FINAL REPORT

Project type: Implementation

Title: Asian Tiger Mosquito and Tick Awareness Workshops

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Abstract: Ticks and mosquitoes are a chronic concern on Long Island. A tick taskforce has been mandated by Suffolk County and although various entities address tick and mosquito issues there are mixed messages and misinformation (e.g., "chiggers", "lavender fabric softener sheets as repellents") presented by other educational entities. In an effort to standardize and streamline information into a meaningful tool for the general public that will also empower them to be able to remediate tick and mosquito issues as well as become educated about them, this project produced the following deliverables. Twenty 1 hour, free workshops, on Asian Tiger Mosquito and Tick Awareness, were given at libraries in Suffolk County, Suffolk County owned or managed facilities, and schools. The workshop emphasized identification, awareness, personal protection and management without pesticides at home and at work. An educational wheel was developed for citizens to be able to rapidly determine which mosquitoes were the ones troubling them at a specific location and how they could personally remediate the issue. A checklist protocol for monitoring and remediating mosquitoes was developed, one for mosquitoes in general and another specific to Asian tiger mosquitoes. The same was developed for ticks. Recognizing harborage and breeding areas was emphasized including structural deficits and landscape features. Participants were taught how to construct and use a tick checking device (flag). A fact sheet was developed on the expanding problem of mammalian meat allergy potentially induced by exposure to Lonestar tick saliva (alphagal syndrome). A visual aid in the form of giant photo boards of ticks and their lifestages were used to excellent effect during workshops. The most important outcome of the project was the development of a Long Island and metropolitan area targeted phone app for ticks including identification, disease potentials, removal, remediation, and the common myths associated with "chiggers" and with ticks in general.

Background and Justification:
MOSQUITOES
Due to our dense population and the anthropomorphic junk that accumulates standing water, plus our natural setting on LI which is rife with salt marsh and fresh water wetlands, mosquito control is an issue that will never go away. To add to this perennial problem, superstorm Sandy created both natural and structural havoc which continues to provide new locations for breeding and for the spread of Asian Tiger Mosquito (Aedes albopictus) in particular. The seven other most common nuisance mosquitoes on Long Island are Ochlerotatus canadensis, O. cantator, O. sollicitans, O. trivittatus, O. vexans, Coquilletidia perturbans, and Culex pipiens-restuans (Dr. Scott Campbell, personal communication). Ochlerotatus mosquitoes were formerly placed in the genus Aedes. Stake holders need to recognize all of these mosquitoes and how to remediate them but most importantly they need to learn about the threat of Asian Tiger Mosquitoes and their habitat and habit differences from the rest of those commonly encountered.

Asian tiger mosquitoes (Aedes albopictus) are quickly displacing other mosquitoes as a result of superior larval competition for resources. Asian tiger mosquitoes (ATM) have benefitted from recent changes in weather patterns and are already present on Long Island in high numbers. The greatest concern for the future is their vector competency for the Chikungunya virus. While this

virus is rarely fatal it is extremely debilitating for about 10 days and has already reached epidemic proportions in Central America and the Carribean. Asian tiger mosquitoes (ATMs) are much more aggressive biters than the traditional host for the virus, Ades aegyptii, which is not found on Long Island. The superior vector capability of ATMs plus their growing status as the number one breeding and biting mosquito for residential and commercial locations makes it imperative that education on identification of and source reduction of ATMs is administered in a meaningful way.

TICKS

The tick problem, promulgated by a catastrophically expanding and increasing deer population, dense human habitation, and rodent harborage all of which bring people into contact with ticks has reached a crisis level on Long Island, particularly on the East End. Reacting to the public outcry over ticks and tick borne diseases in Suffolk County, the County Legislature passed Suffolk County Resolution 689. The Suffolk County Tick and Vector-Borne Diseases Task Force was created in 2012 and then extended into 2014 to study the spread of tick and vector-borne related diseases and to develop a comprehensive needs assessment. Their report is due this month (Dec 2014). There remains a fundamental disconnect between the knowledge of the public, the medical profession, and established facts and research about ticks and tick borne diseases to the point that panic fueled over and misapplications of pesticides for tick control has become routine.

As part of the conversation we heard at our workshops, many, especially on the east end of Long Island, are paying for a service to spray their private properties as often as weekly to keep the ticks at bay. Many of these properties are near waterways, estuaries and wetlands. When asked, "what products are they spraying?", most did not even know. This means that there may be risks associated with repeated pesticide treatments that they do not know. What surveillance techniques does the company provide, or are they spraying without even checking? What products are being used, over and over again, and how much of this ends up as run off or leachate in surrounding environments? These are issues that will not go away without education, and when panic prevails over tick and tick borne disease exposure to pets and children it is difficult to get stake holders to ask questions first and spray later, if at all.

Two of the most common misconceptions is that all ticks carry disease and that they will always transmit this disease. Another is that the larval stage of the lonestar tick is instead a totally separate larval stage of the harvest mite *Trombicula alfreduggesi,* also known as a "chigger". Although no positive identifications have been made during extensive scouting (all samples so far over the years have been larval lonestar ticks) the medical profession as well as many others continue to attribute bites to "chiggers". Multiple bites from lonestar ticks additionally are being suggested as a cause for a new syndrome called "alphagal" which renders certain individuals allergic to mammalian meats and in extreme cases dairy and gelatin products.

Most of the education previously provided has concentrated on the deer tick *(Ixodes scapularis)* and 'Lyme' disease. Most individuals are also unaware of the dangers of Babesiosis, a protozoal disease that does not respond to the standard antibiotic treatments prescribed for Lyme disease. There is an additional locally diagnosed threat from Borrelia miyamotoi. This disease has only recently received attention from the CDC and while not believed to be a severe or common disease, still has had little work done on its epidemiology or long term health impact.

Lone star ticks *(Amblyomma americanum)* ticks have supplanted the deer tick on Long Island in terms of sheer numbers. The lone star tick is incapable of transmitting the bacterium *(Borrelia burgdorferi)* that causes Lyme disease. They are, however, capable of transmitting other diseases

(e.g. ehrlichiosis) with similar symptoms. The potential for encountering lonestar ticks is the greatest among the three common ticks species (deer, dog, lonestar) on Long Island.

Objectives:

1. Develop an educational wheel for detrmining the presence of ATM and other mosquitoes and their breeding habitats based on observation of local site conditions. This tool can also be shared with other stakeholders.
2. Develop and distribute a protocol for monitoring and remediating risk properties with respect to mosquitoes and ticks, such as recognizing potential breeding sites, structural deficits or landscape features that will become harborage or breeding areas, etc.
3. Develop an educational workshop component that can be conducted on a wide basis that will elevate awareness of the ATM and tick problem and teach users how manage source reduction on their own properties and at work.
4. Develop a 'Tick Click' app for use on smart phones, which will allow the user to be able to work through a key for identification and description of three common species of ticks as well as their life stages and potential to transmit disease/ allergy. Ours will focus on for Long Island and the Metro/Hudson Valley region and on Lone Star ticks and issues. Others concentrate on deer ticks, Lyme disease or southern tick populations, or have ticks mixed in with other features. Below find a list of already available apps: http://americannewsreport.com/sos-poison-smartphone-app-is-ready-to-save-lives-887725: iPhones and androids, http://tickapp.tamu.edu/opening.php, androids and iPhones (for southern ticks), https://play.google.com/store/apps/details?id=edu.ncsu.TickID, android phones only, and a lyme disease app from Yale http://news.yale.edu/2010/05/03/lyme-disease-app-iphone-developed-yale-school-public-health for iPhone and androids. From the Lyme disease foundation: http://www.aldf.com/ALDF_iPhone_Application.shtml has a tick removal app.
5. Project evaluation through a visual quiz of ten questions submitted at the beginning of the workshop with answers tracked by the "I-Clicker" method, and then the same ten questions at the end of the workshop with answers tracked by the "I-Clicker" method.

Procedures: Part I, Asian Tiger Mosquito

1. A cardboard wheel of "MIS Fortune" (MIS stands for Mosquito Information Sentinel) was developed where the user dials to the habitat they have spotted, e.g, puddle, tree hole, blocked gutter, etc and the next step shows them which mosquitoes are likely to use this habitat and how to remediate. A web version will be added to the Suffolk County Cornell Cooperative Extension website for stakeholders to download. The wheel is simple to use and is predicated on three simple observations: whether the mosquito that has bitten you has striped legs, a blunt or pointed abdomen, and the time of day you were bitten. SEE WHEEL IN ATTACHED DIGITAL pdf FILES "cutoutmiswheel" for assemled wheel, "miswheelnotcut out" for preassembly. The wheel was printed on stiff cardstock, and a hard copy mailed to go with this report. To try the hard copy of the wheel without a mosquito in hand, see attached digital powerpoint "giant tick identification boards" slide two. This mosquito would have bitten you at night.
1. 2.A more extensive written protocol for monitoring for breeding sites was developed and distributed to be used on a walk through of the property using a checkoff list/factsheet for problem sites and potential remediation. SEE DIGITAL FILES IN WORD atmfactsheet, skeeterchecklist, skeeter check list, and Asian tiger mosq checklist
2. A 30 minute portion of an educational workshop with a checkoff list/factsheet was developed for recognizing and reducing potential problems with ATM. This factsheet will be geared to wide distribution and have educational merit and appeal for a very

diverse audience. Sheets will be numbered to keep track of distribution. SEE DIGITAL FILES IN WORD atmfactsheet, and Asian tiger mosq checklist

3. Evaluation was by pre- and post-workshop power point quiz, where five questions were on ATM and mosquitoes. Answers were recorded by "I-Clicker" for pre- and post-workshop quizzes. The raw results were saved and compiled. The numbers of right versus wrong answers for pre- and post- workshop quizzes were compiled, and compared as a percentage comparison over all 20 workshops to determine efficacy of education. SEE DIGITAL FILES IN WORD Mosquito question one results graph, Mosquito question two results graph, Mosquito question three results graph, Mosquito question four results graph, Mosquito question five results graph.

Procedures: Part II, Ticks

The 'tIck cLick' app was developed so that people can easily and simply identify ticks using I-phone technology. The app concentrated on ticks on Long Island, and the information contained in it was the focus of the tick portion of the workshop as well. The user should be able to work through the app for identification and description of three common species of ticks as well as their life stages and potential to transmit disease/ allergy

From any of the tick types, users can then go to protecting themselves, safe tick removal, tick borne disease, protecting pets, looking for and reducing ticks in the landscape, top tick myths, precautions, gear, repellents, clothing, and constructing a tick checking device.

Users can contact Cornell Cooperative Extension directly from the app which includes profiles for two individual contacts, the main facebook site for Cornell Cooperative Extension of Suffolk County and a physical address with a map.

Numbers of users of the app can be quantified from the app maintenance site which also allows us to send updates and events directly to users such as workshops, and has the capability for RSS feed. The grant budget has allowed us to pre-pay for the app for three years before any more maintenance fees are needed.

APP ADDRESS: THE APP ONCE APPROVED & LIVE WILL BE AVAILABLE ON ITUNES STORE FOR APPLE PRODUCTS & GOOGLE PLAY STORE FOR ANDROID PRODUCTS

2. A more extensive written protocol for monitoring for ticks on properties was developed and distributed to be used on a walk through of the property with the checkoff list/factsheet for problem sites and potential remediation. Sheets were numbered to keep track of distribution. SEE DIGITAL FILES: pdf tickwise scan, word tick check list

3. A 30 minute portion of an educational workshop with a factsheet/checkoff was developed. Work shop and fact sheets covered tick awareness, species and life stage identification, disease and allergy transmission, personal protection (including a review of proper use of repellents and awareness of EPA website sourced below), using non-toxic tools to kill ticks, and how to remove ticks already attached. Landscaping to deter ticks and their animal hosts were covered. Emphasis was on identifying larval ticks, versus the misconception of chiggers. A UNIQUE component of this workshop was the use of "giant" tick sandwich boards (actual pictures at least three feet tall, front and back, printed and laminated individually onto plastic poster board) which was extremely successful as a gimmick in helping people to better recognize and identify types and lifestages and as a talking point for participants. SEE ATTACHED POWERPOINT Giant Tick Identification Boards. We additionally used the visual device of a shadow box of masking tape

with larval ticks en masse, and home made riker mounts with different ticks and their life stages on cotton cosmetic pads so that each participant could observe the actual size during the workshops. This was also very effective (see slides in DIGITAL POWERPOINT Giant Tick Boards).

Rate your repellent for ticks and mosquitoes http://www2.epa.gov/insect-repellents/find-insect-repellent-right-you go to bottom of page and click on export the enitre insect repellent dataset to pdf format

4. Evaluation was by pre- and post-workshop power point quiz, where five questions were on ticks and tick biology. Answers were recorded by "I-Clicker" for pre- and post- workshop quizzes. The raw results were saved and compiled. The numbers of right versus wrong answers for pre- and post- workshop quizzes were compiled, and compared as a percentage comparison over all 20 workshops to determine efficacy of education. SEE DIGITAL FILES IN WORD Tick question one results graph, Tick question two results graph, Tick question three results graph, Tick question four results graph, Tick question five results graph.

Results and Discussion

MOSQUITOES

Expected Outcomes/Impacts: At the conclusion of this project we expected participants would have a much better picture of ATM biology and breeding habititat as well as things they can personally do to reduce mosquito populations. During the mosquito portion of the workshop we covered the biology and habits of the Asian Tiger Mosquito as well as tips for control. We also covered the biology and habits of the other seven most common nuisance mosquitoes, as well as repellents including emphasis on rating repellents as listed in the EPA website referenced earlier. We addressed mosquito myths, and control devices that do not work, e.g., zappers, hidden contributing factors to problems, e.g., outdoor lights. The majority of points in the workshop are addressed on the resources developed: The mosquito identification wheel, ATM factsheet, common mosquitoes of Long Island factsheet/checklist, mosquito checklist which involves the stakeholder by making them go back after they have remediated to identify whether the remediation has had any effects and gives them a record of location and date so that they can go back to those spots at different times in the future, and the Asian tiger mosquito checklist which has enough of a dissimilarity with the other resources so that stake holders will be encouraged to use it separately. This also has stake holder involvement via the permanent recording of date and location plus evaluation of whether the remediations had any positive effects.

The results of the I-clicker evaluation were as follows:

1. Bug zappers are a reliable and efficient method for adult mosquito control DIGITAL FILE Mosquito question one results graph: correct answer increased by about 20% from pre 72% to post workshop 92%. There was also a 5% increase in participants answering that zappers were better for early season control in the post workshop survey.
2. The most reliable method to reduce mosquitoes in my yard is to….DIGITAL FILE Mosquito question two results graph: correct answer increased by about 1% from Pre 91% to Post-workshop 92% . Interestingly we got a higher percentage answering that it was the responsibility of vector control in the post workshop results.
3. How long can water stand in puddles before mosquitoes complete their life cycle in it? DIGITAL FILE Mosquito question three results graph: Correct answers increased by

83% from pre-workshop 17% to 100% post workshop. Pre-workshop favored answers were approximately tied between 72 and 48 hours.

4. All mosquitoes bite all the time. DIGITAL FILE Mosquito question four results graph: Correct answers increased by 30% from Pre-workshop 70% to Post-workshop 100%.
5. When the Asian tiger mosquito lays her eggs she prefers containers with…. DIGITAL FILE Mosquito question four results graph: Correct answer increased 85% from Pre-workshop 15% to Post-workshop 100%.

We distributed over 500 of each mosquito resource created for this project between workshops and information booths at conferences attended by Cornell Cooperative Extension of Suffolk County.

TICKS

Stakeholders attained a greater understanding of tick species and life stages, and steps to take to protect themselves. The giant tick boards were especially helpful to facillitate discussion between workshop participants which then lead to more questions and interaction, anecdotes and further clarification of points such as chiggers, ticks 'flying" or falling out of trees, success of DEET repellents, etc. While this cannot be quantified, the engagement of participants with subject is invaluable and we had testimonials of our program being superior to other multiple efforts at tick education by other entities. Success of a project is founded on the ability of participants to adopt new IPM tactics to cope with ticks and from the dicussion this was definitely boosted by the introduction of audience interaction and may result in fewer emergency applications of pesticides on phaseout and other properties, in turn resulting in reduction of pesticide drift. When we addressed landscape options, reducing leaf litter and plant debris in order to reduce rodent harborage, we were surprised by the number of participants who had not considered this, being solely focused on the deer. We armed the attendees with the tools to not only identify the tick bothering them, but also to consider their daily habits and how to protect themselves. For example, employing the most effective repellent, using the dryer as a tick terminator, performing daily tick checks and removing the attached ticks before twenty four hours, insuring minimal transmission of a tick borne disease. This last point was also an interval that most participants were unaware of.

The results of the I-clicker evaluation were as follows:

1. Chiggers are a big problem in many places in Suffolk County, and on Long Island. DIGITAL FILE: Tick question one results graph: Correct answer increased by 47% from 38% pre-workshop to 85% post workshop. 8% still answered that chiggers were a bg problem post-workshop but this was down 30% from the pre-workshop level.
2. DEET is the most effective tick repellent. DIGITAL FILE: Tick question two results graph: Correct answer increased by 50% from 42% pre-workshop to 92% post-workshop.
1. 3. All ticks can give you Lyme disease. DIGITAL FILE: Tick question three results graph: Correct answer increased by 17% from 78% pre-workshop to 95% post-workshop. Most participants knew this answer beforehand.
3. The best way to remove a tick is to coat it with petroleum jelly or fingernail polish. DIGITAL FILE: Tick question four results graph: Correct answer increased by 36% from pre-workshop 62% to post-workshop 98%.
4. What is the best way to kill ticks on clothing. DIGITAL FILE: Tick question five results graph: Correct answer increased by 52% from pre-workshop 45% to post-workshop

97%. The second most popular pre-workshop answer after the dryer was the washing machine, which dropped from 28% to 2% post-workshop.

We distributed over 500 of the alpha gal factsheets and tick check list, and over 1,550 tickwise fliers between workshops, requests for the flier from other entities and information booths at conferences attended by Cornell Cooperative Extension of Suffolk County. Giant tick boards were also dispalyed at these events including a children's event at Old Westbury Gardens in Nassau County attended by 2000 individuals. The tick app is on platform for three years using the alloted budget of $1,500 and will be live upon approval by NYSIPM. The app has a counter on it so we will be able to tell the number of users once the app goes live. Direct contacts were 323 stakeholders. Indirect contacts: Because several attendees are reaching the public through venues such as the 'Southampton Hospital Tick Borne Disease Resource Center', and public libraries, there is now an established channel to disseminate our literature and smart phone app link. We expect to have at least 10 more workshops beyond the 20 supported by the grant and these will be delivered in 2015. We already have nine scheduled for 2015.

Some observations: Almost everyone knew about Lyme Disease, although many did not know that only the 'black- legged' tick is capable of transmitting it, or that predominately the most likely type of tick one now encounters on Long Island is the 'lone-star' tick. On top of this, participants were mostly unable to identify which tick was which when looking at the large sandwich boards pre-workshop, but knew them post-workshop. We also noted that many are still referring to the larval stage of the 'lone-star' tick as a 'chigger' and that there is a fair amount of dissension on the subject even after education. Many of the medical professionals use this term, and whether or not they know it is actually the larval stage of the 'lone-star' tick or not is questionable. We also heard that many doctors automatically prescribe doxycycline without testing for Lyme, meaning that Babesiosis may be going undiagnosed in the absence of a blood test.

Project Locations:
County of Suffolk 2014 Tick and Asian Tiger Mosquito Workshop Schedule

1.) July 16: Police Property (tick half only), completed on Oct 28 (mosquito half)
2.) July 29: Citizens Campaign for the Environment
3.) Aug 11: AME (Association of Municipal Employees, Union Meeting)
4.) Aug 27: BNL (Brookhaven National Lab, employees)
5.) Sept 10: S.C. DPW Highways, Commack
6.) Sept 11: CCE evening program, open to the public
7.) Sept 16: SCMELC day time program, open to the public
8.) Sept 16: S. C. DPW Highways, Westhampton
9.) Sept 17: S. C. DPW Highways, Yaphank
10.) Sept 18: Master Gardeners
11.) Sept 29: Peconic Land Trust employees
12.) Oct 8: Boy Scouts, Oakdale
13.) Nov 1: South Fork Natural History Museum, open to the public
14.) Nov 5: SCCC, Selden
15.) Nov 5: Sachem Public Library
16.) Nov 6: Wm. Floyd H.S.
17.) Nov 7: Wm. Floyd H.S.
18.) Nov 12: SCCC, Riverhead
19.) Nov 19: S.C. Police Radio Division employees
20.) Dec 9: Cutchogue-New Suffolk Library

Additional Programs/Conferences
Cub scouts, Riverhead NY
Peconic Dunes Camp Employees, Southhold
Stonybrook Southhampton Campus
Old Westbury Gardens Bug Safari (NASSAU COUNTY)
Old Westbury Gardens Night Safari (NASSAU COUNTY)
Old Westbury Gardens Kid's Fest (NASSAU COUNTY)
Cornell Cooperative Extension of Suffolk County ALL-STAFF Meeting
Agrium Conference
Suffolk County Community College Orientation Package

SAMPLES OF RESOURCES DEVELOPED
Hard copy of mosquito wheel, tickwise flyer and alphagal flyer mailed

DIGITAL FILES: WORD atmfactsheet, skeeterchecklist, skeeter check list, and Asian tiger mosq checklist, pdf cutoutmiswheel, miswheelnotcut out, alphagalscan

DIGITAL FILES: pdf tickwise scan, word tick check list, POWERPOINT Giant Tick Identification Boards

TICK APP ADDRESS: THE APP WILL BE AVAILABLE ON ITUNES STORE FOR APPLE PRODUCTS & GOOGLE PLAY STORE FOR ANDROID PRODUCTS