handbook and encourage homeowners to manage their landscape to reduce the presence of ticks around their homes.

V – References

Chris Kelder, NY FARM Bureau, Deer Damage Workshop 27 June 2006

Curtis, P.D., M.E. Richmond, L.A. Miller, and F.W. Quimby. 2008. Physiological effects of gonadotropin-releasing hormone immunocontraception on white-tailed deer. Human-WildlifeConflicts Vol. 2, no. 1, 68-79.

Ginsberg, H.S. and E. Zhioua. 1999. Influence of Deer Abundance on the Abundance of Questing Adult *Ixodes scapularis* (Acari: Ixodidae). Journal of Medical Entomology Vol. 36, no. 3, 376-381.

Levine, J.F., M. L. Wilson, and A. Spielman. (1985) Mice reservoirs of the Lyme disease spirochete. American Journal of Tropical Medicine and Hygiene, 34, 355-360.

Lockhart, J. M., W. R. Davidson, D. E. Stallnecht, and J. E. Dawson. 1997a. Isolation of *Ehrlichia chaffeensis* from wild white-tailed deer(*Odocoileus virginianus*) confirms their role as natural reservoir hosts. J. Clin. Microbiol. 35(7): 1681-1686.

Mark L. Wilson, A.Ducey, T. S. Litwin, T. A. Gavin, and A. Spielman. 1990. Microgeographic distribution of immature *Ixodes dammini* ticks correlated with that of deer. Medical and Veterinary Entomology 4: 151-159.

Means, R. G., and D. J. White. 1997. New distribution records of *Amblyomma americanum* (L.) (Acari: Ixodidae) in New York State. J. Vector Ecol. 22: 133-145.

J. Piesman, A. Spielman, P. Etkind, and D.D. Juranek. 1979. Role of deer in the epizootiology of *Babesia microti* in Massachusetts, USA. Journal of Medical Entomology, 15, 537-540.

Rand, Peter W., C. Lubelczyk, M.S. Holman, E.H. Lacombe, and R.P. Smith, Jr. 2004. Abundance of *Ixodes scapularis* (Acari: Ixodidae) After the Complete Removeal of Deer from an Isolated Offshore Island, Endemic for Lyme Disease. Journal of Medical Entomology, Vol. 41 no. 4, pp779-784.

S. R. Telford , III, T.N. Mather, S.I. Moore, M.L. Wilson, and A. Spielman. 1988 Incompetence of deer reservoirs of the Lyme disease spirochete. American Journal of Tropical Medicine and Hygiene, 39,105-109.

Section

5

Fernando Villlalba (Lead Author), Kristy Cimaglia and Eva Haughie

PUBLIC EDUCATION

EXECUTIVE SUMMARY

From its inception, the Tick Management Task Force (TMTF) realized that education is an effective strategy to prevent and control tick-borne diseases in Suffolk County. The Suffolk County Department of Health Services (SCDHS) has a Public Education professional who speaks to various groups about Lyme disease, Rabies, West Nile virus and other communicable diseases. The Education Sub-Committee believes that those efforts should be escalated for tick-borne diseases. Other strategies to enhance public education regarding tick-borne diseases are listed below.

Recommendations:

1. Enhance Public Education County-wide using the existing SCDHS Public Health Educator. Initially target groups where tick-borne diseases rates are higher than the County-wide average, especially the Senior Citizen Population and children on the east end of the County (See **Section 2**).

2. Update the SCDHS Website for Tick-borne Diseases to include information on prevention, disease education, tick identification and other general information. Provide links to other websites and resources listed at the end of this section. A link to the TMTF standalone booklet (i.e., the Executive Summary of this report) should also be available.

3. Update the SCDHS Lyme disease brochure to include new information on emerging tick-borne diseases, the developing SCDHS Website Link and the existing SCDHS Public Health Hot-line.

4. Prepare or use an existing video on tick-borne disease prevention for Suffolk Local Access Channels, which vary by location.

5. For Items 2, 3 and 4, include information on how to secure the *Tick Management Handbook at: http://www.ct.gov/cases/site/default.asp, which* encourages homeowners to manage ticks using an integrated approach while being environmentally responsible.

I - Introduction:

The TMTF recognizes that education is an effective strategy to prevent and control tick-borne diseases in Suffolk County. Public Education is a component of Integrated Pest Management (IPM) approach that the Task Force adopted. IPM is an approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks" (FIFRA, 7 USC 136r-1). Accordingly, IPM coordinates the use of pest biology, environmental and available technology in order to mitigate pest damage. To be successful, it is important to educate the public of these integrated techniques, their applications and any potential risk they may pose. Likewise, the public should also be informed of the risks that these pests present, especially if they are a health concern. This section addresses educational goals, while providing resources that can be used to enhance public education. .

Of all known diseases that are transmitted by ticks, Lyme disease has become the most common nation-wide, with the highest concentration of cases in the Northeast. The Centers for Disease Control (CDC) has confirmed that based on recent results Lyme disease is the most reported tick-borne disease in the U.S. Lyme disease is also a relatively newly reported illness. It was first identified around 1975 and in 1981 the spirochete that causes the disease was documented. Since the discovery of Lyme disease, its prevalence has increased tremendously. During the quest to understand Lyme disease there have also been an increasing research and knowledge on other tick-borne diseases (see **Section 7**). Consequently, scientists have expanded and continue to expand their understanding of the threat ticks present to the general public.

Prior to the 1970's, the main concern as regards to ticks, specifically American dog ticks, was Rocky Mountain spotted fever (RMSF). With the growing populations of ticks in Suffolk County, such as lone star ticks, the chances of contracting the tick-borne diseases is also increasing. Due to the possibility that the public, county officials and health care professionals have the ability to mitigate the spread and contraction of these diseases, the Task Force understands that education should be a major component in reducing the incidence of tick-borne disease on Long Island. Education has to remain current by continually researching and embracing new and available information.

II – Significance of Tick-Borne Diseases

Nationally, there are over 21,000 Lyme disease cases are reported to the Center for Disease Control and Prevention (CDC) every year. Statistically, this number makes it the most commonly vector transmitted disease in the country. This is an alarming fact and health care professionals are concerned about the future of this illness and the impact it will have on the public.

New York State (NYS) has one of the highest incidence rates for tick-borne diseases in the nation, along with New Jersey, Pennsylvania and Connecticut. In NYS, over a nine year period (1997 to 2006), there were 23,290 cases for all CDC notifiable communicable diseases (for which there are about 80). Approximately 24% of the total number of these diseases that were reported in the State was Lyme disease cases.

In Suffolk County, there were a total of 6,472 confirmed tick-borne disease cases reported over a nine year period, with Lyme representing 88% of these cases. For Lyme disease, 24% of total cases reported in Suffolk were 65 year and older.

Refer to **Section 2** for a discussion on the Incidence of tick-borne disease cases in Suffolk County.

Tick-borne diseases can be a highly debilitating. Lyme disease can affect the nervous system of people who have contracted it. If not properly diagnosed and/or left untreated, the infection can pose serious health effects, possibly leading to permanent damage such as arthritis, severe neurological problems or even death. Other tick-borne illnesses can be just as debilitating.

Because of the seriousness of these diseases, emphasis should be made on educating the general public about understanding the issues, what the best prevention practices are, recognizing the symptoms and how to seek help. Health care providers should also be provided with the resources to stay updated on the new findings and information about tick-borne illnesses and how to treat them.

For a discussion on depression and treatment suggestions in Lyme disease see:
http://www.empirestatelymediseaseassociation.org/Brief_overview_of_depression_etc_in_Lyme_disease.htm

/// - Public Health Education Program

Currently, the Public Health Educator for the SCDHS-Division of Public Health educates people regarding Lyme disease and ticks as well as other communicable diseases that are of public health significance.

The audiences in attendance at these Lyme disease educational presentations are students (kindergarten-12th grades), teachers, school nurses/nurses, librarians, school principals, other faculty staff and staff members, senior citizens, parents, children & toddlers, young adults, daycare facility staff, and many others within the general public.

Venues where the Public Health Educator implements Lyme disease education programs are public school districts (including several schools within the districts), private schools, public libraries, public & private day care school/facilities, recreational centers among other locations. Health Fairs are attended by the Public Health Educator and are well received by attendees.

The feedback from these presentations has continued to be exceptionally positive and effective. The Public Health Educator has had several requests for further presentations every new school year and/or school semester/quarter. Staff, teachers and parents are always especially thankful and pleased to have this education provided to them, their students and children.

During all these presentations, the Public Health Educator discusses Lyme disease and awareness and fosters protection strategies and tips on tick bite prevention. Also she demonstrates proper/improper ways to remove a tick and use of repellents. A video is shown and handouts, including tick identification cards, "Be Tick Free" stickers & handouts including the logo, fact sheets, quizzes, coloring sheets, *"Fite the Bite"* magnets, and bookmarks are distributed to the children and adults. Samples of real ticks, preserved in alcohol, are also

displayed. Detailed specifications on how to dress when playing outside, or in the woods to lessen the likelihood of ticks attaching to the skin, are illustrated as well.

Copies of the Lyme disease PowerPoint slides are handed out to the older students, teachers, principals, and school nurses. "*Fite the Bite*" fly swatters and insect repellents are also given to the staff for the faculty to use for protection against bug bites as well.

Evaluation sheets are handed out to assess the program, and to provide feedback that can enhance the program. In addition, prior knowledge and pre/post tests are given to measure the level of knowledge gained by the audience in attendance.

Distribution of literature to school aged children including fact sheets, pamphlets, brochures, tick identification cards, study sheets are all age appropriate. Real tick samples are displayed for the children to see what a tick really looks like. Informative videotapes on Lyme disease that are shown are also age appropriate. A guide to prevention on Lyme disease is demonstrated as well. Lyme disease-tick coloring, activity sheets, stickers, quizzes, and crossword puzzles are also handed out to the younger children, and Lyme disease tests to the older children.

New York State continues to fund the Lyme disease prevention and surveillance program in Suffolk County. While funding has declined by more than 60% over the past 7 years, the County's Lyme disease education program has continued to be highly beneficial and worthwhile. Over 200 presentaitons are given annually, reaching about 20,000 persons.

We also have resumed success with the "Be Tick Free" campaign, relaying the message of keeping tick free within the County.

IV – Tick Management Options

The TMTF Sub-Committee on Public Education believes that homeowners should have access to the following Handbook that was discussed in **Section 4,** Host and Habitat Management. The Sub-Committee recommends that this document should be referenced in the soon to be updated PH Brochure on Lyme disease.

Section 4 *also lists a number of actions that homeowners can take to reduce ticks on their property. This is the preferred approach for Integrated Pest Management (IPM)*

If broad-cast spraying of a pesticide is considered by a homeowner, then they should follow label directions if using over-the-counter products or consider using licensed and trained professionals, as described ***in Section 3*** *of this report.*

V - Recommendations for Education on Ticks and Tick-borne Disease Prevention Materials and Events

Strategy

1. Update the existing SCDHS Lyme disease Brochure which is specific to Suffolk County to include: tick ID, different stages of ticks, disease awareness and other resources such as the SCDHS Public Health Website.

2. The SCDHS Public Educator should target Health Care professionals by providing them with;

- A compendium of research and resources on tick-borne diseases affecting Suffolk County for both existing and newly emerging tick diseases.
- Regular public meeting to discuss issues and improvement, include specific Lyme disease organizations (Turn the Corner Foundation and ILADS) and other experts
- Biannual conference bringing various science experts knowledgeable in treating, preventing and studying tick-borne diseases. These conferences facilitate debate between conflicting sides of issues with the purpose of resolving controversy in contentious, yet important topics. Open to public participation and/or attendance.

3. The SCDHS Information Technology Division can develop a Website to include information on prevention, disease awareness, tick identification and other general information. The Website should also direct viewers to (a) Message board (b) Additional resource sites (c) News coverage and (d) Testimonies.

4. The SCDHS-Division of Public Health should prepare a Video for Suffolk Public Access TV Channels, and advertise the SCDHS Public Health Hotline: 631-787-2200 (runs June-September)

5. Expand Public Education Programs. Additional funding will be required to expand Public Health's current program to include all items listed above.

V – Resources

A. Written:

1) Literature:

Pamphlets, Brochures, Fact sheets, tick ID cards, other literature available upon request from SCDHS Public Health Website.

Tick Management Handbook Kirby C. Stafford III, PhD, The Connecticut Department of Public Health, TheConnecticut Agriculture Experiment Station, 2007. http://www.ct.gov/caes/site/default.asp

2) **Books:**

Guilfoile, Patrick. *Ticks Off! Controlling Ticks That Transmit Lyme Disease on Your Property.* ForSte Press, Inc. 2004.

Harrod Buhner, Stephen. *Healing Lyme: Natural Healing And Prevention of Lyme Borreliosis And Its Coinfections*. Raven Press. 2005.

Lang, Denise (Author) and Liegner, Kenneth (Contributor). *Coping with Lyme Disease: A Practical Guide to Dealing with Diagnosis and Treatment.* Henry Holt and Company. 1993, 1997.

Murray, Polly. *The Widening Circle: A Lyme Disease Pioneer Tells Her Story* (Hardcover). Saint Martin's Press. 1996.

Rosner, Bryan . *The Top 10 Lyme Disease Treatments: Defeat Lyme Disease with the Best of Conventional and Alternative Medicine*. BioMed Publishing Group. 2007

Rosner, Bryan. *2008 Lyme Disease Annual Report: A Yearly Update for Doctors and Patients*. BioMed Publishing Group. 2008.

Rosner, Bryan. *When Antibiotics Fail: Lyme Disease and Rife Machines, with Critical Evaluation of Leading Alternative Therapies*. 2005.

Singleton, Kenneth B. *The Lyme Disease Solution*. Brown Books Publishing Grou. 2008.

Vanderhoof-Forschner, Karen. *Everything You Need to Know About Lyme Disease and Other Tick-Borne Disorders,* 2nd Edition (Paperback). John Wiley & Sons, Inc. 2003.

Weintraub, Pamela. *Cure Unknown: Inside the Lyme Epidemic*. St. Martin's Press 2008.

Yerges, Karen P. and Stanley, Rita L. *Confronting Lyme Disease: What Patient Stories Teach Us.* BookSurge Publishing. 2006 (IPPY Award Winner: Health/Medicine/Nutrition)

***Note**: Please see list of many more books at:*

http://www.wellnessbooks.com/cgi-bin/search.pl?Operation=ItemSearch&SearchIndex=Books&templates=lymedisease&Keywords=Lyme+Disease

B. Websites:

Suffolk County Department of Health Services-Division of Public Health
http://www.suffolkcountyny.gov/health

New York State Department of Health
http://www.health.state.ny.us

Empire State Lyme Disease Association, Inc.
http://www.empirestatelymediseaseassociation.org

Lyme Disease Association
http://www.lymediseaseassociation.org

Centers for Disease Control & Prevention
http://www.cdc.gov

Turn the Corner Foundation
http://www.turnthecorner.org

Open Eye documentary "Under Our Skin" (trailer)
http://www.youtube.com/watch?v=sxWgS0XLVqw&feature=related

International Lyme and Associated Diseases Society
http://www.ilads.org
& What's new…
http://www.ilads.org/Presentation_ChronicLyme.html

Kids Health
http://www.kidshealth.org

Lyme Disease Foundation
http://www.lyme.org

Lyme Disease Network
http://www.lymenet.org

Health Resources
http://healthresources.caremark.com/topic/home

Columbia University-Lyme Disease Research Studies
http://www.columbia-lyme.org/index.html

The John Hopkins Arthritis Center
http://www.hopkins-arthritis.org/arthritis-info/lyme-disease/

Pet Education
http://www.peteducation.com/article.cfm?cls=2&cat=1556&articleid=458

Lyme Info
http://www.lymeinfo.net/index.html

Parents of Children with Lyme
http://www.pocwl.org

A Healthy Me
http://www.ahealthyme.com/topic/lymedisease

Healing Well...on Disease, Disorders, & Chronic Illness
http://www.healingwell.com/lymedisease/

Living with Lyme
http://www.livingwithlyme.com/LWLEzine01182007.html

Other Resources/Links:

Two NY teens with Lyme Disease

http://youtube.com:80/watch?v=mpB287Yx9iQ

http://www.geocities.com/HotSprings/Oasis/6455/lyme-links.html

http://www.lymebook.com/

http://www.columbia-lyme.org/flatp/resources.html

Audio, Video clips & DVD's:

http://www.lymediseaseaudio.com/

http://www.lymecommunity.com/forums/ubbthreads.php/ubb/postlist/Board/33/page/1

Section

6

Dominick Ninivaggi, Author

OPTIONS FOR TICK CONTROL IN SUFFOLK COUNTY

I – INSTITUTIONAL CONSIDERATIONS

Under the County Charter, the Suffolk County Department of Public Work's Division of Vector Control is "*responsible for the suppression of mosquitoes, ticks and other arthropods which are vectors of human disease and require public action for control*". Ticks are unquestionably "*vectors of human disease*". It is a matter for elected County officials to determine if "*public action for control*" is required.

At present, Vector Control normally limits its control activities to mosquitoes. The fundamental reason Vector Control has not undertaken tick control is that, to this point, it has not appeared that cost-effective and environmentally sound technologies were available to suppress ticks on a landscape basis. However, mosquito control and tick control both represent problems in Integrated Pest Management (IPM). Provided that the appropriate resources are made available, Vector Control is organized in a manner that would allow the addition of certain tick control activities. The Department of Health Services would have to play an important role in tick surveillance and direction of the control program(s) through its Arthropod Borne Disease Laboratory.

Any County-wide program implemented by Vector Control would probably focus on the control of ticks themselves, as part of an overall County IPM effort. Vector Control lacks the authority and/or expertise to implement important IPM measures related to host management, habitat management and education. Host management relates to wildlife issues such as deer population control that are clearly within the mission and authority of natural resource agencies such as NYSDEC and the various Town conservation agencies, and it would not be appropriate for Vector Control to operate in this area. Suffolk County's Parks Department could consider host management as part of its overall management program for County lands, in cooperation with NYSDEC.

While Vector Control operates in the area of habitat management for mosquito control, by participating in wetlands management activities, there seems little opportunity for similar work in tick control. The County, operating through Health Services and/or Vector Control, could play an advisory role in encouraging managers of public lands to adopt practices (described in previous chapters) that would reduce the risk of tick-borne disease. For instance, land managers (Parks Departments, private land managers such as The Nature Conservancy) could be encouraged to manage trails in a manner that reducing the risk of users encountering ticks, such as trimming vegetation. Suffolk County Department of Parks could adopt these practices as a way of demonstrating their usefulness and setting an example for others. Education and public outreach activities, including encouraging the proper use of repellents and other personal protection, are a Department of Health Services responsibility, although, as in mosquito control, Vector Control could assist in this effort.

II – Appropriate Technologies for County Use

To be appropriate for a County-wide program, control technologies must:

A. be effective in controlling ticks and suppressing tick-borne disease
B. require action over large public areas beyond the capabilities of individuals, that is, it must be a technology that requires "*public action*"
C. pose no unreasonable risks to the environment in relations to purpose of the project
D. be capable of being implemented at a reasonable cost.

Items A and B are technical questions that can be answered more or less objectively by a rigorous review of the facts.

Item C involves balancing the risks associated with the activity against the benefits. The legal procedure for balancing these risks versus benefits, and making a decision, is the State Environmental Quality Review Act (SEQRA). The SEQRA review could range from a relatively simple review of the available information with a declaration of no significant impact (a "negative declaration" or 'neg dec') up to a full scale Environmental Impact Statement (EIS). The cost of SEQRA review could be small enough to be handled with existing County staff (for a 'neg dec') or it could range into seven figures. There are specific procedures, under SEQRA, for determining the extent of review that is required.

Item D (reasonable cost) is also somewhat subjective and depends to some extent on the current costs to society and the County resulting from ticks and the diseases they transmit, the likely reduction in those costs to be expected from the control program and how much funding elected officials are willing to devote to this problem compared to competing priorities. This issue of deciding how much should be spent for tick control is clearly beyond the charge of the Task Force. Mosquito control programs in the U.S. typically range from $2 to $4 per person protected, with Suffolk County currently spending approximately $2.40 per person per year for Vector Control Division activities and the Arthropod-Borne Disease Laboratory. The cost of adding tick control should be viewed in the context of adding some reasonable increment to this existing figure.

III – PRACTICAL CONSIDERATIONS

There are three major options for County-wide tick population control as part of the overall IPM effort:

- Area treatments using conventional pesticides, that is, materials such as the pyrethroids and organophosphates that are not recognized by USEPA as minimum risk materials or bio-pesticides.
- Area treatments using USEPA-recognized minimum-risk pesticides or bio-pesticides
- Host targeted technologies.

Each technology will be evaluated in terms of (a) effectiveness (b) appropriateness for a public program (c) likely environmental acceptability under the SEQRA process and (d) likely cost-effectiveness.

1. Area Treatments with Conventional Pesticides:

(a) Effectiveness: There is little doubt that broadcast treatments with conventional pesticides can effectively reduce tick populations in the treated area. For the protection of an individual back yard or an event in an outdoor area, such treatments are a viable option, provided the user is willing to accept the risks involved with the use of relatively broad-spectrum pesticides such as the pyrethroids. The use of such materials in these settings does not address exposure outside the treated areas. This means their

use would, in itself, have a limited impact on the overall burden of tick-borne disease unless adopted on a very wide scale.

(b) Appropriateness for a public program: Exposure to ticks often occurs on private property such as back yards. Protection of individual property from pests, even public health pests such as roaches and rats, is traditionally the responsibility of the property owner. There would appear to be no proper role for Vector Control in treating such areas. One might argue that tick populations in public areas such as active use parks might be a proper role for action by Vector Control, since such exposure to ticks is beyond the control of private citizens.

(c) Likely environmental acceptability under SEQRA: Any program of broadcast use of broad spectrum pesticides over substantial areas by the County would face formidable obstacles under SEQRA. Even if the program was limited to public recreational areas, the nature of the treated areas and their size would undoubted result in the program being classified as a Type I action under SEQRA. A full EIS would be required, and that EIS would have to address substantial issues related to non-target impacts and possible human exposure to pesticides. In addition, it would have to be demonstrated that the reduction in the risk to public health was proportional to the substantial ecological risks. Such a program would be highly controversial. The preparation of such an EIS would be a costly endeavor that could well result in a decision not to undertake the program. Given this outlook, pursuing this option does not appear to be viable for the County.

(d) Cost-effectiveness: Given that such a program is unlikely to be judged acceptable from an environmental point of view, there is no need to analyze the costs, other than to note that they would be substantial for only a modest public health gain.

2. Area Treatments with Minimum Risk Pesticides or Bio-pesticides:

(a) Effectiveness: These two options are being considered together because they have many similarities. At present, there is only limited evidence that these materials are effective. None of the minimum risk materials currently meet the effectiveness standards to which conventional pesticides are held. There are **no** bio-pesticides currently registered for area treatments of ticks in New York State. Until efficacy data is available for these materials that demonstrate they are effective tools, they cannot be considered for a County program on an operational scale. However, continued research and even field trials are warranted, given their potential advantages.

(b) Appropriateness for a public program: As for conventional materials, it would not seem appropriate for Vector Control to undertake treatment of private properties. If they were judged to be effective, there is no inherent reason not to consider these materials for public areas such as County parks, if other factors were favorable.

(c) Likely environmental acceptability under SEQRA: Application of these materials on a wide scale by the County would trigger SEQRA review, although the obstacles would probably not be as substantial as for conventional products. Given the likely area involved, it still seems likely that the program would be classified as a Type I action, that is, that there might be significant impacts that require review. However, it is possible that a full EIS might not be required, given the lower risks that are likely to be inherent in the use of these materials. However, non-target and human health data would still need to be reviewed, although such a review would likely be less costly than an EIS. In particular, minimum risk materials may be low in toxicity to humans, but these materials often are active against a wide variety of organisms other than ticks, and such non-target risks would need consideration. Microbial bio-pesticides typically are active against only a very narrow range of hosts, limiting non-target effects. Microbial products may be particularly promising in terms of surviving environmental review.

(d) Cost-effectiveness: The costs of these materials are poorly known at this time, as are other important factors such as the frequency of treatment required. Use of these materials is likely to be relatively labor-intensive, since they would probably be applied as a relatively high-volume spray with ground equipment. Labor and environmental compliance costs such as record-keeping and data management are relatively high for these types of applications. Still, until these costs are known, it is worth considering these materials further as the information becomes available.

3. Host Targeted Technologies (the 4-Poster):

(a) Effectiveness: As noted in other parts of this report, the "4-Poster" system is the only host-targeted system for tick control likely to be available in New York State in the foreseeable future. There is currently a literature that indicates that in some situations, this system can substantially reduce populations of ticks that use deer as their host for a critical portion of their life cycle, such black-legged ticks and probably lone star ticks. As such, the 4-Poster would seem to deserve consideration in an IPM program for ticks, especially for control of Lyme disease. It should be noted that this system would have little or no impact on ticks that depend on other hosts, so that dog ticks that carry other diseases such as Rocky Mountain spotted fever would not be impacted. However, it remains to be seen whether this technology can be effective here in Suffolk County. To be effective, adequate numbers of bait stations must be sited over a wide enough area to control ticks on a substantial portion of the deer population. Whether this can be done in all or parts of the County remains to be established, given our mosaic of public and private properties, variety of land uses and constraints that are likely regarding where the stations can be placed. The program is unlikely to be effective if too few sites can be found that meet the criteria. This is an import part of the research under way, and it will not be possible to make any judgments on the matter until the study is complete.

(b) Appropriateness for a public program: The use of 4-Poster systems clearly represents the type of technology that must be implemented by a public program. Deer and ticks, like mosquitoes, do not respect human ownership or political boundaries. Only action across these boundaries by an entity that has the authority to act on a broad scale can effectively implement a 4-Poster program. Vector Control has the authority to operate anywhere in the County where control is required. The installation of these systems by private interests is unlikely to have a significant benefit unless very large areas are controlled by those interests.

(c) Likely environmental acceptability under SEQRA: Undertaking an operational program involving the use of the 4-poster by the County would trigger SEQRA review. Given the likely scale of use and the fact that pesticides are involved, the program would probably be considered a Type I action. Until the likely impacts are known, it would be hard to judge whether an EIS would be required, but substantial review would certainly be in order. The possible use of this system raises a host of environmental issues that are described elsewhere in the report and will not be reiterated here. These issues are being examined in the research project that is currently underway. Until the results of the study are in, it can not be determined if the use of the system would or would not be deemed acceptable here in Suffolk County. However, other jurisdictions have allowed its use, which would at least suggest that in some cases, it can be deemed acceptable. The results of the current study will be critical to addressing this issue.

(d) Cost-effectiveness: Once again, the results of the current study will need to be in before an intelligent assessment of cost effectiveness can be made. Critical factors will include the number of stations required per acre, the size of the area where control is possible or needed (which will determine the total number of stations) and the frequency with which the stations must be serviced. These factors will determine the equipment and supply costs for the operation and, most importantly, the level and type of staffing required. To some extent, other components of IPM, such as host management, could also influence the amount of resources required for the program. In addition, like any good vector control program, the use of this technology must be supported by a surveillance effort sufficient to determine the need for and effectiveness of the control effort. At a minimum, long term monitoring of tick populations and the presence of tick-borne pathogens would be required, just as the County currently operates a surveillance program for mosquitoes and mosquito-borne disease.

There is some overlap between the type of work required for the County's current mosquito control program and the type of effort that would be required for using the 4-Poster. The use of this existing infrastructure would eliminate start-up costs and would therefore be more cost-effective than starting a distinct, dedicated tick control program either by the County or by Towns. Vector Control already has systems and facilities in place for pesticide use and handling, as well as for record-keeping and other compliance with environmental laws. Similarly, laboratory facilities already exist that are adequately equipped for tick surveillance.

Existing staff are fully occupied with the Vector Control's current mosquito control program which has been given additional tasks under its Long Term Plan. This means additional staff would be required both in professional/technical titles (for surveillance and analysis of the data) and blue collar series (for operating the stations and assisting in surveillance). As in almost any County program, staffing would be the largest single expense. The number of staff required will depend on the desired size of the program in terms of area to be protected.

IV – TICK CONTROL OPTIONS – SUMMARY

If a tick control program is implemented in Suffolk County, the County Charter places this responsibility in the Department of Public Work's Division of Vector Control. Other important parts of the overall IPM approach would require cooperative efforts on the part of other entities. For instance, host management and other wildlife issues would require cooperation from NYS DEC and other natural resources programs. The Department of Health Services would continue to take the lead on education and personal protection. The extent to which these other IPM measures can be undertaken will have great impact on the scale and design of the control program. Most importantly, a substantial influx of resources would be required to undertake an effort that would noticeably impact tick populations and disease incidence.

There remain many unanswered questions, however, before a decision can be made as to the wisdom of undertaking tick control. Most of these questions relate to the effectiveness, practicality and environmental acceptability of the 4-Poster system, since this seems to be the most viable technology for a wide-scale program. The study that is underway should provide much of the required information. Until the results of that project are in all decisions should be held in abeyance.

The design of any control program depends to a large extent on the scale of the problem that has to be addressed. An examination of the epidemiological data indicates that while much is known, critical information is not yet available. There is no comprehensive survey of the abundance and species composition of ticks on a County-wide scale that could be used to identify with precision the areas where control might be needed. While we generally know East End areas, especially Shelter Island, have the highest incidence of tick-borne disease, far more precision is needed to design control measures. In addition, data is lacking on the infection rates of ticks, and the extent to which that might vary over time and space. Deer are a critical part of the picture, but again, precise information is lacking in time and space. If there is sufficient interest in applying the results of the current study on the 4-Poster to a practical program, consideration should be given to undertaking more widespread tick surveillance concurrently with this work.

To summarize, it is not yet known whether tick control is a desirable or viable option in Suffolk County. However, there is an existing organizational infrastructure available to implement such a program, should the data support that decision. Data is being gathered that will help determine if the 4-Poster system is a practical technology for our unique setting. Decisions await the results of this work.

Section

7

Dr. Sal Scarpitta (Author)

UNRESOLVED TASK FORCE ISSUES

The 1st Resolved of Resolution 1123-2006 states "*that the Suffolk County Tick Management Task Force is hereby created to study the effects of the tick population and the spread of tick-related diseases and to develop a comprehensive needs assessment for the County's approach to this public health and safety issue".*

The 11 member Task Force held two Public Hearings in the fall of 2007 in order to hear testimony regarding mitigation strategies to reduce the incidence of tick-borne diseases in Suffolk County. The Minutes of those meetings are contained on the attached CD-ROM.

While novel ideas for a targeted technology dedicated to tick management were sparse at the Public Hearings, the majority of citizens had concerns regarding medical issues that are captured below. These issues were beyond the scope of the Task Force and would need to be addressed by other Legislative Committees or future Task Forces.

I - MEDICAL

A. New Emerging Tick Diseases –Bartonella and STARI

1. There is now evidence that ticks may be a significant transmitter of the *Bartonella* infection to humans. A study in California showed that a minimum of 2.3% of a pool of 1253 *Ixodes pacificus* ticks tested positive for *Bartonella.* Additionally, it appears that the *Dermacentor* tick species of ticks are also capable of transmitting the *Bartonella* bacteria.

Early symptoms of *Bartonella* infections include a red, crusted, elevated skin lesion where the bacteria enters its host (which can mimic the Lyme disease enlarging rash), followed by flu-like symptoms of fever, muscle and joint aches/pains, nausea, vomiting, and chills.
For further information, see: http://www.lawestvector.org/bartonella.htm.

2. A rash similar to the rash of Lyme disease has been described in humans following bites of the lone star tick, *Amblyomma americanum*. The rash may be accompanied by fatigue, fever, headache, muscle and joint pains. This condition has been named southern tick-associated rash illness (STARI). Studies have shown that is not caused by *Borrelia burgdorferi*, the bacterium that causes Lyme disease. Another spirochete, *Borrelia lonestari,* was detected in the skin of one patient and the lone star tick that bit him. For further information, see: http://www.cdc.gov/ncidod/dvbid/stari/index.htm.

3. While not yet confirmed, two possible tick-borne related diseases worthy of mention are Erysipeloid (see http://www.fpnotebook.com/DER11.htm) and Morgellons (see http://www.morgellons.ca/).

B. Lyme Disease Vaccine

Testimony was given at a Public Hearing by a citizen asking about the potential for a Lyme disease vaccine to be included in the TMTF Final Report. Discussion followed that there are seven infectious agents in three different tick species and that a Lyme DISEASE vaccine would not protect against all of these diseases.

The TMTF knew when it first convened in 2007 that no Lyme vaccine was currently on the market. A product called *Lymerix* was introduced by GlaxoSmithKline in 1998, but some people sued the company, charging that they developed arthritis as a result of taking the drug. The company claimed that the vaccine was taken off the market because of low demand.

In fact, on Feb. 6, 2007, the New York Times reported on a new Lyme disease vaccine being developed at Brookhaven National Laboratory (BNL). The vaccine is genetically engineered to attack different strains of the bacterium that causes Lyme disease. A summary follows:

Traditional vaccines introduce a natural organism to the body. Lymerix used the actual surface protein from the Lyme bacterium as the vaccine which also resembles a human protein. Antibodies created in response to Lymerix may have attacked the human protein in some people, making them sick. But studies have been inconclusive as to whether this autoimmune response caused arthritis.

The new Lyme vaccine, on the other hand, is a protein that has never existed in nature. BNL scientists created it in the lab, altered so that it does not resemble the human protein.

The BNL research was funded by a $2.5 million grant from the National Institutes of Health. Another Lyme vaccine project receiving N.I.H. funding involves Med-Immune of Gaithersburg, Md., and Aventis Pharmaceuticals of Bridgewater, N.J.

No mention was made in the NY Times article on how long it would take for the vaccine to become available, its projected cost or whether Medicare and/or insurance companies would reimburse patients.

The issue of *Lymerix* was addressed in a new Federal Law (Public Law 107-116) that was passed by the Senate and House and signed by President Bush on January 10, 2002. It also gives the 'Will of Congress' on issues pertaining to Lyme disease.

C. Other Medical Issues

These ideas emerged from the TMTF Public Hearing held in Riverhead on Oct 19, 2007.

- Establish a public health position to examine misdiagnosis and treatment of patients with Lyme disease and other tick-borne diseases.
- Future Committees need to look at other medical issues such as long-term care, psychiatric issues and children cases.
- The need for better diagnostic tools (as cases often go undiagnosed). Enhanced education for medical providers and health insurers is needed.

- It is likely that the Lyme treatment duration needs to be re-examined. The treatment with doxycycline is 28 days but each person is different – maybe the duration needs to be longer for some individuals.

- Persons getting yearly physicals should ask for a Lyme disease test.

- A citizen testified that she has been diagnosed with Lyme disease, Erlichiosis, and Babesiosis. Medicare refuses to pay for the Erlichiosis and Babesiosis test, which costs $770. She inquired whether there is anything she can do to get Medicare to pay.

II – Professional Pest Control and Exterminators

An **Entomologist,** who worked as an agent for the Nassau County Cornell Cooperative Extension, spoke. He encourages Suffolk County and the Tick Task Force to work with the Long Island Pest Control Association because they are the extenders of policy and needs. He inquired whether Fishers Island had a Lyme disease problem. If not, they could be used a control. He then encouraged the following:

- Work with Long Island Pest Control Association, the Nassau-Suffolk Landscape Gardeners Association, and Cornell Cooperative Extension in Suffolk in order to educate pesticide distributors who apply tickicides.

- Utilize this group to educate the public on Integrated Pest Management so that broadcast spraying is limited.

A Representative from the **Nassau-Suffolk Landscape Gardeners Association** stated that the tick problem is an issue that is important to the landscaping industry. The Suffolk County Chapter has made considerable efforts to become educated on ticks, tick control, and diseases. The speaker and his colleagues offered assistance on the Four Poster Initiative or any other that the County develops.

President of the Long Island Pest Control Association and Owner of Imperial Pest Extermination stated that ticks are not limited just to Fire Island; they are starting to spread everywhere. Unfortunately, there is not yet a targeted technology to control ticks like there is for other pests (e.g., ant baits for ants). The public (and the Association) are not supportive of broadcast spraying. A targeted technology for tick management is sorely needed. To forge a road away from broadcast spraying, the Association has made efforts to educate members on Integrated Pest Management. It used to be that one could control mice to control ticks; this is not the case anymore. There are plenty of Association members that are certified in Category 8 (what is needed for the Four Poster effort).

Section

8

Compiled by Dr. Sal Scarpitta

APPENDICES

Appendices Used in this Report

- Appendix-I. Demographic Information on Suffolk County 2000. Refers to Section 2
- Appendix-II. Major tick-borne diseases. Refers to Sections 1 and 2.
- Appendix-III. Suffolk County Population in Year 2000 by Zip-Codes - Refers to Section 2.
- Appendix-IV CDC Case Definitions - Refers to Section 2.

Suffolk County, NY **US Census Bureau Web Link**

Census 2000 Demographic Profile Highlights:

General Characteristics - show more >>	**Number**	**Percent**	**U.S.**
Total population	1,419,369		
Male	695,010	49.0	49.1%
Female	724,359	51.0	50.9%
Median age (years)	36.5	(X)	35.3
Under 5 years	100,304	7.1	6.8%
18 years and over	1,049,288	73.9	74.3%
65 years and over	167,558	11.8	12.4%
One race	1,390,185	97.9	97.6%
White	1,200,755	84.6	75.1%
Black or African American	98,553	6.9	12.3%
American Indian and Alaska Native	3,807	0.3	0.9%
Asian	34,711	2.4	3.6%
Native Hawaiian and Other Pacific Islander	484	0.0	0.1%
Some other race	51,875	3.7	5.5%
Two or more races	29,184	2.1	2.4%
Hispanic or Latino (of any race)	149,411	10.5	12.5%
Household population	1,390,791	98.0	97.2%
Group quarters population	28,578	2.0	2.8%
Average household size	2.96	(X)	2.59
Average family size	3.36	(X)	3.14
Total housing units	522,323		
Occupied housing units	469,299	89.8	91.0%
Owner-occupied housing units	374,360	79.8	66.2%
Renter-occupied housing units	94,939	20.2	33.8%
Vacant housing units	53,024	10.2	9.0%

App II - Major Tick Borne Diseases of the World

- Lyme disease
  - Organism: *Borrelia burgdorferi* (bacterium)
  - Vector: *Ixodes scapularis (I. dammini*), *I. pacificus*, *I. ricinus* (Europe))
  - Region: Worldwide, where these tick species exist
- Tick-borne meningoencephalitis
  - Organism: TBEV aka FSME virus, a flavivirus
  - Vector: *I. ricinus, I. persulcatus*
  - Region: Europe and Northern Asia
- Rocky Mountain Spotted Fever
  - Organism: *Rickettsia rickettsii* (bacterium)
  - Vector: *Dermacentor variabilis*, *D. andersoni*
  - Region (US): East, South West
  - Vector: *Amblyomma cajennense*
  - Region (Brazil): São Paulo, Rio de Janeiro, Minas Gerais.
- Babesiosis
  - Organism: *Babesia microti* (protozoan)
  - Vector: *I. scapularis*
  - Region (US): Northeast
- Ehrlichiosis
  - Organism: *Ehrlichia chaffeensis*, *E. ewingii*
  - Vector: *Amblyomma americanum*, *I. scapularis*
  - Region (US): *South-Atlantic South-Central, Northeast*
- Relapsing fever
  - Organism: *Borrelia* species (bacterium)
  - Vector: *Ornithodoros* species
  - Region (US): West
- Colorado tick fever
  - Organism: *Coltivirus* (Virus)
  - Vector: *D. andersoni*
  - Region (US): West

- Tularemia
    - Organism: *Francisella tularensis* (bacterium)
    - Vector: *D. andersoni*, *D. variabilis*, *A. americanum*
    - Region (US): Southeast, South-Central, West, Widespread
- Tick paralysis
    - Cause: Neurotoxin
    - Vector: *D. andersoni*, *D. variabilis*
    - Region (US): West, East
- Anaplasmosis (see: http://www.cdc.gov/Ncidod/EID/vol11no12/05-0898.htm)
    - Organism: *Anaplasma phagocytophilum* (bacterium)
    - Vector: *I. scapularis*
    - Region (US): South-Atlantic, South-Central, Northeast

App III - Demographics by Township and Zip-Code

ZIP	Postal Name	Total	Male	Female
6390	FISHERS ISLAND	289	148	141
11701	AMITYVILLE	26,379	12,167	14,212
11702	BABYLON	14,975	7,256	7,719
11703	NORTH BABYLON	16,336	7,856	8,480
11704	WEST BABYLON	40,114	19,094	21,020
11705	BAYPORT	8,007	3,883	4,124
11706	BAY SHORE	60,460	29,829	30,631
11713	BELLPORT	9,160	4,442	4,718
11715	BLUE POINT	4,407	2,171	2,236
11716	BOHEMIA	10,360	5,140	5,220
11717	BRENTWOOD	51,485	25,838	25,647
11718	BRIGHTWATERS	3,061	1,481	1,580
11719	BROOKHAVEN	2,965	1,417	1,548
11720	CENTEREACH	28,105	14,002	14,103
11721	CENTERPORT	6,218	3,019	3,199
11722	CENTRAL ISLIP	34,491	17,008	17,483
11724	COLD SPRING HARB	3,040	1,482	1,558
11725	COMMACK	29,412	14,228	15,184
11726	COPIAGUE	17,737	8,807	8,930
11727	CORAM	25,603	12,406	13,197
11729	DEER PARK	28,280	13,715	14,565
11730	EAST ISLIP	16,050	7,862	8,188
11731	EAST NORTHPORT	31,250	15,381	15,869
11733	EAST SETAUKET	20,382	10,128	10,254
11735	FARMINGDALE	6,078	3,077	3,001
11738	FARMINGVILLE	16,811	8,426	8,385
11740	GREENLAWN	9,647	4,455	5,192
11741	HOLBROOK	27,857	13,546	14,311
11742	HOLTSVILLE	12,119	5,895	6,224
11743	HUNTINGTON	41,566	20,329	21,237
11746	HUNTINGTON STAT	62,828	31,228	31,600
11747	MELVILLE	16,152	7,863	8,289
11751	ISLIP	15,083	7,373	7,710
11752	ISLIP TERRACE	9,881	4,873	5,008
11754	KINGS PARK	18,847	9,163	9,684
11755	LAKE GROVE	11,402	5,636	5,766
11757	LINDENHURST	46,458	22,737	23,721
11763	MEDFORD	24,743	12,175	12,568
11764	MILLER PLACE	11,120	5,519	5,601
11766	MOUNT SINAI	9,365	4,592	4,773
11767	NESCONSET	13,841	6,861	6,980
11768	NORTHPORT	21,676	10,762	10,914
11769	OAKDALE	9,729	4,637	5,092
11770	OCEAN BEACH	190	107	83
11772	PATCHOGUE	41,913	20,582	21,331
11776	PORT JEFFERSON S	22,440	10,968	11,472
11777	PORT JEFFERSON	9,025	4,379	4,646

ZIP	Postal Name	Total	Male	Female
11778	ROCKY POINT	11,514	5,720	5,794
11779	RONKONKOMA	39,321	19,185	20,136
11780	SAINT JAMES	14,920	7,100	7,820
11782	SAYVILLE	15,897	7,670	8,227
11784	SELDEN	26,411	12,886	13,525
11786	SHOREHAM	5,883	2,918	2,965
11787	SMITHTOWN	34,794	16,780	18,014
11788	HAUPPAUGE	16,836	8,337	8,499
11789	SOUND BEACH	7,660	3,787	3,873
11790	STONY BROOK	18,374	9,059	9,315
11792	WADING RIVER	7,156	3,625	3,531
11795	WEST ISLIP	27,127	13,284	13,843
11796	WEST SAYVILLE	3,835	1,817	2,018
11798	WYANDANCH	15,199	7,240	7,959
11901	RIVERHEAD	23,434	11,670	11,764
11933	CALVERTON	5,857	2,854	3,003
11934	CENTER MORICHES	6,539	3,194	3,345
11935	CUTCHOGUE	3,760	1,842	1,918
11937	EAST HAMPTON	14,854	7,364	7,490
11939	EAST MARION	777	380	397
11940	EAST MORICHES	4,347	2,172	2,175
11941	EASTPORT	2,967	1,512	1,455
11942	EAST QUOGUE	4,996	2,452	2,544
11944	GREENPORT	3,705	1,718	1,987
11946	HAMPTON BAYS	12,802	6,387	6,415
11948	LAUREL	903	455	448
11949	MANORVILLE	11,385	5,649	5,736
11950	MASTIC	14,583	7,282	7,301
11951	MASTIC BEACH	12,794	6,393	6,401
11952	MATTITUCK	4,680	2,270	2,410
11953	MIDDLE ISLAND	12,364	5,893	6,471
11954	MONTAUK	3,851	1,976	1,875
11955	MORICHES	2,652	1,327	1,325
11957	ORIENT	662	326	336
11958	PECONIC	445	222	223
11961	RIDGE	12,664	5,728	6,936
11963	SAG HARBOR	8,498	4,140	4,358
11964	SHELTER ISLAND	1,148	555	593
11965	SHELTER ISLAND HTS	1,080	512	568
11967	SHIRLEY	24,943	12,399	12,544
11968	SOUTHAMPTON	12,032	5,802	6,230
11971	SOUTHOLD	5,575	2,686	2,889
11976	WATER MILL	1,822	911	911
11977	WESTHAMPTON	2,965	1,450	1,515
11978	WESTHAMPTON BCH	3,800	1,866	1,934
11980	YAPHANK	4,221	2,272	1,949
	Totals	**1,419,369**	**695,010**	724,359

Lyme Disease *(Borrelia burgdorferi)*

1996 Case Definition

Clinical description

A systemic, tickborne disease with protean manifestations, including dermatologic, rheumatologic, neurologic, and cardiac abnormalities. The best clinical marker for the disease is the initial skin lesion (i.e., erythema migrans [EM]) that occurs in 60%-80% of patients.

Laboratory criteria for diagnosis

Isolation of *Borrelia burgdorferi* from a clinical specimen or

Demonstration of diagnostic immunoglobulin M or immunoglobulin G antibodies to *B. burgdorferi* in serum or cerebrospinal fluid (CSF). A two-test approach using a sensitive enzyme immunoassay or immunofluorescence antibody followed by Western blot is recommended (7).

Case classification

Confirmed: a) a case with EM or b) a case with at least one late manifestation (as defined below) that is laboratory confirmed.

Comment

This surveillance case definition was developed for national reporting of Lyme disease; it is not intended to be used in clinical diagnosis.

Definition of terms used in the clinical description and case definition:

Erythema migrans. For purposes of surveillance, EM is defined as a skin lesion that typically begins as a red macule or papule and expands over a period of days to weeks to form a large round lesion, often with partial central clearing. A single primary lesion must reach greater than or equal to 5 cm in size. Secondary lesions also may occur. Annular erythematous lesions occurring within several hours of a tick bite represent hypersensitivity reactions and do not qualify as EM. For most patients, the expanding EM lesion is accompanied by other acute symptoms, particularly fatigue, fever, headache, mildly stiff neck, arthralgia, or myalgia. These symptoms are typically intermittent. The diagnosis of EM must be made by a physician. Laboratory confirmation is recommended for persons with no known exposure.

Late manifestations. Late manifestations include any of the following when an alternate explanation is not found:

1. *Musculoskeletal system*. Recurrent, brief attacks (weeks or months) of objective joint swelling in one or a few joints, sometimes followed by chronic arthritis in one or a few joints. Manifestations not considered as criteria for diagnosis include chronic progressive arthritis not preceded by brief attacks and chronic symmetrical polyarthritis. Additionally, arthralgia, myalgia, or fibromyalgia syndromes alone are not criteria for musculoskeletal involvement.

2. *Nervous system.* Any of the following, alone or in combination: lymphocytic meningitis; cranial neuritis, particularly facial palsy (may be bilateral); radiculoneuropathy; or, rarely, encephalomyelitis. Encephalomyelitis must be confirmed by demonstration of antibody production against *B. burgdorferi* in the CSF, evidenced by a higher titer of antibody in CSF than in serum. Headache, fatigue, paresthesia, or mildly stiff neck alone are not criteria for neurologic involvement.

3. *Cardiovascular system.* Acute onset of high-grade (2nd-degree or 3rd-degree) atrioventricular conduction defects that resolve in days to weeks and are sometimes associated with myocarditis. Palpitations, bradycardia, bundle branch block, or myocarditis alone are not criteria for cardiovascular involvement.

Exposure. Exposure is defined as having been (less than or equal to 30 days before onset of EM) in wooded, brushy, or grassy areas (i.e., potential tick habitats) in a county in which Lyme disease is endemic. A history of tick bite is not required.

Disease endemic to county. A county in which Lyme disease is endemic is one in which at least two confirmed cases have been previously acquired or in which established populations of a known tick vector are infected with *B. burgdorferi.*

Ehrlichiosis (HGE, HME, other or unspecified)

For 2008 definition see : http://cdc.gov/ncphi/diss/nndss/casedef/ehrlichiosis_2008.htm

HGA (Human granulocytic anaplasmosis now replaces HGE

2000 Case Definition is shown below.

Clinical description

A tick-borne illness characterized by acute onset of fever, headache, myalgia, and/or malaise. Nausea, vomiting, or rash may be present in some cases. Clinical laboratory findings may include thrombocytopenia, leukopenia, and/or elevated liver enzymes. Intracytoplasmic bacterial aggregates (morulae) may be visible in the leukocytes of some patients.

Three categories of confirmed or probable ehrlichiosis should be reported: 1) human ehrlichiosis caused by E. chaffeensis (HME), 2) human ehrlichiosis caused by E. phagocytophila (HGE), and 3) human ehrlichiosis (other or unspecified agent), which includes cases that cannot be easily classified by available laboratory techniques, and cases caused by novel Ehrlichia species such as E. ewingii.

Laboratory criteria for diagnosis

HME:

Demonstration of a four-fold change in antibody titer to E. chaffeensis antigen by indirect immunofluorescence assay (IFA) in paired serum samples, or

Positive polymerase chain reaction (PCR) assay and confirmation of E. chaffeensis DNA, or

Identification of morulae in leukocytes, and a positive IFA titer to E. chaffeensis antigen (based on cutoff titers established by the laboratory performing the assay), or

Immunostaining of E. chaffeensis antigen in a biopsy or autopsy sample, or

Culture of E. chaffeensis from a clinical specimen.

HGE:

Demonstration of a four-fold change in antibody titer to E. phagocytophila antigen by IFA in paired serum samples, or

Positive PCR assay and confirmation of E. phagocytophila DNA, or

Identification of morulae in leukocytes, and a positive IFA titer to E. phagocytophila antigen (based on cutoff titers established by the laboratory performing the assay), or

Immunostaining of E. phagocytophila antigen in a biopsy or autopsy sample, or

Culture of E. phagocytophila from a clinical specimen.

Ehrlichiosis ,human, other or unspecified agent:

Demonstration of a four-fold change in antibody titer to more than one Ehrlichia species by IFA in paired serum samples, in which a dominant reactivity cannot be established, or

Identification of an Ehrlichia species other than E. chaffeensis or E. phagocytophila by PCR, immunostaining, or culture.

Case classification

Probable: a clinically compatible illness with either a single positive IFA titer (based on cutoff titers established by the laboratory performing the test) or the visualization of morulae in leukocytes.

Confirmed: a clinically compatible illness that is laboratory-confirmed.

Rocky Mountain Spotted Fever (*Rickettsia rickettsii)*

2004 Case Definition

Clinical description

Rocky Mountain spotted fever (RMSF) is an illness caused by *Rickettsia rickettsii*, a bacterial pathogen transmitted to humans through contact with ticks. *Dermacentor* species of ticks are most commonly associated with infection, including *Dermacentor variabilis* (the American dog tick) and *Dermacentor andersoni* (the Rocky Mountain wood tick). Disease onset averages one week following a tick bite. Age specific illness is highest for children. Illness is characterized by acute onset of fever, and may be accompanied by headache, malaise, myalgia, nausea/vomiting, or neurologic signs; a macular or maculopapular rash is reported in most patients, and a rash is often present on the palms and soles. RMSF is fatal in approximately 20% of untreated cases, and severe fulminant disease is possible.

Laboratory criteria for diagnosis

Serological evidence of a significant change in serum antibody titer reactive with *Rickettsia rickettsii* antigens between paired serum specimens, as measured by a standardized assay conducted in a commercial, state, or reference laboratory.

Demonstration of *R. rickettsii* antigen in a clinical specimen by immunohistochemical methods.

Detection of *R. rickettsii* DNA in a clinical specimen by the polymerase chain reaction (PCR assay).

Isolation of *R. rickettsii* from a clinical specimen in cell culture.

Note: For confirmed cases, a significant change in titer must be determined by the testing laboratory; examples of commonly used measures of significant change include, but are not limited to, a four-fold or greater change in antibody titer as determined by indirect immunoflourescent antibody (IFA) assay or an equivalent change in optical density measured by enzyme-linked immunosorbent assay (EIA or ELISA).

Case classification

Confirmed: A person with a clinically compatible illness that is laboratory confirmed.

Probable: A person with a clinically compatible illness and serologic evidence of antibody reactive with *R. rickettsii* in a single serum sample at a titer considered indicative of current or past infection (cutoff titers are determined by individual laboratories).

Tularemia *(Francisella tularensis)*

1999 Case Definition

Clinical description

An illness characterized by several distinct forms, including the following:

Ulceroglandular: cutaneous ulcer with regional lymphadenopathy

Glandular: regional lymphadenopathy with no ulcer

Oculoglandular: conjunctivitis with preauricular lymphadenopathy

Oropharyngeal: stomatitis or pharyngitis or tonsillitis and cervical lymphadenopathy

Intestinal: intestinal pain, vomiting, and diarrhea

Pneumonic: primary pleuropulmonary disease

Typhoidal: febrile illness without early localizing signs and symptoms

Clinical diagnosis is supported by evidence or history of a tick or deerfly bite, exposure to tissues of a mammalian host of *Francisella tularensis*, or exposure to potentially contaminated water.

Laboratory criteria for diagnosis

Presumptive

Elevated serum antibody titer(s) to *F. tularensis* antigen (without documented fourfold or greater change) in a patient with no history of tularemia vaccination or

Detection of *F. tularensis* in a clinical specimen by fluorescent assay

Confirmatory

Isolation of *F. tularensis* in a clinical specimen or

Fourfold or greater change in serum antibody titer to *F. tularensis* antigen

Case classification

Probable: a clinically compatible case with laboratory results indicative of presumptive infection

Confirmed: a clinically compatible case with confirmatory laboratory results

End of document