Deer Management Committee
Final Report

Presented to First Selectman, Gordon Joseloff
Westport, Connecticut

November 12, 2013

Preface

The Westport Deer Management Committee is a volunteer committee appointed by First Selectman, Gordon Joseloff pursuant to a resolution of the Representative Town Meeting (RTM). The mission of the Committee is to determine the management of the town's deer herd, subsequent to the recommendations made by the Environment, Health & Human Services and Public Protection Committees of the RTM. The Committee is tasked with considering the two guidelines adopted by the RTM in its session on August 2, 2011:

1. There is a need to control the deer population in Westport
2. The RTM is "in favor of upholding the current Westport Hunting Ordinance" which prohibits hunting.

At the August 2 meeting, the RTM also requested that the Committee "implement a public education campaign which would focus on ways to protect against the harmful effects of deer," and "create a volunteer board… charged with monitoring advances in deer control techniques."

The Committee has been meeting since February 6, 2012 and has had numerous committee and subcommittee meetings. In addition, there has been active public participation at these meetings. The Committee compiled a comprehensive list of deer management topics. In addition, the Committee agreed (after consultation with the First Selectman), that all deer control methods would be evaluated by the Committee, including lethal means, despite Westport's No Hunting Ordinance. The various topics were researched extensively with an emphasis on recommendations that could be supported by controlled, published scientific studies, rather than purely anecdotal evidence or emotions. The purpose of this Final Report is to provide the First Selectman, the RTM and the community with:

1. A summary of our activities and findings during the course of our seventeen month study, research, discussion and debate;
2. A set of educational programs to create a more informed population on Lyme Disease prevention and methods of mitigating the impacts of deer; and
3. An assessment of varied approaches for deer population control that were explored by the Committee and specific recommendations for a program that will monitor and possibly reduce the size of the Westport deer herd.

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Summary

1. Westport Deer Count: No one has been certain of the deer population in Westport or whether it is growing or shrinking. Opinions on this topic are strong, but are mostly based on anecdotal evidence. Although the state of Connecticut performs periodic aerial surveys, they do not sample in Westport. The Committee identified a relatively inexpensive service company that offers aerial infrared radar mapping of deer. This set a baseline for our current deer population and mapped its distribution.
2. Aerial Survey: At the recommendation of the Committee, the Town of Westport funded a Forward Looking Infrared Survey (FLIR) conducted by Vision Air Research on March 10, 2013. This count utilized a unique, relatively cost effective technique. FLIR counts each individual deer in an area rather than random transects which are then extrapolated to the entire area of interest. This provides not only the total number of deer, but also an indication of their distribution. The survey estimates the Westport deer population at 589 deer. With sampling error, the deer population is estimated at 26 30 deer per square mile. Aerial flyover manual counts performed in Westport in 2000 and 2004 estimated the population between 30 and 60 deer per square mile using transects north of the Merritt Parkway. This indicates that the deer population in Westport is stable or declining, similar to Fairfield County as a whole.
3. Opinions on Deer Control: Regarding deer population control, Committee embers initially fell into two camps, with some suggesting lethal methods such as sharpshooters and hunting and others opposed. The committee explored hunting and sharpshooting programs used by other communities, including those currently in place in surrounding towns. As we learned more about the limitations of culling through hunting and sharpshooting programs and the cost effectiveness of the Porcine Zona Pellucida PZP) contraceptive program, support moved to the non lethal, contraceptive approach.
4. Recommendations: The Committee recommends the creation of a committee or committees to assist and oversee the implementation of recommendations regarding:
   a) Deer population control (PZP contraception program)
   b) Education programs to mitigate the effects of deer
   c) Education programs to assist residents in protecting themselves from tick borne diseases
   d) FLIR deer counts every other year to monitor changes in Westport's deer population

   The Committee ould also keep apprised of new techniques and research regarding deer population control.
5. Immunocontraception: The Committee recommends the Town of Westport facilitate and promote a PZP deer contraception program. Newer contraceptive techniques have recently made deer contraception both effective and affordable. The Committee has contacted Dr. Alan Rutberg of Tufts University who has successfully implemented similar programs in other areas and has expressed interest in implementing a similar program in Westport. The goal of the program would be to decrease deer numbers in areas of town where residents feel the deer are a nuisance rather than a town wide project aimed at reducing the entire Westport deer herd. The program envisioned by the Committee ould e ery economical and would be implemented voluntarily in neighborhoods where residents

support this program and are willing to fund it for their neighborhood. Funding could be supplemented by the town and animal advocacy roups as has been done in other communities.

6. Lyme Disease and Deer: The Committee presumed that residents were interested in deer control, in part, because of their concerns of Lyme and other tick borne disease. The Committee thoroughly reviewed the myriad available research studying the link between deer populations and tick borne disease. Unfortunately, there is no clear cut ink. Evidence suggests that even a dramatic reduction in the deer population has limited impact on Lyme Disease; owever, xperts disagree on exactly how low a deer density is required for impact. Despite the ambiguous relationship, the Committee felt, based on comments by the RTM, that Lyme and other tick borne disease should be part of its purview. The following aspects of Lyme and other tick borne disease were investigated by the Committee: the life cycles of *Borrelia burgdorferi* (the causative agent of Lyme Disease); the various tick borne diseases and the blacklegged tick (*Ixodes scapularis*); the history of reporting by physicians and the number of cases in Westport and other areas; the various methods for personal protection against Lyme Disease; and methods for reducing tick populations on town and resident owned properties.
7. Lyme Disease revention: It is difficult to find hard numbers on the incidence of Lyme Disease, but it is one of the most common reportable diseases in Connecticut. Recent reports indicate that seniors are now the most affected age group in Connecticut. The best methods for reducing the incidence of Lyme Disease at this time are improved education throughout the community. The Committee has proposed methods of educating the public regarding these topics in an effort to further reduce the incidence of Lyme Disease n Westport.
8. Deer and Landscaping: The Committee explored various methods of mitigating the impact of deer on private landscaping. Effective methods of reducing deer browsing exist including planting of "deer resistant plants" and use of deer repellant sprays. The Committee has proposed methods for educating the public with this information and recommends that homeowners utilize this information to protect their personal property. The committee found only anecdotal evidence that reducing deer populations reduces browsing in suburban landscapes; however, individual neighborhoods could elect to implement the proposed PZP immunocontraception program for this purpose.
9. Deer Vehicle Accidents (DVAs): The Committee found a relatively low frequency of reported DVAs in Westport. Even an aggressive deer population reduction program would have a minimal effect on Westport's overall automobile accident rate. The committee concluded that any programs aimed at reducing DVA's should target education.
10. Deer, forests, biodiversity and Lyme Disease: Since the middle of the last century, researchers have documented the negative impact of overabundant deer on forest plants and trees. More recent studies have reexamined the matter and concluded that "too many" and even "too few" deer numbers vary by the specific geographical region. Furthermore, Westport is largely non forested with some areas of small sized wetlands forest patches. The Committee concluded that to their knowledge, there are no studies done in Westport that have shown what is the "just right" number of deer for maintaining a "healthy" fragmented forest. For these reasons, the Committee is unable to make any recommendation regarding this issue.

Overview f ite Tailed Deer (*Odocoileus virginianus*)

The range of the White Tailed Deer stretches from Southern Canada to South America, and includes most states in the United States. In Connecticut, deer are active year round. Breeding season runs from October to early January with fawns being born in May and June (Connecticut Department of Energy and Environmental Protection, 1999). Deer frequently have twins and the rate of twinning increases when the deer population drops (referred to as the "rebound effect") making deer population control more difficult (Swihart et al.,1998; Richter & Labisky, 1985). Deer are primarily grazers that eat non woody and flowering plants, leaves, acorns, grass, lichens and fruit. They also will browse on tree seedlings, saplings and new growth of any plant, including those in landscaped gardens (Whitaker et al., 1998). Deer are most active at night and dawn, but can be seen any time of the day. Deer that live in the suburbs can expect to live an average of two to three years. Deer that live to the age of seven will have ground their teeth completely down and are at risk for starvation (Pennsylvania Game Commission, 2010). In the suburbs a deer can travel within a ten mile range but with adequate food and mates they generally remain in a single square mile range for most of their life; this is likely the case in Westport (Swihart et al., 993; iccolo et al., 2000). They n sprint up to thirty miles per hour and leap as high as eight feet and as far as thirty six et (Fairfax County Public Schools, 012). Deer habitat requires open areas with tall brush and shrubs to provide cover and forage in addition to forest. (Latham, 2005). Since Westport geography is comprised of small areas of fragmented forest with residential and commercial developed areas in between, the Town provides ideal deer habitat.

Deer pulation Measurement

Forward Looking Infrared Radar (FLIR): Accurate deer counts provide the basis for analyzing the success of population control strategies. Traditional measurement methodology, whether counting deer from flyovers, deer vehicle collisions, or observing foliage reduction have produced results with wide variations in accuracy because these are sampling techniques (Daniels, 2006); whereas, FLIR provides a comprehensive count (Gill, 1997). In addition, this technique provides the distribution of deer in addition to a total count (Belant & Seamens, 2000; Drake et al, 2005). To the Committee's knowledge, deer reduction programs throughout Fairfield County have not been accompanied by any counting to assess the success of implemented strategies.

Summary of Aerial Survey and Results: Based upon a recommendation by the Committee to First Selectman Joseloff and subsequent funding of $6,500 by the Board of Finance, Vision Air Research, Inc. www.visionairresearch.com was contracted to conduct an aerial survey of Westport. The survey was conducted from 7:00 PM to Midnight on March 10, 2013. The company used a forward looking infrared camera mounted on an airplane that identifies animals by their heat signature. It was 39 degrees F at the start of the flight, which ovided good conditions for the survey. Using their extensive experience, Vision Air experts reviewed the data from the flight to identify deer and their locations on an aerial map of Westport.

The survey counted 589 deer within 203 deer groups of one to eight individual deer. The detection rate in this kind of survey varies with the canopy closure of the land being surveyed. Based on controlled studies, Vision Air Research estimates the detection rates as follows:

Canopy	**Detection Rate**
None (Open areas)	Near 100%
Deciduous forests	86%
Conifer forests	50 80%

Assuming an average detection rate of 85% for Westport (as estimated by Vision Air based on tree cover and conditions), the Committee calculated that there are approximately 700 deer in town (589 er/0.85 = 693 er). Using an estimate of 22 square miles in Westport after removal of area covered by water, this results in an average deer count of 32 deer per square mile (693 er/22 square miles = 31.5 deer per square mile). The survey map, Attachment B, shows that the deer are not spread evenly around the town but are concentrated in certain areas, such as north of the Merritt Parkway.

Indirect Deer Population Measurements: **e** Committee investigated the possibility of using sampling methods to monitor the Town deer population size on a periodic basis. Some of the methods that have been utilized for this purpose include counting deer along transects in a vehicle, (Collier et al., 2007), counting deer droppings (dung) (Campbell et al., 2004) and counting numbers of deer harvested (Roseberry & Woolf, 1991). Because these methods involve sophisticated statistical analysis typical of research studies, the Committee determined that they are not feasible to implement at this time.

Deer pulation ntrol

The Committee looked extensively into the issue of reducing the deer population. The following reasons have been cited for reducing Westport's deer herd:

1) Private landscaping damage
2) Deer vehicle accidents (DVA's)
3) Prevention of tick borne disease (especially Lyme Disease) and
4) Protection of the forest understory and habitat.

Evidence for reducing the deer population to reduce DVA's or protect Westport's "forest" was not compelling. estport's reported DVA's account for less than 2% of the total number of accidents in Westport (which is significantly lower than several surrounding towns) with no serious injuries or fatalities in recent years (Labonte, 2012; Kilpatrick, 2004; Williams, 2012). The w studies on deer populations and deer vehicle accidents have shown a fairly linear relationship between the two; even dramatic reductions in Westport's deer population would only have a minimal effect on overall rates of accidents in town (Rutberg & Naugle, 2008; DeNicola & Williams, 2008). This contrasts with towns like Princeton Township NJ, a small suburban town with similar (human) population density to Westport. They initiated a deer

culling program in 2001 based on a reported DVA rate 2800% higher than Westport's per capita rate (DeNicola & Williams, 2008). A recent Yale study indicated the deer population in Fairfield County was not sufficient to significantly impact diversity of its forest (Rutherford, 2010). Westport has minimal forested areas consisting of fragmented forest. The Committee could find no information pertaining specifically to impacts of deer on this habitat, but felt that deer management programs directed at this goal were not warranted at this time.

The Deer – me nnection: Reducing the deer herd to reduce the incidence of Lyme Disease and other tick borne disease is a highly controversial topic. It has often been stated that reducing the deer population below 8 12 deer per square mile greatly reduces Lyme Disease. Most researchers seem to agree that reductions above this level do not impact Lyme Disease rates (Stafford, 2007). What is hotly contested is whether levels below this will reduce the incidence of Lyme. The Committee examined various studies which demonstrated reductions in Lyme or infected ticks with deer reduction, others showed no impact and still others showed permanent or temporary increases in Lyme or infected ticks Table 1). This is because Lyme Disease and the blacklegged tick have a highly complicated two year life cycle involving multiple hosts. Deer are also "dilution" hosts and break the transmission of Lyme Disease. pending on the presence and variability of other host species, this can increase or decrease tick infection rates (Swei et al., 2011; Perkins et al., 2006; Telford et al., 1988; Keesing et al., 2009; Van Buskirk & Ostfeld, 1995). In addition, successful tick viability, tick infection rates and infection of humans or pets also depend on numerous environmental factors. Therefore reducing just one component of the cycle (the number of deer) may not have the impact that seems intuitive to some. (Ostfeld, 1999)

Garnett, JM, NP Connally, KC Stafford & ML Cartier, Evaluation of Deer Targeted Interventions on Lyme Disease Incidence in Connecticut, Public Health Report, 2011, 46 454; Kilpatrick and LaBonte. 2003, Deer Hunting in a Residential Community: A Community Perspective, Wildlife Society Bulletin, 340 348	Mumford Cove CT (a peninsula) eer educed rom 20/sq i o 0 er q i nd maintained at that level ne tudy showed a reduction in Lyme cases based on self reporting of Lyme cases; A second study showed no statistical difference in Lyme rates when Mumford Cove rates were compared to surrounding ommunities (surrounding communities rates decreased to the same degree as Mumford Cove despite no deer reduction in those areas).
Rand, PW, et al, Abundance of *Ixodes scapularis* Acari:Ixodidae) after the complete removal of deer from an isolated offshore island, ndemic or yme isease, urnal f edical Entomology, 2004, 779 84	After complete eradication of deer from a small island (1 square mile, 100 residents) with no other mammals besides Norway rats, number of infected ticks increased 4 fold and % of infected ticks increased 2 3 fold for 2 3 years, then tick numbers decreased to approximately 7% of original numbers. Number of human Lyme cases was not reported. (Lyme has been reported elsewhere to have significantly decreased on the island).
Rand, PW, et al, Deer density and the abundance of *Ixodes scapularis* (Acari:Ixodidae). Journal of Medical Entomology 2003, 179 184.	Study on the coast of Maine: few ticks were collected at densities less than 18 deer/sq mi. Deer presence was overall weekly correlated to tick presence (but did correlate somewhat to deer pellets).
Stafford, KC, AJ Denicola & HJ Kilpatrick. Reduced abundance of *Ixodes scapularis* Acari:Ixodidae) nd he ick arasitoid *Ixodiphagus hookeri* ith eduction f hite tailed deer. Population and Community Ecology, 2003, 642 645.	Nymph populations reduced substantially (about 90%) after reductions in deer populations from 200 to 20 40/sq mi.
Jordan RA, TL Schulze & MB Jahn, Effects of reduced deer density on the abundance of *Ixodes scapularis* Acari:Ixodidae) nd yme disease incidence in a northern New Jersey endemic area, Journal of Medical Entomology, 2007, 752 7.	Reduction of deer from 118 to 63 per square mile did not affect Lyme Disease rates in ernards ownship ew rsey.

Wilson, ML, F evine pielman, educed bundance f Immature *Ixodes dammini* Acari: odidae) ollowing limination of Deer, Journal of Medical Entomology, 1998, 224 228; Wilson, ML, JF Levine & A Spielman, Effects of deer reduction on abundance of the deer tick *Ixodes scapularis*), Yale Journal of Biology Medicine, 1984, 687 705.	Great Island MA: eer were reduced from 35/sq mi to approx 10/sq mi on this isolated eninsula; no reduction in Lyme Disease rates occurred. Subsequently deer were reduced and maintained at 3 5 deer/sq mile. Nymphs gradually decreased by about 50% over several years. Lyme rates decreased from approximately 2 3 cases/100 residents to 0.3 cases/100 residents yearly (self reported data) (Westport's current reported Lyme rate is 0.03 cases/100 residents)
Duffy, DC et al. *Ixodes scapularis* Acard:Ixodidae) eer ick mesoscale populations atural reas: ffects f eer, rea, nd location, urnal f edical ntomology, 994. 52 158.	Lyme rates correlated with nymphal tick numbers but not ith eer umbers. reas with no deer had Lyme and nymphal tick rates significantly (93%) lower than areas with deer It hould e oted hat ome reas ith o eer ad yme ates imilar o Westport's current Lyme rates).
Jordan, RA & L chulze, eer rowsing nd he istribution f *Ixodes scapularis* Acari:Ixodidae) entral ew ersey orests. Environmental ntomology, 005, 01 806.	New Jersey: No correlation was found between deer populations and the number of ticks in those areas.
Ostfeld RS et al., limate, eer, odents, nd corns s determinants of variation in Lyme disease risk. Plos Biology 4, 2006, 1058 1068.	Dutchess County, NY: No correlation was found between deer populations and nymphal ticks. Correlations were found for ticks with mouse and chipmunk populations.)
Deblinger RD, et al., educed bundance f mature *Ixodes dammini* Acari: odidae) ollowing cremental emoval f eer. Journal of Medical Entomology, 1993, 144 150; Steere, AC, yme Disease: A growing threat to urban populations, Proceedings of the National Academy of Sciences, USA, 1994, 2378 2383; Awerbuch, TE & A Spielman, 1994, Role of Host Density in the Ecology of Lyme Disease, *in* yme orrelliosis, d y S xford DHE Rees.	Crane Reservation, Ipswich MA: Deer reduced from 170 to 22/sq mi. Nymphs decreased significantly but adult ticks and larvae increased. Lyme Disease rates in Ipswich A creased 0 fold during that period (rates were not compared with surrounding communities). A computer odel redicted hat ick opulations ould not decrease significantly until there were less than a total of 8 deer in the entire 2.2 square mile area.
Levi, T et al., eer, redators nd he mergence f yme Disease, Proceedings of the National Academy of Sciences of the United States of America, 2012, 10942 10947.	Lyme Disease rates throughout tates MD, N, I, A) ere onitored ver 0 years and were unrelated to deer populations, but did correlate with local fox and coyote populations. A few of the areas with 10 15 deer/square miles ad ome f the highest Lyme rates in the study.)
Pepkin, KM, et al., GeographicvVariation in the Relationship between human Lyme Disease incidence and density of infected host seeking *Ixodes scapularis* nymphs in the United States, American Journal of Tropical Medical Hygiene, 2012, 1062 1071.	Comprehensive national tudy howing yme ates 3 tates ere ariably elated to density of nymphs and density of infected nymphs.
Jaenson, TG & L Talliklint, Lyme borreliosis spirochetes in *Ixodes ricinus* Acari:Ixodidae) nd he arying are n olated lands the Baltic, Sea, ournal f edical ntomology, 996,. 39 343; Junttila J et al., revalence f *Borrelia burgdorferi* *Ixodes ricinus* icks rban ecreational reas f elsinki, ournal f Clinical Microbiology, 1999, 1361 1365.	Two studies in which Lyme Disease and *Ixodes* icks *Ixodes ricinis* he ick pecies that carries Lyme Disease in Europe) are present reas ithout eer y maller mammals.

Table 1. Summary of deer reduction studies on tick abundance and Lyme Disease incidence.

Deer unting/Culling: Reducing the population of deer herds is extremely challenging. If does are in good health and have sufficient food and resources, they can produce fawns annually starting as young as one year of age and with a high percentage of twin births. Studies have shown that twinning increases dramatically due to hunting. Hunting reduces the number of deer in the hunted area. The remaining does become healthier and better fed due to the smaller number of deer competing for the same amount of food. These healthier does (especially young does) have higher fertility rates and a higher percentage of twin births (Richter, 1985; Swihart, 1998). Cornell University's current deer management program has produced a greater reduction in deer numbers using contraception rather than hunting presumably due to the "rebound effect" in the hunted areas of the program (Curtis, 2012).

Some studies have indicated that reductions of 40% per year or ore can be necessary to effect population reductions and a recent publication from the UK proposed annual cull rates as high as 50 60% per year because 20 40% annual reductions have not been successful (Jordan et al., 1995; Peterle, 1987; Waeber et al., 2013). Another barrier to deer population control is public opposition. Many municipalities' lethal deer population control programs have been hampered by opposition by residents and/or animal rights activists creating additional political and financial obstacles (DeNicola, 2000; Stern, 2005; KTRK TV, 010; Stafford, 2007).

The Committee reviewed extensively the various methods available for deer reduction. Methods such as trap and release or net and bolt were immediately dismissed for practical and humane reasons. The Committee evaluated the deer management programs that have been in place in most of the surrounding towns in Fairfield County for the last 10 15 years. Many towns have implemented backyard hunting and controlled hunting programs to reduce their deer herd. These programs are attractive to communities because of their low cost. Unfortunately, none of these towns have monitored their deer population with any official deer counts or measures of their impacts (including Lyme Disease), and some recent media reports from these towns have documented complaints that their programs have not been successful (Wilson, 2012). The Greenwich, CT health department indicated that their deer management program had not impacted Lyme Disease rates in the town (Serafin, 2012). Overall, the deer population in Fairfield County has been stable for over a decade. The latest counts in 2013 by the State showed a decline, but it is unclear, yet, if that is a permanent change (Gregonis, 2000; Gregonis, 2003; Gregonis, 2007, Kilpatrick, 2009; Kilpatrick, 2013). In addition, a study by Dr. J Nicola of White Buffalo (a sharpshooting company) and others, showed that controlled hunting programs similar to those being used throughout Fairfield County are unable to reduce deer populations below 45 er r square mile (Williams, 2012).

The Committee evaluated several programs which utilized aggressive sharpshooting or other lethal means to dramatically reduce the deer population within a community. Bernards Township and Princeton Township in New Jersey have been successful at dramatically reducing their er populations. er vehicle accidents have been reduced and residents are reporting less landscape damage. Princeton has not evaluated the impact on Lyme Disease. The Director of the Princeton Township health department feels that Lyme has not been impacted by the program (Henry, 2012). A paper published in 2007 showed no impact on Lyme or tick populations after instituting an aggressive deer culling in Bernards Township in 2002, but data is still being collected (Jordan et al., 2007; Deer Management Program in Bernards Twp., 2011). These programs can be very costly: Greenwich, CT spent approximately $52,000 on their sharpshoot in 2005 to remove 80 deer from one neighborhood (LaBonte, 2005) and Princeton Township has spent over one million dollars in 10 years on their program (Stern, 2005; LaBonte et al., 2005).

The Weston Westport Health District does not recommend deer population control as a part of Lyme Disease prevention (Weston Westport Health District, 2008). Although, the state of Connecticut does recommend lethal deer management, it also acknowledges that "with the exception of some islands or peninsulas, the need for such a drastic reduction in the deer

population to achieve satisfactory control of ticks may render this strategy unrealistic"(Stafford, 2007). The Committee has concluded, at this time, that lethal methods of population control such as sharpshooting, state regulated hunting and culling are not cost effective nor feasible in Westport. The Committee felt it would be irresponsible to recommend a town wide lethal deer control program to reduce Lyme and other tick borne diseases without conclusive vidence of its effectiveness.

Studies on this subject in Fairfield County and throughout the Northeast are ongoing and the implementation committee should continue to monitor the results of these studies. For example, the town of Redding is involved in a study by the CT Agricultural Experiment Station (funded by the CDC) evaluating various methods of tick control including lethal deer control (Stafford, 2012). A study at Cornell is evaluating the use of hunting and contraception for deer population control and will evaluate any impact on Lyme Disease. Preliminary results have shown a greater reduction in the population in the contraception group than the hunting group but no data is available yet for the impacts on Lyme Disease (Curtis, 2012). Any program aimed to reduce the deer population also requires aggressive ongoing programs to stabilize the population at the "desirable" level (DeNicola, 2000).

Porcine Zona Pellucida (PZP) mmunocontraception: The Committee recommends the Town of Westport offer a deer contraception program to be developed Alan Rutberg of Tufts University using an experimental PZP vaccine. Based on the results of the FLIR count, some areas of town clearly support many more deer than others. This correlates with Westport residents who have subjectively reported much variation on the number and impact of deer in their neighborhoods. There has been much debate as to the role of town government on managing deer for the benefit of individual property owners. One of the attractions of this program is that it would allow interested residents to participate without committing or affecting the town as a whole. In addition, the Committee felt that a contraception program would be more accepted by the town than other types of deer population control programs, even by residents who chose not to participate. A contraception program also would not require overturning the Westport No Hunting Ordinance.

Over the last few years PZP immunocontraceptive techniques have recently made deer contraception much more effective (a single vaccination lasting two to three years or more), simpler (deer can now be darted and marked simultaneously from as little as 35 yards away) and significantly more affordable (as low as $70.00 per deer in a recent study; see Rutberg, et al., 2012). The PZP vaccine works by producing antibodies to sperm blocking fertilization. The PZP vaccine is safe for residents as well as the deer and poses no threat to animals or humans who might later consume a vaccinated doe (Miller et al., 2001). The Committee has discussed such a plan with Dr. Alan Rutberg of Tufts University who has successfully implemented similar programs in other areas and has expressed interest in implementing a similar program in Westport (Rutberg, 2012). Although the vaccine is still considered experimental, the DEEP has indicated they would be willing to grant Westport a permit for this type of project (Kilpatrick, 2012). The goal of the program would be to decrease deer numbers in areas of town with the highest deer densities where residents feel the deer are a nuisance. Female deer would

darted in those areas prior to the breeding season. Deer counts performed every two years would monitor the population in these areas. The program envisioned by the Committee would be very economical and would be funded by interested residents, possibly animal advocacy organizations and the Town of Westport. An implementation committee would be essential in facilitating collaboration between Town Government, interested residents and Dr. Rutberg to manage this project.

Hastings on Hudson, – mmunocontraception Program: The Committee discussed er contraception using PZP with Peter Swiderski, the Mayor of Hastings on Hudson in Westchester County (Swiderski, 2012). Hastings on Hudson has developed an immunocontraception program with Dr. Alan Rutberg and will utilize PZP and further test its effectiveness in reducing the deer population in an open mainland community over one to three years. Their program differs from the one recommended by the Committee in that they will be immobilizing the deer with a tranquilizer delivered by dart and they will inject the deer with PZP by hand. They plan to commence injecting deer in 2013. The implementation committee should stay in contact with Hastings to see what Westport can learn from their experience**.**

<u>Lyme & Other Tick Borne Disease</u>

The Committee presumed that residents were interested, in part, in deer control because of their concerns of Lyme and other tick borne disease. The Committee thoroughly reviewed the available research studying the link between deer populations and tick borne disease but was unable to find a clear cut link. Evidence suggests that even a dramatic reduction in the deer population has limited impact on Lyme Disease; however, experts disagree on exactly how low a deer density is required for impact and it may vary by habitat. Despite Lyme's ambiguous relationship to deer, the Committee felt, based on comments by the RTM and the community during its hearings, that Lyme and other tick borne disease prevention should be part of its purview.

Lyme/Tick Borne Disease Numbers: The Committee examined Lyme and other tick borne disease numbers and trends over the last 20 years for Westport and other Fairfield County towns. The criteria for reporting cases of Lyme Disease as well as the definition of Lyme Disease cases have changed repeatedly over the last 20 years, making trends difficult to establish, but the overall trend in Westport appears to be a peak in 1999 2002, with a fairly steady decline since (Connecticut Department of Public Health, 2013 c). Although numbers are not available for Westport specifically, children have historically been the most affected group in Connecticut, followed by seniors and then adults. However, in 2011 and 2012, seniors (age 50+) had an even higher rate of Lyme Disease than children (Connecticut Department of Public Health, 2013 b). Other tick borne diseases (*Anaplasma*, *Ehrlichia*, & *Babesia*) are still fairly uncommon and their rates are currently fairly stable (Connecticut Department of Public Health, 2013 a). A new strain of *Borrelia* causing relapsing fevers in addition to symptoms similar to Lyme Disease was reported in patients in New York and Connecticut in January 2013 so the incidence of this new strain remains to be en (Krause et al., 2013). The subcommittee also investigated and recommends monitoring Lyme Disease in Westport through the use of

HealthMap (www.healthmap.org) for lf reporting of cases by residents (Field). Although not scientific, it might help the town more efficiently utilize resources to target Lyme hot spots in the town.

Despite the fact that Lyme Disease is a reportable disease, the official numbers of Lyme Disease cases in Connecticut are probably grossly underestimated for the following reasons:

1. The earliest symptom is a bulls eye rash (EM or Erythrema migrans), but it is absent or atypical in 0 30% f cases and possibly more (Centers for Disease Control & Prevention, 2011; Tibbles et al., 2007).
2. Subsequent early symptoms may not be reported to a physician or may be missed by the physician as possible Lyme Disease (Burrascano, 2008).
3. A person presenting late symptoms may not have sufficient antibodies to *B. burgdorferi* and laboratory testing could result in a false negative result (Marques, 2010).
4. There is no system of oversight to insure that physicians report Lyme Disease as required to by the state.

Although it is not reasonable to expect that any state can obtain completely accurate numbers of cases of Lyme Disease through physician reporting methods, the Committee explored ways to encourage and/or monitor Westport physicians to make the required reports to the state. However, after discussions with the Connecticut Department of Health, Infectious Diseases division (Nelson, 2013), it became clear that the purpose of surveillance reporting of Lyme Disease cases, as well as most other Infectious Diseases is to monitor trends of disease numbers and incidence over time. It is not the intent of the State, nor would it be even possible to obtain accurate numbers of Lyme Disease cases. Therefore, the Committee recommends that no action should be taken that would affect the frequency of reporting by Westport physicians or laboratories.

Lyme/Tick Borne Disease Prevention

Personal Protection: Prevention of Lyme Disease through personal protection measures has been studied extensively and many behaviors have scientifically documented effects on the prevention of Lyme Disease. The Committee recommends that all residents practice these measures. The Committee also recommends that the implementation committee collaborate with the Westport Weston Health District to implement effective education campaigns regarding these measures. (Recommended methods for dissemination of this information can be found in the education section). The Health District has indicated they would be interested in assistance from this type of committee (Wheeler, 2012).

- Wearing protective clothing such as long sleeves, pants, socks (ideally with pants tucked into socks) and closed shoes; tick repellent products applied to the skin or clothing; tick repellent impregnated clothing are especially effective in preventing tick attachment (Vaughn & Meshnick, 2011). Applying tick prevention products to pets may also help prevent transfer of non attached ticks to humans.
- Self Checks: checking oneself, one's children and one's pets after exposure to potential tick infested areas is effective in removing ticks before they have sufficient time to

transmit tick borne diseases (Connally et al., 2009). It is important for residents to be familiar with the appearance of nymphs, adult ticks and both engorged adult ticks and nymphs. Anecdotally, although many are familiar with adult blacklegged ticks, many residents still are unable to recognize the nymphs, which are the main source of Lyme in humans and often mistake engorged blacklegged ticks for other types of larger ticks (which do not carry Lyme Disease) and fail to pursue timely treatment after exposure.

- Showering within 2 hours after coming in from outside has been shown to wash off infected ticks before they are able to transmit disease. In addition, removing clothing and washing and drying the clothing can prevent ticks adhered to clothing from attaching and infecting individuals at a later time (Connally et al., 2009).
- Recognizing the bull's eye and atypical rashes. Although most are familiar with the bulls eye rash, 30% or more of Erythema migrans rashes are considered atypical. Residents with atypical rashes often fail to receive appropriate antibiotic treatment. Even physicians may fail to recognize these atypical rashes (Nadelman & Wormser, 2002).
- Seeking treatment after exposure. Studies have shown that after infected tick bites, 90% of Lyme infections can be prevented with a single dose of doxycycline administered within 72 hours of exposure (Nadelman et al., 001). In addition, recognizing the symptoms of Lyme (muscle or joint pain, fever, chills, headache, fatigue, neurologic symptoms) or Lyme rashes and receiving timely treatment early in the course is thought to reduce the chances for persistent infection (Smith et al., 2002).
- Knowledge of high risk areas and seasons for ticks. Early to midsummer is the peak activity for nymphs and human transmission of Lyme Disease (Piesman et al., 1987). Spring and fall are the peak seasons for adult ticks that transmit Lyme and other tick borne diseases to pets (Little et al., 2010). Ticks, however, can be found year round depending on the weather. Most residents know to be careful when hiking in the woods or parks, but many residents still aren't aware that 75 % of Lyme Disease is contracted in their own back yard (Falco & Fish, 1988). In addition, ticks typically prefer moist, shady areas, especially those adjacent to woodlands and are less frequently found in sunny y areas of the yard (Stafford et al., 2009).
- Lyme Disease vaccination. Unfortunately, an effective Lyme vaccination was removed from the market shortly after it was introduced. A new Lyme vaccine is currently in clinical trials which appears in the current studies to be very safe and effective (Wressnigg et al., 2013). It is unknown when or if this vaccine will be available to the general public.
- Resources: The Westport Weston Health District has extensive detailed information on prevention and is the subject in brochures and links on their website (http://www.wwhd.org); www.wwhd.org/downloads/personal1%20protection.pdf). The University of Rhode Island has a very informative website (www.tickencounter.org). The Connecticut Department of Public Health website contains a comprehensive handout on self checks and personal tick repellent products: (www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/tickbiteprevention05.pdf)

Landscaping Strategies to Reduce Ticks and Lyme Disease Risk on Personal & wn Property: Using knowledge of the tick life cycle and habitat preferences, residents can make many simple changes to the landscaping and how they utilize their property to greatly reduce their family's chances of tick exposure. Since back yard exposure is thought to account for 75% of Lyme Disease cases these changes can be significant (Falco & Fish, 1988). Residents are increasingly becoming more wary of using pesticides on their properties, both for personal safety reasons as well as for its general effects on the environment. Using these strategies pose no threats to people or the environment; if pesticides are used, they can be minimized by targeting tick habitats. The Committee recommends that residents educate themselves regarding these measures and utilize them around their homes. In addition, the Committee recommends the implementation committee collaborate with the Westport Weston Health District to increase awareness of the availability of these preventive measures (recommended methods for dissemination of this information can be found in the education section).

- Wood chip barriers between yards and woodland areas have been shown to prevent tick penetration into yards from adjacent wooded areas. Also, using 3 foot wood chip barriers to insulate family areas from tick prone areas reduces family tick exposure. In addition, using wood chips, mulch or gravel or stone in place of ground covers which harbor ticks, mice and other small mammals that carry ticks reduces tick exposure (Maupin et al., 1991).
- Situating family and child play areas (as well as pet play and elimination areas) in sunny, dry parts of the yard with short grass and away from shady, moist areas with plantings or ground cover as well as stone walls, firewood piles, birdfeeders, compost piles and other shelters or attractions for mice and other small mammals reduces family tick exposure (Duffy et al., 1994).
- Keeping the yard free of leaf litter and other brush where the majority of ticks overwinter is also very effective at reducing tick populations (Maupin et al., 1991).
- Removal of Japanese Barberry (a popular deer resistant shrub) has been shown to greatly reduce tick populations in an area (Williams & Ward, 2010).
- Using both chemical and natural tick control products in yards can be very effective at reducing the numbers of ticks. Studies have shown strategically applying chemical acaracides in one fall application is as effective as multiple applications throughout the year without repeated chemical exposure to family and environment (Schulze et al., 2008). In addition, by utilizing knowledge of the tick life cycle, only potential tick infested areas need to be treated further minimizing pesticide use. A current study by the CDC in Connecticut and other areas is evaluating whether reducing ticks with a chemical spray translates into a reduction in the incidence of Lyme Disease in that area (Centers for Disease Control & Prevention, 2012).
- Resources: the Westport Weston Health District has extensive detailed information on this topic in both brochure form and available on their web site (www.wwhd.org); American Lyme Disease Foundation, Inc**.** is dedicated to the prevention, diagnosis and treatment of Lyme Disease and other tick borne infections www.aldf.com); BLAST based in Ridgefield, CT was developed to raise awareness of the most effective Lyme

Disease prevention practices, as well as to educate the community about the early sign and symptoms of Lyme and other tick borne diseases (www.ridgefieldct.org)**;** University of Rhode Island has an extremely informative website (www.tickencounter.org).

Other Strategies to Reduce Ticks and Lyme isease On Property:

The Committee researched numerous other tick control methods**.** Some are not yet commercially available or still experimental. The Committee did not make any specific recommendations for the town regarding these methods; however, it is recommended that the implementation committee continue to monitor these products which may have a role in tick control in private households or on town property in the future.

- Dr. Kirby Stafford has recently concluded a study on a fungus (*Metarhizium anisophae*) which has good efficacy (75%) against ticks and is not harmful to beneficial organisms (Stafford & Bharadwaj, 2010). The organic product will be available in 2014 from the company Norozymes.
- Several oils have shown some efficacy for killing ticks in the landscaping. Rosemary oil (Eco exempt IC 2/Essential IC 3) was as effective as a chemical product in killing ticks, but lasted about half as long and with a temporary effect on bees and beetles (Elias et al., 2013). A garlic oil product (Mosquito Barrier) was shown to be effective but needed frequent reapplication (Stafford, 2011). Nootkatone from cedar and grapefruit has been shown to have acaracide activity for a month or more with minimal effects on insects or plants. (Bharadwaj et al., 2012)
- A device called the 4 poster passively applies the acaracide (aka "tickicide"), permethrin, to deer head, neck and shoulders with paint rollers while they are feeding at a bait station. This has been shown to be effective at reducing the density of ticks and the rate of Lyme Disease in communities where the device has been studied (Garnett et al., 2011; Stafford et al., 2009). One disadvantage to this technique is the expense to establish and maintain the devices (see Attachment H). Opponents of this method claim that since the device utilizes corn as bait, it contributes to increasing deer numbers; however, proponents claim that corn does not provide adequate nutrients to affect the population size. A second disadvantage is the increased risk of the permethrin exposure, particularly to people handling the apparatus and eating venison; however, toxicity studies on mammals show that it is safe if handled properly (Pound Miller, 2006). In addition, permethrin is highly toxic to honeybees, fish, and aquatic invertebrates due to disruption of sodium channels (National Pesticide Information Center).
- Rodent bait boxes containing permethrins aimed at killing the ticks on rodents have had mixed results in reducing infected ticks and nymphs (Dolan et al., 2004; Stafford, 1992; Deblinger & Rimmer, 1991). A similar product containing fipronil showed good efficacy at reducing tick populations and a study in Fairfield County is currently underway to determine if this translates into fewer cases of tick borne disease (Centers for Disease Control & Prevention, 2013). As with the 4 posters, a disadvantage is this requires the feeding of mice, which could result in a higher mouse population.

- Rodent bait boxes containing doxycycline do not kill the ticks, but instead eliminate *Borrelia* and *Anaplasma* from ticks, reducing the number of infected ticks in an area. These have been extremely effective but are not commercially available (Dolan et al., 2011).
- Other non chemical products have been studied and are continuing to be studied. Some, such as using birds (guinea fowl, turkeys etc.) living in yards to devour ticks have been ineffective in reducing the incidence of Lyme Disease (Ostfeld & Lewis, 1999; Ostfeld et al., 2006). Others have produced unforeseen effects on the environment. Many others are the subject of ongoing research including a Lyme Disease vaccine for mice which has been shown to prevent Lyme Disease transmission from the mice to ticks which infest them. The vaccine is not yet commercially available and further research is needed to determine if this translates into decreased Lyme rates (Voordouw et al., 2013).
- Other factors which may or may not be practical for the town or residents to implement is encouraging a diversity (more varying species) of wildlife in our local environments, especially small and medium sized mammals which harbor the Lyme bacteria (*Borrelia burgdorferi*) and are the primary hosts that transmit Lyme Disease to ticks. Although it seems counterintuitive, studies have demonstrated that due to the dilution effect, higher diversity of these mammals correlates with lower percentage of ticks infected with the Lyme Disease causing bacteria (LoGiudice et al., 2003; Ostfeld & Keesing, 2000; Ostfeld, 2011). Areas with increased numbers of foxes have also been shown to have lower rates of Lyme Disease (Levi, 012). In addition, it may be important for predators (hawks, owls and other raptors) of small mammals that are the major carriers of Lyme Disease (mice, shrews, voles and chipmunks) to be present in the environment to manage populations of small mammals when their population occasionally increases exponentially due to years of higher availability of food, i.e. acorn mast years (Guilfoile, 2004).

Mitigating the Harmful Effects of Deer

Reducing Deer Browsing n Personal Property: There is much information available to residents on ways to reduce the impact of deer on their personal property. The Committee makes the following recommendations to residents (methods for disseminating these recommendations can be found in the education section):

1) Residents should plant species that are less desired by deer to protect private landscaping. Many lists of these "deer resistant plants" are available on the web. Excellent resources for planting deer resistant gardens are: The White Flower Farm (www.whiteflower_farm.com/deer resistance plants); Twombly Nursery (www.twomblynursery.com/resource_deer); Rutgers Cooperative Research & Extension (www.njaes.rutgers.edu/deerresistance).
2) Residents should be encouraged to use organic deer repellent sprays on plants that are typically browsed by deer (hostas, lilies, daylilies etc). This has proven to be a very

effective way to deter deer from eating foliage, bark and blossoms. A study by the CT Agricultural Station demonstrated that egg based products appear to be the most effective (85 100%) but require frequent applications every 1 2 weeks. Rotating types of products periodically can be more effective over using a single product exclusively. Product effectiveness decreases as deer browsing pressure increases (Ward, 2010). Anecdotally, two members of the Committee reported trying several products over the years in their own gardens and both had excellent success with egg based deer repellents. A thorough review of numerous repellent products and other methods for deterring deer can be found at: (www.ct.gov/caes/lib/caes/documents/publications/fact sheets/controllingdeer.pdf). Alabama Cooperative Extension System is another informative resource: (www.aces.edu/pub/docs). See also Attachment D for a comparison of spray repellent products. The products tested were tested using label directions. More frequent applications of some products may produce better efficacy (Ward & Williams, 2010).

3) The town should discourage the feeding of deer by private citizens Doenier et al., 1997).
4) Residents can use fencing to exclude deer from landscape shrubbery. There are different types of fencing that protect personal property. "Net fencing" is a cost effective way to keep deer at bay; an "electric fence" is a relatively inexpensive and efficient way to keep deer from entering property and "permanent high fencing" is the most expensive type of fencing that's available, but it offers effective protection for orchards and gardens. The metal wire used for these fences can last up to twenty five years (Riverside Fence, 2012). Residents should install fencing with caution, as studies have shown that for properties under two acres, the exclusion of deer may increase the number of infected ticks on the property. In properties larger than two acres, the perimeter of the yard can harbor increased numbers of Lyme infected ticks erkins et al., 2006).

Deer Vehicle Accidents (DVA's)

Deer Kill Incident Reports (DKIR) and Deer Vehicle Accident (DVA) Data: In an effort to understand the scale of deer vehicle accidents in Westport, relevant available data on this subject was obtained and analyzed. A summary of the Deer Kill Incident Reports (DKIR), from 2000 to 2010, was obtained from Scott Williams of Department of Forestry and Horticulture. The data contained latitude and longitude for each DKIR which enabled each DKIR to be plotted on a geographical map. This exercise revealed areas of DKIR concentration and the number of reported DKIR for each year. Somewhat higher concentrations of DKIR were noted to have occurred in the proximity of the Merritt Parkway and Connecticut Turnpike (I 95). The Committee also observed (although it was not scientifically analyzed) that on other roads within town the distribution of DVA's mirrored the deer distribution in town according to the FLIR Data. er Vehicle Accident (DVA) data obtained by own resident Ellen Linker from the Westport Police, indicates a total of 90 reported deer vehicle accidents from 2007 to 2010, and the name of the town street where they occurred; however, a house number is not associated with the street where the accident was reported to have occurred. The lack of house numbers

does not allow determining the exact accident location. This comprises less than 2% of all traffic accidents in Westport and did not include any fatalities.

The Westport Police and Animal Control Officer are responsible for recording vehicle accidents which occur on town roads. The Conservation Officers are responsible for recording deer vehicle incidents statewide and town wide. The State Police are esponsible for ecording er vehicle accidents on highways (Merritt Parkway, 58, 59, I 95), which are subsequently reported to DEEP. Based on our conversations with Scott Williams, the Westport Police Department forwards deer accident reports to the Department of Forestry and Horticulture (Williams, 2012).

Deer Vehicle Accident (DVA) Prevention: Based on the small number of reported DVA's in Westport, the Committee felt that even an aggressive deer reduction program would result in only a small decrease in overall traffic accidents in Westport and is not warranted. There are numerous methods employed by municipalities to reduce DVA's, but only a few have data proving their effectiveness.

Road Management Devices

The following Road Management Devices have proven efficacy in reducing the incidence of DVA's. The Committee is not currently making any of these recommendations to the Town, but they could be employed In the future (North Jersey Transportation Planning Authority, 2005; Jackels, 2011; Associated Press, 2012; Yi, 2003).

- Dynamic signs have proven efficacy in reducing DVA's. On local roads, upon deer detection, they emit a light to warn approaching motorists to slow down. On highways, this system uses transmitters and microwave radio signals; when a large animal crosses a signal's beam, beacons flash on top of signs to warn motorists they could encounter wildlife. Static signs are less effective.
- Fencing is effective but costly (Northeast Deer Technical Committee, 2008).

Drivers Education

The Committee does recommend including DVA education within the driver's education programs in the school system and through other education programs throughout town (these are outlined in the education section). These programs aim to:

- Increase driver awareness of the defensive driving techniques and knowledge of deer characteristics. This could be done through the local media and town agencies as well as making it part of any driver's education curriculum.
- Educate the public of particular roads in an area and of the specific times of the year when the risk of encountering a deer is greatest.

Deer, Deforestation, Biodiversity, and Lyme Disease Risk

Many studies have indicated that overpopulation of deer can degrade ecosystems by over browsing woody plants and trees preventing tree regeneration, reducing plant species richness, changing the plant composition of the ecosystem and contributing to the spread of invasive plant species (deCalesta, 1997). Studies have also demonstrated that overabundant deer are an indirect factor in declining numbers of forest bird species by reducing the amount of forest understory through over browsing (Meadows, 2000). However, recent research using deer enclosures indicates that the "right" number of deer for a balanced forest ecosystem may depend on the locale; and, in some cases, there can be too few deer (Nisley, 2012). Perhaps this "locale" effect explains the puzzling results obtained from the study that looked specifically at deer impact on plant composition in western Connecticut woodlots (including northern Fairfield County). Based on the data, the researchers concluded that in 007, the year of the study, er density was not the primary factor in determining variations in vegetation (diversity), including tree regeneration, across this area (Rutherford & Schmitz, 2010). The question remains unanswered for our area—what is the "right" density of er for balance in the ecosystem? In Westport, any extensive forestland that once existed has been severely degraded through human activity; development has resulted in forest patches or what is also called "fragmented forest" (see Attachment I). In the opinion of the Committee, unless the Town of Westport and its residents in conjunction with the State undertake major efforts to study and implement ways to maintain and/or increase the size of the existing forest patches, further degradation and loss of woodlots will most likely continue along with its cascade of negative effects. Based on the research, it is unclear what the role of deer is in this process, but certainly human activity is a major contributor to this cascade process. One of these negative effects has been shown to be an increase in density of the white footed mouse, the main carrier of the bacteria that causes Lyme Disease. (Levy, 2013) Another is the overall loss of mammalian species diversity. Because mammals are hosts for the blacklegged tick, there is strong evidence that both of these effects together result in an increase in Lyme Disease infected ticks. Therefore, decreases in forest patch size results in an increase in Lyme Disease risk (Allan, 2003). Whether caused by human actions, invasive species, deer abundance, reduction in mammal diversity or other factors, the Committee concluded that the potential for continued loss of forest ecosystem is a huge concern for many; however, this extremely complex issue is well beyond the scope of this Committee

Educational ograms and Community Outreach

Educational programs would target these two specific topics:

1) Prevention of Lyme Disease and other tick borne diseases; and
2) Mitigation of the effects of deer on personal property and preventing deer ehicle accidents.

The Committee was surprised to find how much information is available on prevention of Lyme Disease. The majority of this information is backed by controlled scientific studies on the subject. The Westport Weston Health District's (WWHD) website has an entire section devoted to Lyme Disease prevention. Although the incidence of Lyme Disease is decreasing in Westport,

it is unlikely that many Westport residents are availing themselves to the plethora of information available. The challenge is disseminating that information to Westport residents. Because of the current economic situation, the Health District does not have the financial resources to disseminate this information effectively. The Committee recommends that the implementation Committee take an active role in education program development and implementation. The Committee envisions the implementation Committee working closely with the WWHD to actively disseminate the already available information to the residents of Westport.

Children and seniors are the most affected age groups for Lyme Disease, so many of the programs would target these groups specifically. Adults under the age of 50 would also be targeted, as educating adults who are parenting minor children would likely nefit all age groups. The programs' focus is also on the topics of preventing deer browse on landscaping and preventing deer vehicle accidents (DVA's). The implementation committee would develop and oversee the following proposed programs. Most of these programs aimed at reducing exposure to Lyme Disease are needed only during the late spring and early autumn.

1. School Based Education of Children
   The Committee recommends that a Lyme Disease/tick borne disease prevention curriculum be incorporated into public and private school curricula. These curricula would likely be most effective if instituted at the pre school, elementary school and middle school levels. These curricula are already available for elementary, middle and high school. The "Lyme Research Alliance" (previously known as "Time for Lyme") is a Stamford, CT based group that has developed age specific curricula about tick borne diseases for elementary school, middle school and high school students which s used in several school districts throughout Connecticut. The curricula can be ordered for a nominal fee from the Lyme Research Alliance web site (also see Attachment J). Students are given effective tools to learn personal prevention, proper tick removal and signs and symptoms of Lyme Disease. The curricula can be ordered for a nominal fee from the Lyme Research Alliance website, www.lymeresearchalliance.org; also see Attachment J. Other excellent resources are: Brigham and Women's Lyme prevention education tools for educators, parents and children www.bwhpreventlyme.org); and, BLAST, Ridgefield, CT www.ridgefieldct.org). nformation about "tick free zones" in the children's backyards and risk of recreational areas they frequent should also be present in these curricula. Finally, driver education courses taught in Staples High School and the Continuing Education Program should include DVA prevention strategies.
2. Education of Senior Citizens
   Seniors now account for the highest incidence of Lyme Disease Connecticut (Connecticut Department of Public Health, 2013 b). Pamphlets are already available at the Westport Weston Health District regarding Lyme Disease prevention and deer repellant techniques. These materials should also be distributed and displayed in the lobby of the Senior Center. In addition, the implementation committee ill oordinate with the Westport Senior Center and the WWHD to offer lectures and seminars

regarding personal Lyme and tick borne disease prevention, landscaping to reduce tick borne disease, deer repellant techniques for gardeners and possibly DVA avoidance. (Also, e o. 8 below).

3. Education Pamphlets at Targeted Town Events and Activities
   A supply of pamphlets and printed materials (see No. 2 above) will be made available at a booth or table that is set up during key Westport events. The Lyme Awareness Booth (LAB) will be present at events approximately once monthly between May and September, the months when tick activity is the highest. LAB events to target are:

   a. May Art About Town Opening ight, Castles in the Sand
   b. June Westport Outdoor Antique and Vintage Emporium (WAVE), Westport Community Gardens
   c. July Levitt Pavilion Concerts, Westport Fine Arts Festival, Point to Point Swim, Westport Library Book Sale
   d. August Levitt Pavilion Concerts, Westport Community Gardens
   e. September Taste of Saugatuck, Blues, iews & BBQ Festival, Westport Kiwanis Club Triathlon
   f. October Wakeman Town Farm Pancake Breakfast

   Materials with information about strategies to keep ticks off of personal property and how to prevent DVA's will also be included.

4. Education Pamphlets Placed in Strategic Public Locations
   A supply of pamphlets and printed materials (see No. 2 above) will be maintained in highly visible locations in the following Town offices and Westport areas of attraction:

   a. Earthplace
   b. Westport Public Library
   c. Westport Weston Family Y
   d. Westport Parks and Recreation Office
   e. Longshore Sailing School
   f. Westport Town Clerk's Office

5. Education Pamphlets and Information Mailings to Newcomers
   Key pamphlets and printed information about Lyme Disease evention, deer browse prevention and deer vehicle accident prevention will be included in the Welcome Packet sent to new homeowners by Welcome Wagon, run by the Westport Weston Chamber of Commerce. Note that there is normally a fee for this service.

6. Additional Communication Methods for Lyme Disease Prevention Information
   Twice monthly "robo calls" will be made with the Town's emergency alert system between May and October informing residents that ticks are active and that increased

risk of exposure to Lyme Disease is present. Calls will direct residents to the WWHD website. Duration of these calls should be brief, no more than 15 60 seconds long and will include one of a series of prevention tip in the form of a short, catchy phrase or slogan, i.e. “shower within two hours” [after being outside] and “after 24 hours, the bite of a tick can make you sick.” A list of 10 15 different slogans will need to be created. Also wire stake signs will also be made containing the same slogans used in “robo calls” and from May to October will be placed in strategic locations in Town. “Robo calls” will also mention availability of information on the WWHD website for preventing deer browse on landscapes and driving tips to prevent DVA’s. The newsletter published by the Westport Parks and Recreation during the summer months will include information about Lyme Disease and prevention tips, as well as reminders about deer deterrent methods and DVA prevention.

7. Media Resources
   A series of educational columns on Lyme Disease prevention, landscaping and other deer impact mitigation topics will be provided to the local media in the form of press releases**.** Recommended local resources are: The Westport News, Westport Patch, The Daily Westport, Westport Now, The CT Post, The Stamford Advocate and Channel 12 News**.** Local blogs such as Dan Woog’s “06880”, could be used as important tools to keep the community informed.

8. Lectures and Seminars
   Speakers with expertise in Lyme Disease prevention, and other deer mitigation topics will present lectures and seminars to the public. The Lyme Research Alliance, based in Stamford CT offers a free one hour presentation to any interested organization (see Attachment K). It is advantageous to collaborate with appropriate organizations that currently have programs with speaking events for the public. Suggestions include Westport Public Library, Earthplace, Westport Continuing Education, Westport Senior Center and Westport Garden Club.

9. Wakeman Town Farm Environmental Education Programs
   The Wakeman Town Farm offers the Environmental Boot Camp, a one week course in the summer that teaches environmental sciences and field ecology. Students are interested in the sciences and are in grades 6 10. The complex ecology of Lyme and/or the effects of deer on natural habitat might be a useful topic(s) to be studied in this program. It would be very beneficial to generate a core group of students with a comprehensive understanding of these problems.

Summary of Recommendations

- Westport should repeat the FLIR aerial survey every two years and should attempt to replicate the survey methodology as much as possible. This will provide an accurate measure of the trend of the deer population in town.

- Westport should take steps to enable a Porcine Zona Pellucida (PZP) deer contraception program described in this report to be implemented voluntarily in neighborhoods where residents support this program and are willing to fund it for their neighborhood. One key step would be the appointment of a committee for the purpose of facilitating a pilot program. The committee would have the authority to work with Dr. Rutberg, the state of Connecticut, Westport residents, and Town of Westport officials and staff for this purpose.

- The Committee strongly recommends the creation of an implementation committee or committees. With the current fiscal situation in Westport, there is little town funding available to commit to the implementation of the recommendations outlined in this report. The Westport Weston Health District (WWHD) has myriad educational resources available to the town and the public, but not enough financial resources to actively distribute them. The organization and implementation of a contraception program could be accomplished by town staff and elected officials; however, again, financial constraints may limit this. The implementation committee would:

    1) Collaborate with the Westport Weston Health District (WWHD) to educate the public about Lyme Disease prevention through creation of a school curriculum, senior center programs and other outreach programs;
    2) Collaborate with the WWHD develop programs to disseminate information to residents on ways to reduce the impact of deer on their properties and reduce DVA's.
    3) Collaborate with town government and Dr. Alan Rutberg of Tufts to establish a contraception program if there is sufficient resident interest;
    4) Continue to monitor the deer population size and distribution through FLIR deer counts every two years; and
    5) Continue to monitor ongoing research on the subjects of deer management and tick borne disease prevention. This could be one committee, or separate committees.

- Education in Our Schools: The Committee highly ecommends that established Lyme Disease curricula used in our schools o teach children the many aspects of Lyme Disease prevention. The curricula developed by the Lyme esearch lliance targets kindergarten and grades 3, 6 and 9. Age appropriate goals, activities and guidelines have been established for each grade level. In addition, DVA avoidance should be added to any school Drivers Education programs.

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Aerial Thermal Infrared Imaging White - tailed Deer Count
Westport, Connecticut

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April 22, 2013

Vision Air Research was retained by Westport, CT, to conduct the deer population survey within the township. The goal of the project was to conduct and aerial infrared survey for white – tailed deer within Westport, Connecticut, map group locations, and provide a count of deer observed.

Study Area

The study area encompasses the town of Westport, CT located on the Long Island Sound. It is roughly 33 square miles. This is a residential area dominated by houses, other buildings, recreational fields, open parks, and hardwood and mixed forests.

Methods

The survey was conducted March 10, 2013 between 1900 and 2400 hours. Flight line transects were established running roughly east – west and parallel to the coastline. Transects were spaced 800 ft apart and flown at 1,000 ft above ground level. The sensor look angle was approximately 45° elevation. The sensor was aimed to gain more oblique or vertical look angle. Wide field of view was used to search for the deer while the narrow field of view was used to verify the object, as needed. Portion of the flight along transects were recorded to on onboard computer. The pilot and sensor operator communicated to verify the location of the boundaries at the start and end of transects.

The video was reviewed by playing the video backward and forward and in slow motion and frame by frame as needed to identify deer group and count within the group, and map group location. Deer were located by observing their level of emitted infrared energy versus background levels. Video editing and image extraction was not conducted. The video was collected for population counts by a skilled thermographer not for entertainment or educational purposes.

Duplicates or repeat groups were identified. Groups were mapped at their approximate observed position. I performed an additional check of the data through sampling the videotape for detection verification, and checking for duplicate groups. Orthophoto quadrangles were used as the base layer, which provided vegetation cover type to assist in mapping group locations. Group mapping locations are approximate.

Equipment

We used a forward – looking infrared (FLIR) by PolyTech Kelvin 350 II (Sweden) mounted on the left wing of a Cessna 206 “Stationair”. The sensor gimbal allows 330° of azimuth and 90° of elevation allowing us to look in all directions except directly behind the airplane. The infrared sensor installed in the gimbal is the high resolution Agema Thermovision 1000, which is a long wave system (8-12 micron). It has 800 by 400 pixels providing good resolution with the ability to determine animals by their morphology or body shape. The thermal delta is less than 1° C, which means it can detect objects with less than 1° C

different than the background. There are 2 fields of view (FOV): wide (20 ^{o}) and narrow (5°). At 1,000 ft. above ground level looking straight down using the wide FOV the footprint or area covered by the sensor is 360 ft. x 234 ft. while the narrow FOV provides a footprint 90 ft. x 59 ft. The sensor operator / wildlife biologist sat in the rear seat and watched a high resolution 15 in. monitor to aim and focus sensor.

Results

The meteorological conditions were good for flight safety and infrared surveys. Image clarity was good (Figure 1). Winds were out of the south it was clear of clouds at the start of the survey with increasing clouds as the survey period progressed. It was 39 ^{o} F at the start of the survey. Locations of deer groups were plotted and the total number in each group was tallied. A total of 589 deer were found in 203 deer groups (Appendix A). Deer group size ranged from 1 – 8 individuals.

Figure 1. Infrared image clarity was very good during the FLIR survey by Vision Air Research in the Westport, CT survey area, March 10, 2013.

Detection Potential

Cover type influences the availability of the deer to be detected by the sensor. A dense canopy will make it more difficult to detect the deer since infrared doesn't see through vegetation. Research I've conducted to determine detection rates have been based on known target subjects. One or more individuals in a group had radio collars. The location of the target subject was monitored by a second aircrew in another airplane or via ground based crews to avoid any detection bias. These controls allowed me to determine if the individual or groups were detected, were available to be detected and subsequently missed, or unavailable to be detected because they were no longer in the search area. In areas where no collared animals were available, previously detected animals were used as targets in subsequent replicates. This is similar to a mark – recapture method for determining detection. These efforts have revealed a consistency as to which variables influence detection. The vegetation cover type is the primary variable to confound detection rates. Infrared cannot detect or "see" through a canopy cover. As such, evergreen species can thwart detection. Branches and tree boles can also influence detection based on the size of the animal (Figure 2). Cloud cover can enhance detection. Ambient temperatures do not influence detection unless it changes the subject animals habitat use or behavior. The temperatures during this survey were not unusual and no changes were expected.

Figure 2. The deer can be seen behind in the deciduous canopy of branches in the lower left but the deer in the lower right is more difficult to detect because of more branches.

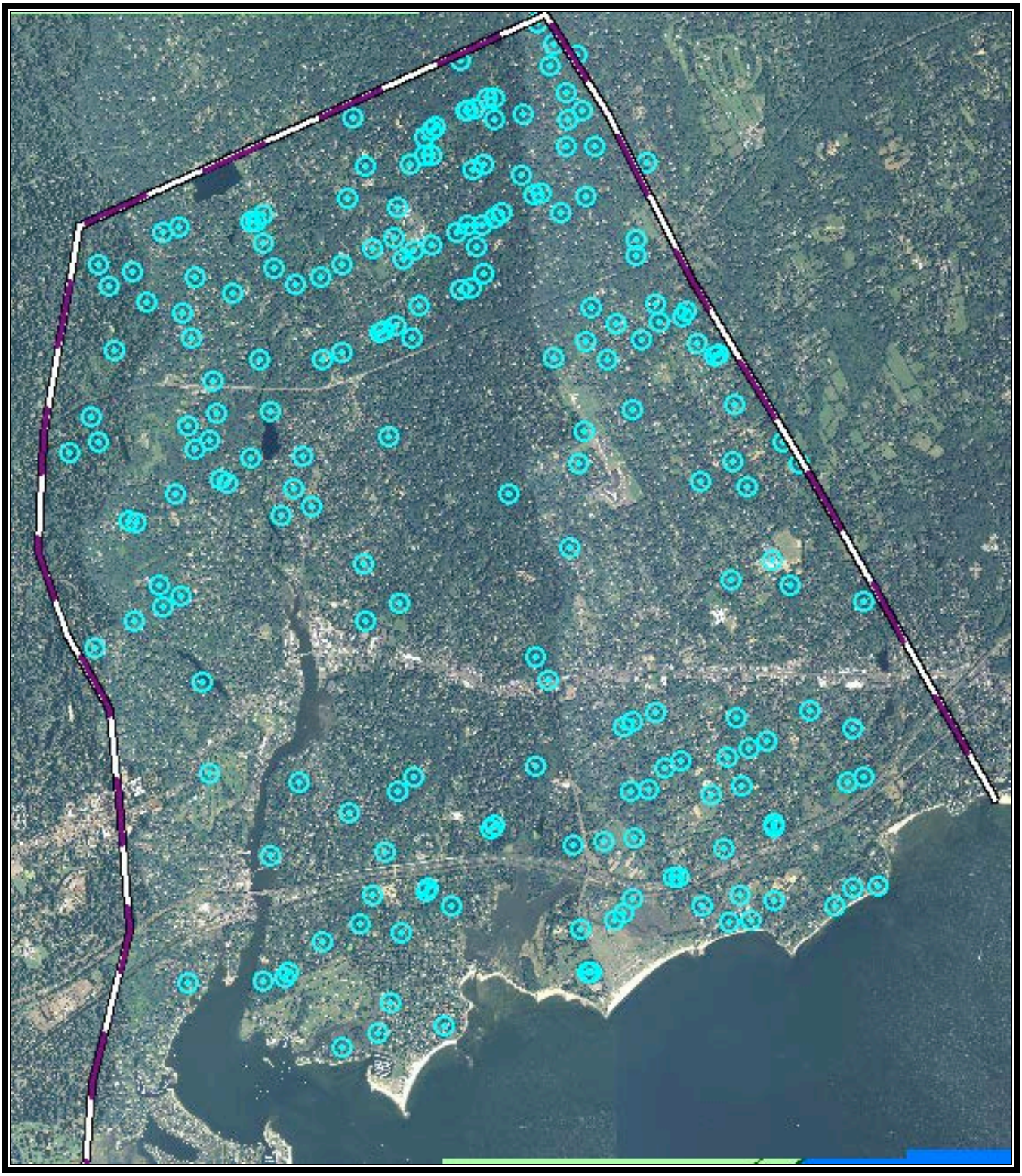
The multiple look angles provided by an oblique angle and the ability to aim and focus increases detection. Video capture instead of still images provides a dynamic view of the landscape.

Detection rates for open areas such as parks and meadow can be 100%, deciduous forests were roughly 86%, and conifer can range from 50 – 80% or less depending on the canopy closure (Figure 3). What was not obvious was the effect of bud break on detection. Although the deer, for example, could be seen visually through tree branches during bud break, the deer can be masked by the energy given off by the bud break. Buds effectively "glow" masking deer behind the canopy. Bud break may have diminished detection under some tree species and shrubs but it did not appear to be widespread during this survey.

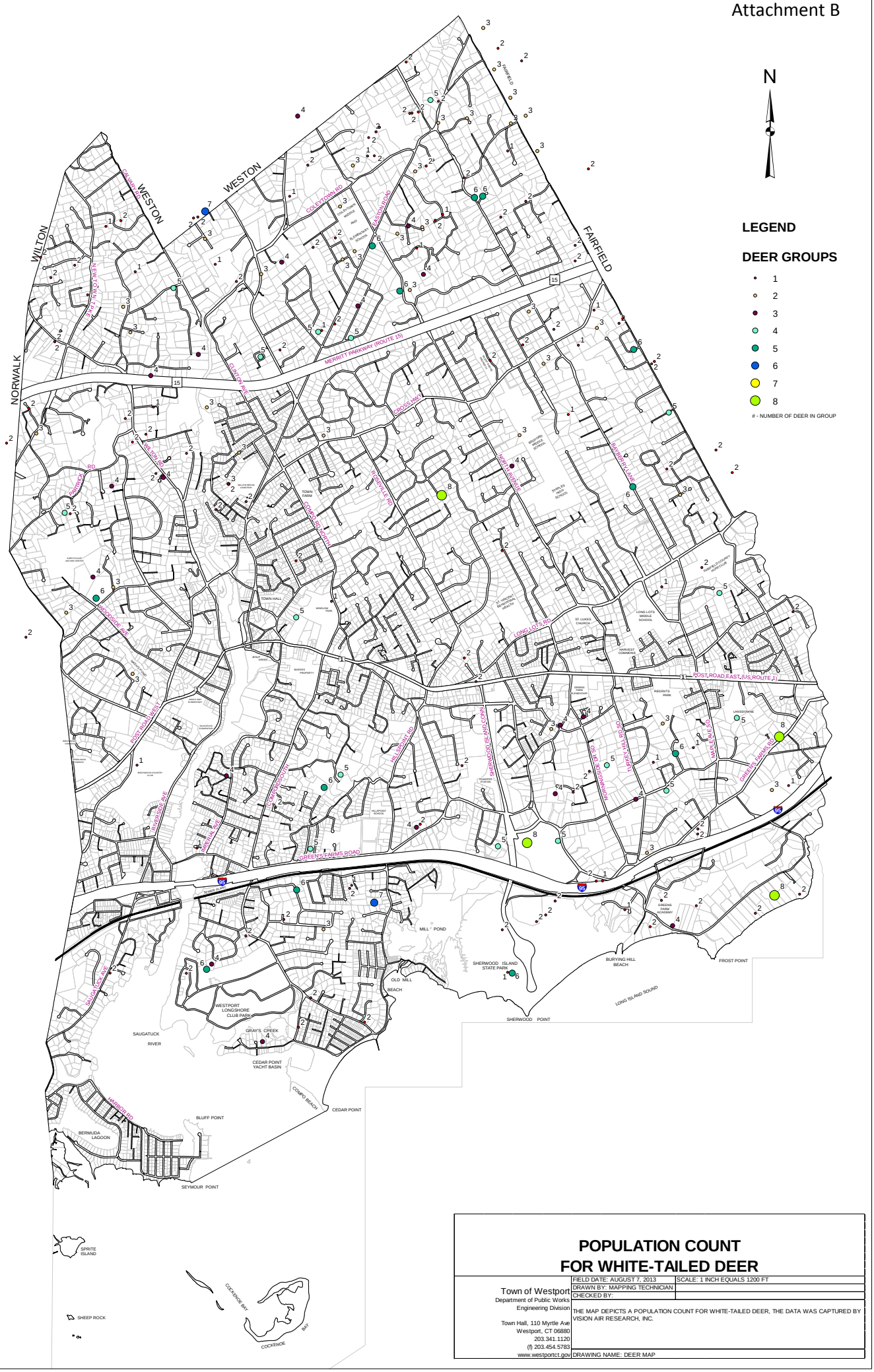
All wildlife surveys are a snapshot in time whether they conducted from the air or ground. This survey can provide a good index or baseline for density and distribution of deer within the community.

Figure 3. The deer in the meadow are easier to see than the deer in the shrubs. There is an additional deer crossing the road.

Appendix A : A total of 580 deer were located in 203 groups within the Westport, CT project area during the aerial infrared deer survey conducted by Vision Air Research on March 10, 2013. Deer groups are shown in blue icons. Deer locations are approximate.



Attachment B



POPULATION COUNT FOR WHITE-TAILED DEER

Town of Westport Department of Public Works Engineering Division Town Hall, 110 Myrtle Ave Westport, CT 06880 203.341.1120 (f) 203.454.5783 www.westportct.gov	FIELD DATE: AUGUST 7, 2013	SCALE: 1 INCH EQUALS 1200 FT
	DRAWN BY: MAPPING TECHNICIAN	
	CHECKED BY:	
	THE MAP DEPICTS A POPULATION COUNT FOR WHITE-TAILED DEER, THE DATA WAS CAPTURED BY VISION AIR RESEARCH, INC.	
	DRAWING NAME: DEER MAP	

Westport Weston Health District

Source: WWHD Website, www.wwhd.org

Westport Weston Health District's Position Statement on Deer Management and Lyme Disease

WWHD Mission:
The mission of the local health district is to preserve the public's health, prevent the spread of disease, promote wellness and enforce state health and local statutes and codes.

Position
WWHD is committed to reducing residents' risk of contracting Lyme disease. Through public education and active surveillance, WWHD strongly believes reduction of Lyme disease in Westport and Weston is possible. The concept of Integrated Pest Management (IPM) is regarded as the best practice by many researchers in the country.

Integrated Pest Management involves the selection and use of several methods to reduce a pest population with expected ecological, economic, and sociologic costs and benefits. The ultimate goal is to reduce the number of human cases of disease as much as possible with the resources available.

WWHD continues to support the concept of Integrated Pest Management in relationship to Lyme disease. The WWHD will continue:

- To provide education to residents regarding Lyme disease, Integrated Pest Management, and Deer Management.
- To work with the local physicians to conduct active surveillance monthly.
- To work with the Connecticut Agricultural Experiment Station, Centers for Disease Control, and the Department of Public Health as test sites for new products/initiatives in an effort to reduce the incidence of Lyme disease in Westport and Weston.
- To review scientific studies relating to deer reduction and human transmission of Lyme disease.
- To review/revise/adopt the WWHD position statement at least annually, or when new research is available on the relationship of deer reduction and human transmission of Lyme disease.

Background/Factual Evidence

- White-footed mice are the primary reservoir for Lyme disease. According to Kirby Stafford, Ph.D., of the Connecticut Agricultural Experiment Station, more than 90% of white-footed mice will be infected with the Lyme disease spirochete in many areas (Stafford, 2007 [pg. 27]).

- White-tailed deer transport female ticks onto one's property. The ticks can lay thousand of eggs, increasing the number of larval ticks available to feed on small animals. Deer are reservoir incompetent; they do not infect feeding ticks with Lyme disease bacteria (Stafford, 2007 [pg. 52]).

- Observational studies and computer models suggest that a reduction of deer densities to less than ten to twelve deer per square mile could decrease the tick population to a level that would reduce the burden of Lyme disease in a community (Stafford, March 10, 2008).

- It is noted by Dr. Stafford that in the absence of deer, adult ticks will also feed on other medium sized animal hosts such as opossums, raccoons, coyotes, and skunks. Ticks may continue to be introduced into an area on migrating birds, even with the complete removal of deer. It is doubtful that I. scapularis can be maintained in significant numbers just from feeding on these medium-sized alternate animal hosts (Stafford, 2007 [pg. 56]).

- Deer management options recommended by experts include deer fencing, deer repellents, deer resistant landscape planting, and removal of deer.

It is still unclear whether the recommended thresholds for deer reduction can be sustained, and what the cost to the community(ies) would be. Therefore, until such time when this information can be provided, the Westport Weston Health District will continue to support Integrated Pest Management as the best option for reducing Lyme disease in Westport and Weston.

Adopted by the Westport Weston Health District Board of Directors on September 8, 2008

Attachment D: Deer Repellant Product Comparison. CT Ag Station Research

CT Ag Station Deer Repellant Comparison Study:

PRODUCT	Efficacy (%)	Frequency of Application in study
Control	49	N/A
Repellex	50	yearly
Deer Solution	52	every 100 days
Coyote urine	53	after rain
Plantskydd	60	every 6 months
Deer-Off	65	every 2-3 months
Big Game	72	every 2 months
Chew-Not	74	yearly
Liquid Fence	78	1 week, then monthly
Hinder	83	every 10-14 days
Bobbex	93	every 10-14 days
Physical fence	100	N/A

Attachment E: Defensive Driving Tips to Avoid Hitting a Deer

Source: Insurance Information Institute

1. Be especially attentive from sunset to midnight and during the hours shortly before and after sunrise. These are the highest risk times for deer-vehicle collisions.
2. Drive with caution when moving through deer-crossing zones, in areas known to have a large deer population and in areas where roads divide agricultural fields from forestland. Deer seldom run alone. If you see one deer, others may be nearby.
3. When driving at night, use high beam headlights when there is no oncoming traffic. The high beams will better illuminate the eyes of deer on or near the roadway.
4. Slow down and blow your horn with one long blast to frighten the deer away.
5. Brake firmly when you notice a deer in or near your path, but stay in your lane. Many serious crashes occur when drivers swerve to avoid a deer and hit another vehicle or lose control of their cars.
6. Always wear your seat belt. Most people injured in car/deer crashes were not wearing their seat belt.
7. Do not rely on devices such as deer whistles, deer fences and reflectors to deter deer. These devices have not been proven to reduce deer-vehicle collisions.

If your vehicle strikes a deer, do not touch the animal. A frightened and wounded deer can hurt you or further injure itself. The best procedure is to get your car off the road, if possible, and call the police.

Tufts UNIVERSITY | Cummings School of Veterinary Medicine

FACT SHEET: DEER IMMUNOCONTRACEPTION

Dr. Allen Rutberg, Center for Animals and Public Policy

How Immunocontraception Works

Immunocontraceptive vaccines activate the immune system to block a crucial aspect of reproduction. The porcine zona pellucida (PZP) vaccine causes female deer to produce antibodies that bind to the protein envelope surrounding the egg, blocking fertilization. ***PZP is NOT a hormone and does not affect other body processes.***

History of PZP Field Research

PZP was first recognized as an effective contraceptive in the 1970's. Since we first began treating deer on Fire Island, New York, in 1993, nearly 2000 deer have been treated at field sites in seven states. ***The effects of PZP on deer and other animals are very well known.***

Effectiveness

Treatment of white-tailed deer with PZP typically reduces pregnancy rates by 80-90%. PZP can be delivered by hand or remotely, by dart. Using current technology, ***a single hand-injection of PZP prevents pregnancy for at least 2 years.***

Side Effects and Safety

PZP is a naturally occurring protein that must be injected to be effective. ***If eaten, PZP is broken down like any other protein.*** In deer, the only known side effect of PZP treatment is extension of the mating season; there is no evidence that this causes any harm.

Population Control

Suburban deer populations have been stabilized and modestly reduced (20-50%) at three field sites. Typically, population stabilization is rapid, but population reduction is gradual (5-10% per year). All three sites are semi-isolated by geography or development, but deer move on and off all of them. ***Population effects of contraception are site-specific.***

Deer-Vehicle Collisions

Data from the Maryland site show that the number of deer-vehicle collisions goes down as deer population size goes down. ***PZP treatments do not increase deer-vehicle collisions.***

Cost and Effort

At Fripp Island, SC, the cost of initial capture and treatment of deer with 2-year vaccine was approximately $500/deer; dart-delivered annual boosters cost $100/deer. Achieving rapid population stabilization and slow decline for about 300 deer would require approximately ***$40,000 for both the first and second years***, and lower amounts after.

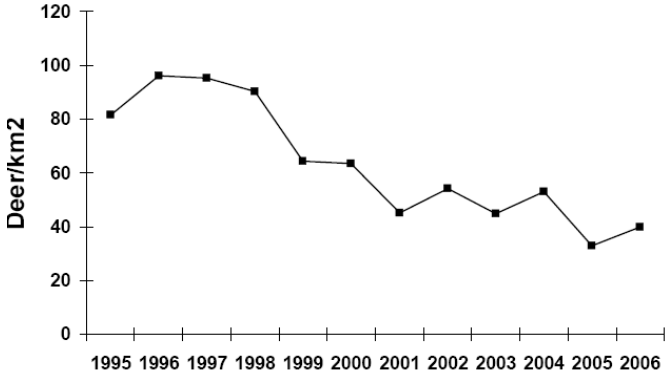
Regulatory Status

Use of PZP on deer must be approved by the NYSDEC. Federally, the EPA and FDA share jurisdiction over wildlife contraceptives. Historically, we have conducted our research under FDA authorization. However, ***in September 2009, HSUS filed an EPA registration application for use of PZP in wild horses***; deer studies will soon shift to EPA as well.

Contact Information: allen.rutberg@tufts.edu

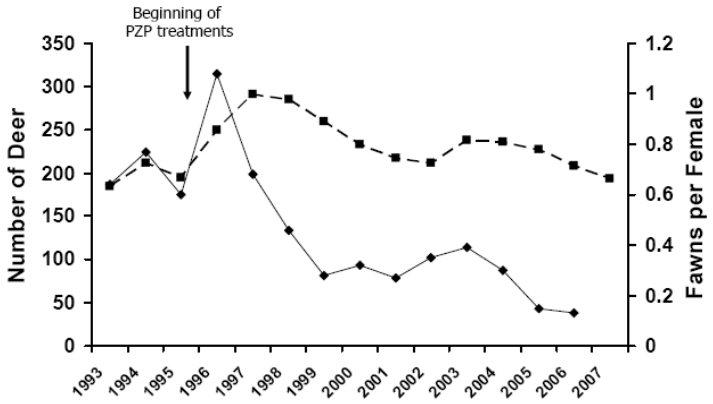
January, 2010

Fire Island National Seashore, 1995-2006



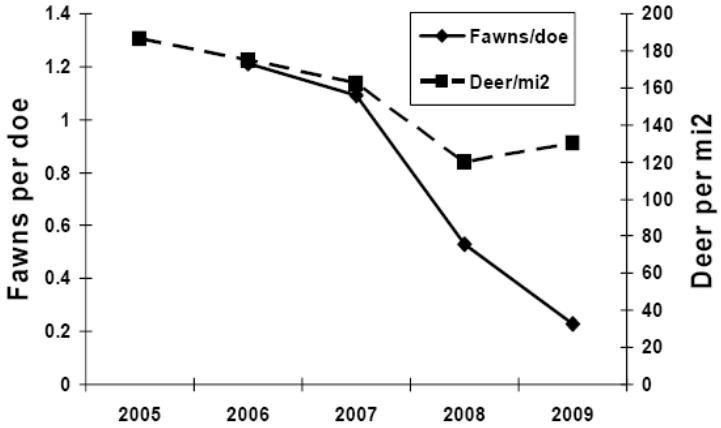
From Rutberg & Naugle 2009

National Institute of Standards and Technology, MD, 1993-2008



From Rutberg & Naugle 2009

Fripp Island, SC, 2005-2009



From 2009 Progress Report to SCDNR

Contact Information: allen.rutberg@tufts.edu
January, 2010

Some Per-deer Cost Estimates from PZP Study Sites
January, 2010

Fire Island National Seashore, NY

- Deer are highly accessible.
- Individuals have never been captured and are not ear-tagged or individually recognized.
- Deer are treated annually by dart with simple emulsions of PZP/adjuvant.
- Marking darts are used to determine which individuals have been treated.

Costs per treatment exclusive of labor: $64
Person-hours labor per deer: 1.0 hrs.
Labor costs/deer @ $15/hour $15
Total estimated treatment cost: $79 per deer

National Institute of Standards and Technology, MD

- Deer are moderately accessible.
- Individuals are initially captured, ear-tagged, and hand-treated with simple emulsions of PZP and adjuvant.
- Subsequently, they are treated annually by dart with simple emulsions of PZP/adjuvant.

Cost of initial capture and treatment exclusive of labor: $160
Person-hours labor to capture, eartag, and treat deer: 6.7 hrs
Labor costs/deer captured @ $15/hour: $101
Total estimated cost of initial capture and treatment: $261 per deer

Costs of booster delivery exclusive of labor: $58
Person-hours labor per deer: 2.0 hrs
Labor costs/deer @ $15/hour: $30
Total estimated cost of annual re-treatment: $88 per deer

Fripp Island, SC

- Deer are highly accessible.
- Individuals are initially captured, ear-tagged, and hand-treated with timed-release two-year vaccine.
- After two to three years, they are re-treated by dart with simple emulsions of PZP/adjuvant.

Cost of initial capture and treatment exclusive of labor: $390
Person-hours labor to capture, eartag, and treat deer: 8.2
Labor costs/deer captured @ $15/hour: $123/deer
Total estimated cost of initial capture and treatment: $513 per deer

Costs of booster delivery exclusive of labor: $58
Person-hours labor per deer: 3.0
Labor costs/deer @ $15/hour: $45
Total estimated re-treatment cost: $103 per deer

Contact Information: allen.rutberg@tufts.edu

Starting New Deer Projects

Dr. Allen Rutberg
Tufts-Cummings School of Veterinary Medicine,
North Grafton, MA
July 2012

Initial Contact

Off-site assessment

Site visits

Project development

Project implementation

How deer contraception projects start: Initial contact and evaluation

- Who's asking?
  - Must have interest of local official in authority.
- Preliminary investigation (remote)
  - Is there a real deer problem?
  - Biological feasibility: site characteristics, deer accessibility
  - Political feasibility: stage of decision making, likely public support, state/federal agency response
  - Possible funding sources

How deer contraception projects start: Site visit

- Biological/logistical project feasibility
  - Are deer accessible?
  - Can they be captured/darted safely?
  - Can we get land access?
  - How are adjacent lands being managed?
  - What proportion of deer are likely to be resident?
- Political & fiscal feasibility
  - Public talks, meetings with community leaders, potential funders, initial contacts with state agency

Building the project

- Design the project
- Identify and train field personnel and other collaborators
- Write proposals
  - State/federal agency (research permits)
  - Local community & funders
  - Institutional Animal Care & Use Committee (AWA compliance)
  - Federal regulatory compliance (EPA experimental use permit)

Implementing the project

- Secure permits and permissions
- Purchase equipment, supplies, and vaccine
- Schedule field work, including lodging and vehicles (if needed)
- Conduct additional field training of new personnel

Attachment H: Cost Estimates of Deployment of 4-Poster Stations in Westport

Please note that the Committee is not recommending this method, but the information may be useful to the Town in the future.

Source: E-mail and personal communication by Linda McCracken with Andy Szulinski on Oct. 11, 2013.[a]

It was a pleasure speaking with you this morning. The project that you are contemplating is one that is very worthwhile and will need some good planning and execution.

Please feel free to call if you have any questions regarding the quote or the deployment of the units.

As per our conversation I am quoting 3 scenarios. A deployment of the following possible quantities of systems:
25 each 4-Posters, 140 each 4-Posters, and 280 each 4-Posters,

To start, my suggestion is to consider the 25 and 140 quantities. I think that if you are using the 280 figure to account for covering 50 acres per unit, you might be overbuying possibly. I can't guarantee that, but my experience has shown is to start slow, get used to the product and then expand. My completely uneducated guess, without seeing the layout of the land, actual acreage etc. is that you will eventually probably require a quantity slightly more than the 140. If you look at the 25 quantity as a down payment on the system- get acquainted with it and comfortable, and then the 140 as the big rollout, you might have the ideal total number, if not, it will probably be very close. If you should need extra units, that can always be taken care of after the fact.

Each of the 3 quotes will be in two parts. The first part is for the deployment of the systems, which includes the 4-Poster units and all permanent necessary accessories. The second part is the annual purchase, which for the first year is purchased at the same time, but then repeats annually.

25 unit deployment

25 each item# 441140 - 4-Poster Base unit - $449 each (Volume discounted from $499) line total-$11,225
4 each item# 44145 - 12 pack of warning signs -(2 signs per unit) $38 each - line total- $152
2 each item# 441135 - Applicator Gun (used to apply Tickicide to rollers) $125 each - line total $250
25 each item #441155 - Spring Post Upgrade (highly recommended-cuts down maintenance)$28-line total $700
Total onetime cost - $12,327 plus any applicable state sales taxes and freight

Annual items: (need to be purchased at time of base order shipping, then annually)
25 each item #441140 - 12 Pack applicator rollers - $40 each - line total $1,000
25 each item #441130 - Gallon of Tickicide - $185 each - line total $4,625 *
Total Annual Cost - $5,625
* The Gallon of Tickicide per unit per year is an estimate. Given your geographic area, my guess is that a gallon may last more than 1 year, maybe 1.5 years, so that re-purchase may be a little staggered.
The rollers, more than likely will be an annual purchase, as they will wear.

Given all the above explanations, the 140 and 280 quotes will list items and dollars and not repeat all the extra information.

---

[a] Prices do not include the cost of bait, which must be clean whole kernel corn (once washed is acceptable) at 1 ½ pounds per day for each deer visiting the station. Cost of set-up and maintenance not included; once acclimated to job, maintenance time spent is 15 minutes per week for each station, assuming each station is accessible via vehicle.

140 unit deployment

140 each item #441140 -4-Poster Base unit - $449 each - line total $62,860
24 each item #44145 -12 pack warning signs - $38 each - line item $912
6 each item #441135 - Applicator Gun - $125 each - line total $750
140 each item #441153 - Spring Post Upgrade -$28 each - line total $3,920
Total onetime cost - $68,442

Annual Items:
140 each item # 441140 - 12 pack rollers - $40 each - line total $5,600
140 each item # 441130 - Gallon Tickicide - $185 each - line total $25,900
Total Annual cost - $31,500

280 unit deployment

280 each item #441140 - 4-Poster Base unit - $449 - line total $125,720
48 each item #441145 - 12 pack warning signs - $38 each - line total $1,824
12 each item #441135 - Applicator Gun - $125 each - line total $1,500
280 each item #441153 - Spring Post Upgrade - $28 each - line total $7,840
Total onetime cost - $136,884

Annual Items:
280 each item #44140 - 12 pack rollers - $40 each - line total $11,200
280 each item #441130 - Gallon Tickicide - $185 each - line total $51,800
Total Annual cost: $63,000

Additional Information

Units are priced to sell unassembled. Listed charge for assembly by factory is $50 each. We will waive the assemble cost for an order this size. This helps you 2 ways.
1. No need to read directions, spend 40 minutes assembling and wondering if you got it right.
2. You can deploy the units the day you receive them.

Freight on orders of any of the above quantities is by truck. The 25 quantity would ship by over the road LTL carriers. For the 140 and 280 quantities would ship via dedicated trucks (the only load on the truck would be yours) Freight rates would be quoted at time of placing order, since rates these days are pretty fluid, moving up and down during the year - affected mostly by fuel surcharges that fluctuate with the market.

All orders are manufactured to order, so lead times are necessary to complete the manufacturing process. Accurate lead times can be provided at time of order. Order quantity and manufacturing production backlogs affect lead times.

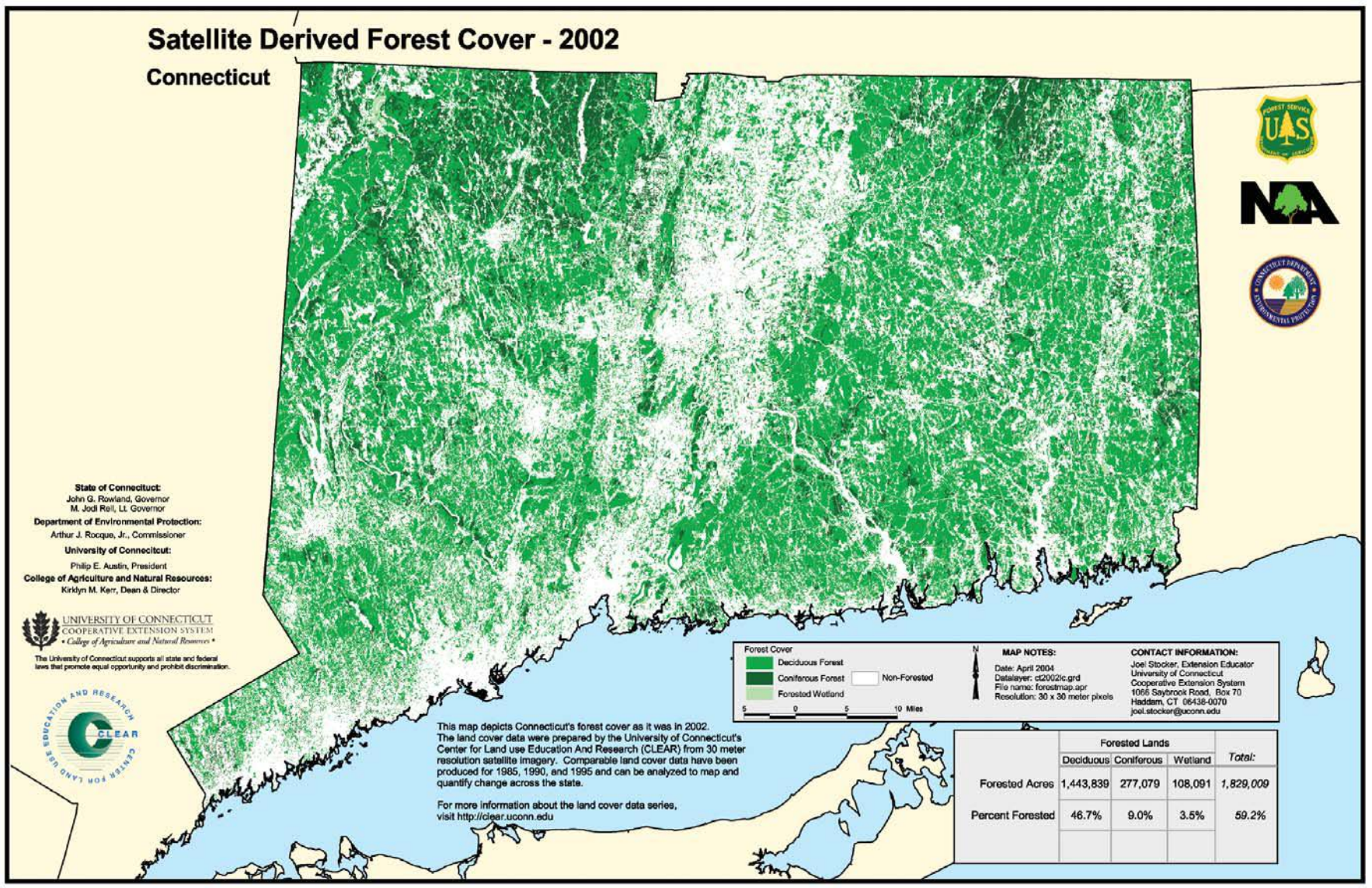
Terms are net 30 with approved credit.

Thank you for this opportunity. Again, if you have any questions, please feel free to call me.

Best regards,
Andy Szulinski, Vice-President
Dandux Outdoors
C.R. Daniels, Inc.
3451 Ellicott Center Drive
Ellicott City, MD 21043
800-933-2638 ext

Source: CT DEEP Web Site

Attachment I: State of CT Satellite Derived Forest Map



	Forested Lands			Total:
	Deciduous	Coniferous	Wetland	
Forested Acres	1,443,839	277,079	108,091	1,829,009
Percent Forested	46.7%	9.0%	3.5%	59.2%

Lyme Research Alliance Curriculum / DVD / Information Order Form

Curriculum - A curriculum about tick-borne diseases for grades K, 3, 6 and 9 with age appropriate goals, activities and measurable guidelines. The curriculum covers tick awareness, prevention tips, proper tick removal, and the signs and symptoms of Lyme disease. The curriculum is designed for use in elementary school (grades K and 3), middle school (grade 6) and high school (grade 9). The K and 3rd grade programs focus on what ticks look like, where they live, and what to do if you find a tick, with activities designed to ensure understanding of the program. The 6th grade program introduces more sophisticated concepts of prevention, presented in both print materials and a 22 minute DVD. The 9th grade program adds a discussion of the psychological, emotional and social ramifications of Lyme disease, best described in the words of the high school students through a 20 minute DVD, specifically designed to address this complex issue. Our hope is that education will prevent Lyme disease in those who are well, and promote empathy, understanding and compassion for those who are struggling to overcome their illness.

Diagnostic Dilemma DVD- An effective tool to help recognize Lyme and other tick-borne diseases that are prevalent in your community. Learn about the difficulty in diagnosing Lyme disease from a nationally recognized group of experts, featuring Richard Horowitz, MD, former Assistant Director of Medicine, Vassar Brothers Hospital and Brian Fallon, MD, MPH Assistant Professor Department of Psychiatry, Columbia University College of Physicians and Surgeons, Director of Columbia Lyme Disease Research Center.

Information Packet- A general packet of information about Lyme disease symptoms, diagnosis and prevention as well as sources for further information.

ITEM	PRICE	QUANTITY	TOTAL
Curriculum Package	**$60**	_____	_____
Diagnostic Dilemma DVD	**$20**	_____	_____
Information Packet	**$ 0**	_____	_____0____
Tax-Deductible Donation for Lyme Disease Education & Research			_____
TOTAL PAYMENT ENCLOSED			_____

Please Print Delivery Address:

Name: _____

Address: _____

E-mail Address: _____

Phone Number: _____May we add you to our mailing list? Yes____ No ____

Payment Method: Personal Check or Credit Card (Visa / Master Card / Amex Accepted)

My check for $_____ is enclosed. (Please make check payable to ***Lyme Research Alliance, Inc*.)**

Please charge $_____Card #_____Exp. Date_____

_____

Authorized Signature

Lyme Research Alliance, Inc. (Affiliate of the Lyme Disease Association, Inc)
A 501(c)3 Charitable Organization, Tax ID# 06-1559393
2001 West Main Street Suite,280
Stamford, CT 06902, (203) 969-1333

LUNCH 'N LEARN TALK
LYME TALKS: WHAT YOU NEED TO KNOW ABOUT LYME DISEASE
(and associated tick-borne diseases)
Time: 50 minutes including 10 min. Q&A

LRA's Lunch 'n Learn talk What You Need to Know About Lyme Disease informs attendees about:

- What Lyme disease is and why it can be a major health problem
- How Lyme disease is transmitted
- Where ticks are found, geographically and types of terrain and foliage
- The impact of co-infections: babesiosis, anaplasmosis, Powassan
- How to recognize Lyme disease symptoms and symptoms of co-infection
- What to do if you get a tick bite
- Diagnostic procedures; what you need to know about testing
- Prevention: How to avoid ticks and prevent tick bites
- What homeowners can do to lessen exposure on your property
- Clothing, sprays and repellents

Lyme disease is a huge and growing problem, especially in the Northeast. The Centers for Disease Control recently raised their official estimate of new cases from 30,000 to 300,000 annually, 90% of which are concentrated in the Northeast and Upper Midwest. Not only is the geographic footprint of the disease increasing but a growing number of the Lyme-transmitting deer ticks now carry at least one additional pathogen and can transmit such diseases as anaplasmosis, babesiosis and the potentially deadly Powassan virus in addition to Lyme disease.

Although newly contracted Lyme disease cases usually respond to a 4 week course of antibiotics, when left untreated, Lyme can become an incurable and severely debilitating long-term disease. So the stakes are high, especially for suburban families and those who love the outdoors.

The good news is that tick-borne diseases are largely preventable. Most cases of Lyme are contracted on the home property and there are many steps that can be taken to prevent tick bites and simple steps to take immediately following a tick bite to prevent the onset of Lyme disease.

For more information or to schedule a talk,
Email: Info@LymeResearchAlliance.org

Lyme Talks are presented by Lyme Research Alliance
as a service to the community