Strategies, Research Priorities, and Partnerships for Community IPM to Prevent Tick-Borne Diseases

An Executive Summary of the U.S. Environmental Protection Agency's *Promoting Community IPM to Prevent Tick-Borne Diseases Conference*

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I. Introduction

The Environmental Stewardship Branch of the U.S. Environmental Protection Agency (EPA) held the *Promoting Community Integrated Pest Management (IPM) to Prevent Tick-Borne Diseases Conference* on March 30th and 31st, 2011 in Arlington, Virginia. The conference brought together 150 onsite participants in addition to nearly 100 webinar participants representing local and state governments, federal agencies, patient advocacy groups, other non-governmental organizations (NGOs) and other stakeholders under the auspices of the Pesticide Program Dialogue Committee's Public Health Work Group. The conference sessions included:

(I) Creating Institutional Structures for Community Level IPM;
(II) Protecting Children in Schools and Outdoor Environments;
(III) Landscape Planning and Tick Management;
(IV) Public Outreach Strategies to Reach Targeted Populations;
(V) Protecting Outdoor Workers Exposed to Ticks;
(VI) Measuring the Impact of Prevention Strategies;
(VII) Research Strategies;
(VIII) Cost Effectiveness of Prevention;
(IX) Case Study for Public Health Protection; and
(X) Summary of Research Needs and Knowledge Gaps.

150 people registered to attend the conference in person

The conference agenda is provided in Appendix A.

The conference was introduced by Keith Matthews (EPA), Charles "Ben" Beard (CDC), and Christopher Zarba (EPA). Keith Matthews explained that prevention is a smart, cost-effective strategy to address the problem of ticks. He also explained that EPA's Office of Pesticide Programs (OPP), Biopesticides and Pollution Prevention Division (BPPD) has a mandate for pollution prevention. IPM falls under the auspices of pollution prevention. Beard said that Lyme disease is seventh on the list of diseases reported to CDC each year in the United States. The priority is to secure the necessary information, methods, and collaborative relationships required to launch a national Lyme disease prevention program. Zarba impressed upon the participants the need to synthesize available information to address community IPM for tick-borne diseases, develop an organized plan, assess relevancy to each agency and group represented, and move forward. Hopefully, this will lead to follow-on meetings to discuss the progress of these plans.

Michael McDavit, EPA, carefully framed the meeting by explaining that the focus is on prevention, rather than diagnosis or treatment. IPM can be considered the activities that prevent infected ticks from attaching to human or pets.

The following report provides highlights from the conference organized by the three conference goals which were to:

1. Identify successful strategies for community IPM programs
2. Identify research priorities and knowledge gaps
3. Identify partnerships amongst participants

II. Strategies for Community IPM

Vector-borne diseases create community problems and consequently require coordinated community level response for effective prevention. John Carroll, U.S. Department of Agriculture (USDA), explained that vectors cross property lines and consequently control must consider community action. Tick-borne diseases are the most significant arthropod disease reported to the Centers for Disease Control (CDC). With tick-borne diseases being a concern for communities, an understanding of strategic approaches using IPM is necessary. Participants in the conference discussed community level IPM strategies and considered programs that have been implemented in various areas.

Understanding the Problem

There are communities throughout the country that have emerging or entrenched tick-borne disease problems. There are also areas that do not currently have a reported problem but may have community members affected by tick-borne disease. In order to develop community IPM programs that focus on ticks, it is necessary to obtain baseline information regarding the ticks and pathogens they carry within the area. It is also important to identify other animals that may serve as tick hosts in the area including, but not limited to deer, small rodents, and raccoons. Information should also be gathered on the landscape features and the identification of potential tick habitats. This information can be used to develop a true understanding of the problem and risk to citizens. Without an understanding of risk, it is more difficult to encourage people to follow prevention strategies.

Structural Institutions

Dr. Karl Malamud-Roam discusses institutional structures for community IPM

Carroll explained that there are institutions at various levels that can be considered when implementing community level IPM. Large, well-established institutions are typically the hardest to change but have more resources. In contrast, smaller institutions are typically easier to change but many have fewer resources. Consequently, making decisions on how to implement community wide programs may be very difficult. In some cases, it may be valuable to expand existing organizations or programs to promote community level IPM for tick management. This was done in Monmouth County, NJ, Chester County, PA, Ridgefield, CT, and Fairfax County, VA all of which participated in the conference to provide lessons learned and strategies implemented. In some areas, the local mosquito control districts expanded their roles to include tick management in response to increasing prevalence of tick-borne disease. In other situations, it may be more valuable to develop a new program that will focus on community level IPM for tick management as was done in Chadds Ford Township, PA. Various aspects of the community should be considered in the implementation of community level IPM institutions including the economic climate, population,

prevalence of the tick problem, community acceptance, capabilities of existing institutions, and potential success of new institutions.

Surveillance

Surveillance is used to monitor the vector population and determine any changes in distribution and density, evaluate the effectiveness of control strategies, and to facilitate decision-making. Adequate surveillance is imperative to determining the scope of the problem and to developing a coordinated community response to address it. Surveillance programs may utilize a variety of different strategies. Several surveillance strategies used by conference participants include tick trapping, dragging, and flagging in the field. Strategies also include pulling ticks from deer hunts, veterinary clinics, and animal shelters or collecting them directly from people. Mapping techniques can also identify potential tick habitats and problem areas.

Communication and Outreach

In order to garner support for local community IPM efforts and to promote prevention, communication and outreach with local citizens is imperative. People are less likely to be interested in preventive measures if they have limited understanding of the problem and risk involved. One question concerning communication and outreach in communities, posed by Karl Malamud-Roam, is who should educate whom?

Local health departments are currently working to spread information regarding ticks and prevention. Lessons can be learned from these institutions regarding what works effectively for communication and what does not. The Ridgefield, CT, Health Department has developed the BLAST program using several successful strategies for outreach and communication. The program name is purposefully an easy to remember acronym: **B**athe or shower after coming indoors; **L**ook for ticks and remove with tweezers; **A**pply repellents for skin and/or clothing; **S**pray the perimeter of your yard for ticks; and **T**reat your pets. The BLAST program focuses on simple, short messages that can be communicated through a variety of media. BLAST tries to maximize marketing opportunities and uses fun tools to attract people to booths at events. The Fairfax County, VA, Health Department also attends local events and tries to attract people to the booth through educational calendars, books, and temporary tattoos. Fairfax County also has used advertisements in local theatres to promote their messages. The Chester County, PA, Health Department has also used innovative strategies for outreach and communication including signs in parks, providing parks with information to distribute to patrons, and a public health badge program with the Boy Scouts. The California Department of Public Health has developed a tick database for residents to reference.

Targeted outreach strategies can be effective at reaching at-risk populations or for targeting those without an understanding of the risk involved. For example, people living in urban areas are not likely to come into contact with ticks, on the other hand those living in suburban and rural areas are much more likely to be exposed to ticks. As a result, targeting at-risk populations would reduce outreach and communications cost while maximizing the effectiveness of the message. In Fairfax County, VA, a knowledge, attitudes, and practices survey was conducted on residents. This survey demonstrated that there was a lack of understanding of tick-borne disease in the Spanish speaking community. In response to this, the county put out a series of advertisements in Spanish to target this community.

Currently there is a lack of knowledge among workers who are prone to high tick exposure—landscapers, foresters, surveyors. There is a lack of data on incidence by occupation (or other lifestyle factor) that could be very beneficial in targeting outreach efforts to the most affected segments of the population.

Host Control

Host control was one of the methods suggested for the prevention of tick-borne diseases. Deer management and small rodent management were two subsets of host control that were widely discussed at the meeting.

Deer:
According to Mat Pound (USDA), the objective of control of ticks on deer is primarily to prevent successful feeding of adult ticks and effectively remove deer as a source of blood and interrupt the tick life cycle. There are several different methods for managing ticks on deer populations. These include preventing ticks from feeding on deer through depopulation or density reduction, anti-tick vaccines and chemical control using systemically active and topically active acaricides.

Deer population management, while contentious, has many ancillary benefits, like reduced traffic accidents, which may increase support for this strategy. Population management can be done through deer hunting or the use of contraceptives. Deer hunting is one of the more controversial deer control measures. However, several communities have proven that if support is obtained, this can be an effective strategy. In Chadds Ford Township, bow hunting has successfully reduced the size of the deer population in the area. When implementing a deer control program it is important to consider acceptance by the community (which can change quickly) and also to communicate with surrounding areas on the effort.

Managing ticks on deer can also be done by application of systemic or topical acaricides to the deer. One method for the application of systemic acaricides is through medicated bait. Essentially, medicated corn can be used as a dosing medium while not increasing population since it has low protein levels. Pound and the Agricultural Research Service (ARS) conducted four field trials to determine the effectiveness of medicated bait. They found that this method was effective in significantly reducing tick populations.

Topical application of acaricides can be done through 4-poster deer feeders and tick collars. The 4-poster deer feeder has been tested through several studies in many different areas and has been highly effective in reducing the number of ticks on deer. The ARS also conducted field trials on the 4-poster deer feeder and found significant control of ticks. The research team was more successful using a 10% permethrin formulation than a 2% oil formulation. The 4-poster method can be conducted using feeding stations placed around different areas with treatment adaptors. As the deer feed, they rub their necks along the adaptor which in turn applies acaricide to the coat. Once the deer groom, they spread the acaricide along their coat. There are issues with non-target animals interfering with the feeding stations and this should be taken into account when implementing 4-poster projects.

Wild boar interfering with deer feeder shown during presentation by Mat Pound (USDA).

Pound and the ARS also studied the application of Amitraz collars on deer. To do this, they developed an automatic deer collaring device to apply the collars to deer as they walked by. The device assesses animals based on shape and temperature before applying the collar. This method has proven to be effective in significantly reducing lone star ticks. Despite the effectiveness of the device, it is very expensive to implement. It can also apply immune-contraception shots as well to reduce population densities.

Small Rodents:
Methods for reducing ticks on small rodents are similar to those used in deer. One of the methods being used in Chadds Ford Township, Pennsylvania are Damminix Tick Tubes®. These are small tubes filled with cotton balls treated with permethrin that mice will gather for nesting materials. Chadds Ford Township makes these tubes available for purchase by residents. This specific control measure would be too expensive to provide for the entire county. Another option that used to be available was Maxforce® bait boxes that were discontinued for commercial reasons. These bait boxes lure rodents in and wick them with fipronil. While this product is not currently available, interest has been expressed in relicensing the bait box.

Tick Control

Acaricides are powerful tools in controlling tick populations and can be considered by any community IPM plan. Many people are fearful of using chemical insecticides on their lawn. However with adequate communication concerning proper use of acaricides, this alternative may be more widely accepted. It is important that people understand that one, well-timed application of acaricide as a barrier is considered effective in controlling ticks; multiple applications are not necessary. Perhaps if people understand the low level of chemicals that is needed, they may be more open to using this approach.

Repellents and Clothing

Proper clothing was discussed at length by participants. One method for reducing tick bites is wearing proper clothing when outside in potential tick habitats. Suggested clothing includes wearing long pants tucked into socks, long sleeved shirts, closed shoes, and light colors. Permethrin clothing spray can be applied to outdoor clothes before they are worn to prevent tick bites. People are still hesitant to dress properly and to spray chemicals on their clothes when going into potential tick habitat. These behaviors are easy to enforce when uniforms are required such as in schools or in the military. Impregnated clothing is endorsed by the Department of Defense (DoD) and they are moving towards using this on all uniforms to protect soldiers from tick-borne disease. The Friends Community School, College Park, MD, also was able to enforce a dress code for students playing outside when they determined that school grounds had a significant tick problem, including having children bring in socks specifically for outdoor use that were treated with repellents and kept at the school.

Influencing Behavior

Studies have shown that human behavior regarding tick prevention measures is difficult to change. People are constantly bombarded by information regarding things that they should do to keep themselves and their families safe and healthy. Designing effective public education programs is complex and is different for historically endemic versus emerging areas of infestation.

One issue concerns the need to “scare people” to get their attention, but not so much that they avoid the outdoors or are turned off to the message altogether. People need an understanding of the risk involved from certain activities and need help in decision-making. There are several strategies mentioned to assist people in decision making. One of the tools mentioned that is likely to come out soon was discussed by Thomas Mather, the University of Rhode Island. Mather discussed his current project, a web-based decision support tool called the TickEncounter Risk Calculator. Essentially, this tool can be used by people at the household level to determine the risk from ticks in their own yard. The homeowner answers a series of questions regarding their landscape features, human activity, current prevention practices etc and use a weighted statistical model to determine the level of risk. Once the level of risk is identified, specific risk-based recommendations on control measures will be provided.

Another issue regarding the management of people is that many people have misconceptions regarding ticks that need to be addressed for community IPM to be effective. Misconceptions exist regarding the ticks that transmit disease, proper removal methods, locations on the body where ticks are found, effective repellents, and acaricides yet these are all effective tools for prevention. These misconceptions need to be addressed and people need clear, specific information on how to prevent tick-borne diseases to themselves, their families, and communities.

It is also possible to manage people in outdoor environments. Benedict Pagac and Ellen Stromdahl, both of the U.S. Army Public Health Command, explained efforts used by the U.S. Army during the National Scout Jamboree to protect scouts and other attendees from tick-borne disease. Through advanced planning during the large scale event, the Army was able to identify potential tick zones, put up warning signs, plan how land would be used, and place a testing facility onsite during the Jamboree. The pre-planning facilitated prevention of tick bites to attendees and provided for real time tick testing. For large outdoor events, the Army model can be considered to prevent tick bites during these activities, especially in endemic areas. Other similar management strategies mentioned for people in outdoor areas include use of paved or gravel trails in parks and putting up warning signs like those provided by the CDC.

Managing Landscapes

Landscape barrier on yard edge as presented by Kirby Stafford (Connecticut Agricultural Experiment Station)

Ticks require certain habitat for survival. According to Howard Ginsberg, U.S. Geological Service, *Ixodes scapularis* (ticks that carry the Lyme disease pathogen) nymphs require moist leaf litter, typically with forest canopy cover, and appropriate hosts. The habitats or landscape features that lower tick abundance include dry at ground level, open forest canopy, and exclusion of appropriate hosts. As a result, managing landscapes can be an effective tool for IPM. Kirby Stafford, Connecticut Agricultural Experiment Station, explained that an estimated 75% of ticks are picked up outdoors at home. This suggests that homeowner and community level landscape changes may be effective in reducing exposure to ticks. Several changes suggested by Ginsberg include crushed rock or woodchip barriers, fencing to keep people out of tick habitat, and use of paths through forested areas. Residential landscape management practices explained by Stafford include mowing, pruning, clearing brush, restricting groundcover, removing leaf litter, deer resistant plantings, landscape barriers and deer fencing. Northeast Organic Farming Association has developed standards for organic land care and specific measures for tick and pest management.

A study published in 2008 by Gould and colleagues in *Vector-Borne and Zoonotic Diseases* entitled, “Knowledge, Attitudes, and Behaviors Regarding Lyme Disease Prevention Among Connecticut Residents, 1999-2004” considered resident willingness to use different prevention strategies. According to Stafford, the results of the study indicate that most respondents were willing to remove brush or leaf litter (91%) or create barriers (82%). Residents were less willing to use deer fences (52%) or spray pesticides (47%). Another important factor that was noted during the study was that 44% of residents were willing to spend up to $100 for control and 37% were willing to spend more than $100. Involving landscape planners in the development of communities may also be beneficial in creating communities with landscape features that do not support ticks and also minimizing deer.

The role of invasive species in tick management was considered during the conference. Studies suggest that ticks are associated with exotic vegetation. A study conducted by Scott Williams and colleagues published in 2009 in *Environmental Entomology* titled "Managing Japanese Barberry (Ranunculales: Berberidaceae) Infestations Reduces Blacklegged Tick (Acari: Ixodidae) Abundance and Infection Prevalence with *Borrelia burgdorferi* (Spirochaetales: Spirochaetaceae)," considered invasive barberry and ticks. Stafford explained that questing adult blacklegged tick abundance was greatest in areas with Japanese barberry and by managing this exotic species the density of spirochete infected ticks dropped to nearly 60% of that of unmanaged infestations (Williams et al., 2009). This research suggests that management of certain exotic vegetation in landscapes may reduce tick abundance and could be used in prevention programs.

Strategies for Community IPM Conclusion

There are many available strategies for the development of community IPM programs to reduce encounters with ticks. These strategies involve developing an understanding of the problem, conducting surveillance, communication and outreach, use of tools (i.e. tick control, host control, and repellents and clothing), management of landscapes and management of people. By implementing proven strategies and by developing new ones, it is possible to develop comprehensive community IPM programs in the future. Several questions raised regarding strategies for community IPM include:

1. Given the current portfolio of prevention strategies including personal protective measures, four posters etc. what is showing the largest reduction in human cases of tick-borne disease?
2. From our TickNet study we felt the best option was using acaricides. What other options can be brought into community trials?
3. Which of these afford the best cost-benefit ratio? People believe there is a risk in using synthetic pesticides but how can we weigh this against prevention? Should we lean more towards zero tolerance for pesticide use?
4. Which interventions work under which circumstances?
5. Should we be focusing on area-wide control measures or more localized smaller scale control efforts?

Overall, it is imperative to look at current proven strategies and to also develop new effective strategies and develop plans for communities. This effort can be undertaken through a suite of partnerships. EPA has been charged by the audience with providing recommendations on new products that can be used for tick control, and new repellents that are effective against ticks. It was also suggested that EPA encourage the development of efficacious biopesticides for tick control.

III. Research Priorities and Knowledge Gaps

While there is a significant amount of information that is understood regarding ticks and tick-borne pathogens, there are many unanswered questions. These knowledge gaps point to various research priorities that can be facilitated through the support of partnerships and funding.

Reliable Surveillance Data

One of the most important components of any IPM program is having an understanding of the problem on the ground. Collecting reliable surveillance data in different areas and providing for the dissemination of this information across political boundaries is necessary for developing successful IPM programs. Tick problems vary from community to community depending upon landscaping, presence of available hosts, species present, and pathogens carried. Without knowledge of this information, it is difficult to develop a

sound prevention approach. By obtaining adequate surveillance, targeted control efforts can be conducted. Given the current economic climate, targeted prevention approaches are necessary. This also allows for an understanding of current problem areas and monitoring for trends or changes in species dispersal. This can help predict new areas where ticks may become problematic to the surrounding community. By making surveillance information more widely available, it is possible to identify areas where attention is needed and to determine potential partners.

Alternatives to Area-Wide Acaricides

While chemical-based, area-wide acaricides are highly effective in reducing tick populations, several studies that were discussed during the conference suggesting that people are hesitant to use them even in areas with high levels of tick-related disease. Several useful acaricides include carbaryl, cyfluthrin, fulvalinate, permethrin, deltamethrin etc. This suggests that in areas where risk is even lower, people may be even less prone to use these products. As a result, several conference participants encouraged the development and promotion of efficacious, reduced-risk products for tick control. Joe Piesman has been working with colleagues on isolating nootkatone, an extract found in Alaska cedar and grapefruit, to be used as a natural tick control agent. By using a high pressure spray application, the formula has proven to be an effective natural acaricide. This research suggests that natural products may play a role in controlling ticks. However, the formulation used for research is very expensive to produce and alternative formulations that are less expensive will need to be produced for this to be a realistic product for consumer use. If these products are made available to consumers they can be used in community IPM programs.

Efficacy of Alternative Control Strategies and Repellents

One of the most important considerations regarding control products and repellents is product efficacy. Without an adequate understanding of the efficacy of the available products, it is difficult to make IPM recommendations. Current understanding of the efficacy of alternative control products is lacking. While studies have been put out regarding biopesticides for ticks, they have not been widely distributed and this demonstrates a large disconnect. The development of new alternative products that are efficacious is also needed. Alternatives to chemical pesticides are the cornerstone control elements of any IPM program. Development of these products is also important because people are hesitant to use chemical acaricides. EPA is responsible for registering products and needs to very closely look at efficacy for tick control products as well as encouraging the development of new products.

Linking Entomological and Epidemiological Data

It is difficult to link entomological data with epidemiological data and to identify causal links. Current studies have not created a definitive link and this is problematic in understanding the issue and identifying control strategies that will reduce tick-borne disease. Many studies that continue to come out have entomological outcomes; one challenge is determining how these can be used to create robust models in the future linked to epidemiology. The interaction between entomological and epidemiological data may also vary by location and tick species/pathogen. By identifying a clear link between entomological and epidemiological data, the cost-effectiveness of different IPM control methods can be evaluated.

Measuring the Impact of IPM on Tick-Borne Disease Incidence

IPM strategies may be effective in reducing the incidence of tick-borne disease. However, causal links have not been determined. Without this evidence, it is difficult to recommend that people use IPM to control ticks. While it may seem logical that use of any strategy to reduce encounters with ticks may impact the incidence of disease, without direct evidence, people will be less willing to listen. According

to Paul Mead, the CDC is conducting the Lyme and Other Tick-borne Diseases Prevention Study (LTDPS). The purpose of this study is to determine if use of acaricide barriers in yards has any impact on encountering ticks. Use of acaricide barriers is one of the tools that can be used as part of a tick IPM program.

By measuring the impact of IPM on tick-borne disease incidence, it is possible to more effectively determine the cost-effectiveness of prevention. Martin Meltzer, CDC, has conducted research to try and quantify the cost-effectiveness of prevention and found that there is a lot of critical data missing. Meltzer cited various studies with conflicting results when it comes to prevention strategies and explained that the data is missing the relationship between the reduction in the number of ticks and the number of human cases of tick-related disease. When the Lyme disease vaccine was available, the cost effectiveness of using the vaccine was determined by targeting it to at-risk populations in endemic areas. Targeting prevention using proven approaches will be the most cost effective method.

Inventory of Outreach Materials

There is an immense amount of outreach and education materials that are available regarding ticks and tick-borne disease. While much of this may be useful, it is possible that some materials may not be scientifically valid. It is imperative that an inventory of available outreach materials is conducted. This will aid in the identification of the best available materials for different audiences and lead to creativity for the production of new materials. Currently, available materials include brochures, pamphlets, calendars, books, tick identification cards, website pages, advertisements, etc. While these traditional forms of outreach materials are useful and many can be used in future efforts, alternative communication tools should be considered. Benedict Pagac, U.S. Army, mentioned the possibility of using social media to convey messages to the public. Herbert Bolton, USDA, also noted that the focus should be on providing information that people want not necessarily the information that we think they need.

Fairfax County Health Department engaging in community outreach as presented by Joshua Smith

Creation of Evidence-Based Policies

Policies need to be developed that are based on scientific evidence. In order to create evidence-based policies it is necessary that proven techniques are identified and their impact quantified. Without this information, it is difficult to provide the momentum needed to develop sound policies and provide recommendations. Many participants pointed out the need for solid recommendations and several felt that this was not possible given the lack of sound information. On the other hand, participants felt that it is possible to at least promote the prevention message and provide general guidelines on possible strategies for community IPM.

Research Priorities and Knowledge Gaps Conclusion

The identification of research priorities and knowledge gaps provides a good basis for understanding what needs to be done in the future. Major priorities and gaps that were identified during the conference include adequate surveillance data, alternatives to area-wide acaricides, efficacy of alternative control strategies and repellents, linking entomological and epidemiological data, measuring the impact of IPM on tick-borne disease incidence, inventory of outreach materials, and the creation of evidence based

policies. By focusing on these research priorities and filling in knowledge gaps, it is possible to develop effective community IPM programs. Several questions regarding research priorities and knowledge gaps include:

1. How do we link entomological and epidemiological success together?
2. How can we weigh the risk from using synthetic pesticides against prevention?
3. How can we effectively prioritize research given the current limitations in funding?
4. Given the current knowledge gaps, do we have enough information to make sound policy recommendations to local governments or communities?

Focusing efforts on understanding these key research questions and working closely with partners is one method to overcome funding challenges and to ensure the development of better recommendations and policies.

IV. Partnership Opportunities

There are various different stakeholders involved in tick-borne diseases. This includes local county and state governments, federal agencies, patient advocacy groups, NGOs, and other institutions. In order to truly address the tick-borne disease problem, it is imperative that partnerships are leveraged between various stakeholders and communication is facilitated to improve coordination and information transfer.

Local, State, Federal Partners

There are many opportunities to develop partnerships with local, state, and federal partners. Many counties have existing mosquito control districts with experience in vector-control. Some of these mosquito control districts have begun to implement tick programs. These districts likely have experience managing the community as well as the vector and may have valuable insight into the development of community IPM for ticks. They may also be a valuable resource for distributing information and conducting surveillance. However, budget constraints may limit the effectiveness of these programs so partnerships remain critical.

State governments may also be a valuable resource for the development of partnerships. Assistance from state organizations such as state health department and forestry departments would help in the implementation of broader policies. State Fish and Game agencies would be instrumental in the implementation of any host control strategy that involves hunting or other population control. All of these state agencies would be valuable partners for developing strategies for community IPM.

Federal agencies are currently collecting and distributing information on tick-borne disease and prevention methods and conducting or supporting research efforts. The Centers for Disease Control, Department of Defense (DoD), Department of Agriculture, specifically the Agricultural Research Service , and National Park Service all had participants in the conference. Each of these organizations is interested in preventing tick-borne diseases and partnership opportunities exist for the EPA. These federal partners will be instrumental in understanding the entomology, epidemiology, outreach strategies, and related issues that will assist EPA in developing successful IPM strategies for communities. These agencies will also be instrumental in providing grant money to support research projects into community IPM for ticks. By working together, it is possible to further realize the goal of preventing tick-borne disease and promoting healthy communities.

The DoD has been very active on the issue of preventing tick-borne disease. This is due to the risk to soldiers from spending long hours out in the field as well as risks to their families on military bases. As a result, the military would be an excellent resource to partner with and to learn from. According to Ellen

Stromdahl, U.S. Army Public Health Command, military researchers have a long history of work on arthropod vectors of human disease. She also explained that the earliest work on tick surveillance and on the development of repellents was led by DoD entomologists.

Advocacy Groups and Other NGO Partners

There are many NGOs that are focused on preventing tick-borne diseases and communicating with the public. Several of these organizations provided representation at the conference including the Lyme Disease Association; the Lyme Disease Association of Southern Pennsylvania, Inc.; Time for Lyme, Inc.; and the Lyme Association of Greater Kansas City to name a few. Many of these non-profit organizations have a high level of involvement with the community, experience with outreach and education, and motivation for empowering people to prevent tick-borne diseases. These organizations have flexibility with regards to the programs that they can implement and where they can focus efforts, making them valuable partners. Conservation organizations were also present at the conference and may prove to be valuable partners with innovative new strategies for reducing tick prevalence while supporting the local environment.

Universities

Universities are excellent sources for research on ticks and tick-borne disease. Land-grant universities were specifically named by several panelists as partners to pursue. This is because land-grant universities must fulfill their mandate for openness, accessibility, and service. They have experience in research, education, and extension so they are valuable partners. According to Herbert Bolton, land-grant partners are a first line resource for USDA for research and extension efforts to assist USDA in accomplishing its mission. Karl Malamud-Roam also mentioned that land-grant universities have partnered with the USDA in the IR-4 program to facilitate registration of sustainable pest management.

Medical Personnel and Veterinarians

While this meeting was focused on prevention, medical personnel are often involved when prevention measures fail. Medical personnel have experience communicating with patients and can disseminate prevention information. One key group identified during the conference was school nurses. School nurses serve as the medical authority on school grounds and have interactions with students, parents, teachers, and support staff. This makes them an asset for distributing prevention information so that children are better protected from tick-borne diseases. Since children are at higher risk of tick-borne disease, school nurses are one way of reaching this population.

Another key group identified for partnerships at the meeting was veterinarians. Veterinarians have experience communicating to pet-owners about risk to pets from ticks and providing information on protecting pets from ticks. This group can be involved in surveillance efforts, distributing information, and also determining effective communication strategies. The Fairfax County Health Department, for example, goes to local veterinary clinics to collect ticks for surveillance. They also provide cards on the county tick identification service for veterinarians to give to their customers.

Social Scientists

One of the key partnerships highlighted repeatedly during the conference was with social scientists. This is because many of the people who are involved with tick-borne disease are entomologists and others that do not understand how people relate to information and make decisions. By integrating social scientists into the community IPM effort to control tick-borne diseases it is possible to develop a better understanding of why people are not engaging in preventative measures. Obtaining an understanding of

human behavior and decision making will lead to the development of better outreach materials and, ideally, better communication on the risk of tick-borne disease and the benefits of prevention.

Structural Pest Control (Pest Management Professionals)

Panelists discussing the role of medical personnel and pest control operators during the Protecting Workers Session

PMPs interact with homeowners in need of pest control services. This makes them a valuable group to partner with. PMPs can be educated with regards to tick problems and can also distribute materials to homeowners. One method of educating PMPs is through certification programs as was done in Rhode Island. According to Thomas Mather, a group of 15 PMPs was provided with training on tick management in people's backyards. In order to obtain certification, they had to develop tick bite protection and prevention plans. Within these plans, the PMPs had to demonstrate an understanding of the level of control needed to properly address the situation while not overusing pesticides. Certification programs in other states may be a valuable tool in obtaining better IPM approaches for pest control in communities.

Another method of reaching PMPs is through the National Pest Management Association (NPMA). According to Jim Fredericks, NPMA, the association represents the professional pest management industry and prides itself on educating pest management professionals. The NPMA surveyed members about ticks and found that while there is awareness about ticks, it is not a priority and its members are not taking precautions against ticks, although only a small number of members participated. The survey indicates, however, that educating this population may be valuable and Fredericks suggested the use of a webinar. Fredericks also suggested that another valuable way to partner with NPMA to reach out to PMPs was by providing recommendations on landscape design, personal protection, and IPM. PMPs were valuable as partners during West Nile virus outbreaks and tried to provide necessary services, IPM recommendations, and informational material throughout the community.

One challenge to integrating PMPs into the community IPM for ticks process is that one properly timed treatment with an acaricide is effective in preventing ticks. This single year treatment, according to Ron Harrison at Orkin, goes against PMP business models that rely upon multiple treatments to obtain a profit. As a result, it is difficult for PMPs to offer tick control treatments. This challenge can be addressed through a variety of mechanisms. PMPs can be incentivized to provide these services. It is also possible for neighborhoods or communities to incentivize PMPs to offer tick control services by having multiple properties treated together.

Landscaping/Lawn-care Businesses

Landscaping and lawn-care businesses work closely with homeowners or facility managers to develop landscapes and care for lawns. As noted earlier, most cases of tick-borne disease may result from contact around the home. Also, the people working for these organizations are also at risk for tick bites due to their exposure to different habitats and working outside. As a result, this is one of the potential partners for community IPM and tick prevention. It is necessary to provide outdoor workers including landscapers and lawn-care workers information on how to protect themselves from ticks. CDC's National Institute for Occupational Safety and Health (NIOSH) does an excellent job providing resources to these individuals.

It is also possible to provide organizations with materials regarding tick prevention that they can then distribute to homeowners. PLANET, an international association serving landscaping and lawn-care professionals, conducted a survey of its membership and of those surveyed 89% said they would like information to pass onto their employees and 71% said that they would like to have information to pass onto customers about Lyme disease. This study is promising in that these organizations may provide a valuable resource for disseminating information to protect workers as well as communities.

Schools

Children have been identified as a high priority group since they are particularly at risk from tick-borne diseases. As a result, it is increasingly important to continue partnerships with schools. Schools are instrumental in providing information to students and parents. They are also areas where children may be exposed to ticks. People who play a role in protecting children from tick-borne disease include coaches, parents, office staff, teachers, maintenance staff, nurses, and students. It takes a lot of effort to facilitate coordination between these groups.

The IPM Institute of North America currently works very closely with schools to develop IPM plans to help reduce risk to children from both pests and pesticides. This is done by empowering people to create sustainable programs and minimize reliance on pesticides in demonstration schools. The Institute is currently fostering the development of self-expanding coalitions which uses trained professionals working in demonstration schools to recruit and mentor professionals in other school systems within their state. Thomas Green provided several lessons-learned regarding partnering with schools including: the identification of key decision-makers in the districts, developing compelling messages, and working with school planners. Schools can also be used to provide information to the community and by educating students now, they will make better choices as adults in the future.

According to Diane Blanchard, Time for Lyme, Inc. developed a school curriculum on ticks targeted to children in four grades (K, 3, 6, 9). The school curriculum becomes increasingly complex as it moves up the grade levels and provides children with age appropriate information on ticks. Time for Lyme, Inc. has provided this curriculum to many schools for inclusion in health classes. Part of the 9th grade curriculum is a one-hour video, "*A Time for Lyme—Students, Teachers and Lyme Disease*," that has been distributed in 23 states, Washington D.C. and Canada. Providing curriculum in schools on prevention of tick-borne diseases is one way to disseminate information in a formal, structured setting.

Partnership Conclusion

It is clear that there are many partnerships that can be leveraged to implement community based IPM. Partnerships can exist between local, state, and federal agencies, patient advocacy groups, NGOs, medical and veterinarian personnel, universities, social scientists, pest management professionals, landscaping and lawn-care organizations, schools. By creating valuable partnerships, it is possible to broaden the scope of projects and more efficiently use valuable but limited resources. There were many potential future partnership sources that were identified during the conference. However, there were also questions surrounding partnerships for consideration in the future. These questions include:

1. Multiple federal partners have done studies on Lyme disease prevention, what activities provide synergistic partnerships?
2. What are the potential obstacles towards these federal partnerships?
3. What is currently being done for coordinated efforts?
4. Who is responsible for reducing tick-borne disease? Is it individuals, city planners, local public health officials, states, the federal government?

While the development of partnerships may provide certain challenges, these can be overcome. Ideally, through close partnerships it will be possible to develop community IPM strategies to effectively reduce tick exposure.

V. Summary

Maction Komwa presenting a case study for public health protection

The conference gathered various stakeholders who presented an overview of current research and information surrounding prevention of tick-borne diseases. The three main objectives of the conference were to identify successful strategies for community IPM programs, identify research priorities and knowledge gaps, and to identify potential partnerships amongst participants. Successful strategies for IPM that were mentioned include developing an understanding of the problem, conducting surveillance, communication and outreach, use of tools (i.e. tick control, host control, and repellents and clothing), management of landscapes and management of people. Research priorities and knowledge gaps that were identified are surveillance data, alternatives to area-wide acaricides, linking entomological and epidemiological data, inventory of outreach materials, measuring the impact of IPM on tick-borne disease incidence, and the creation of evidence based policies. Key partnerships can be developed between local, state, and federal agencies, patient advocacy groups, NGOs, medical and veterinarian personnel, universities, social scientists, pest management professionals, landscaping and lawn-care organizations, schools.

IPM promotes the use of strategies that will limit exposure to both pests and pesticides. Maction Komwa, George Mason University, explained that control measures will not only be measured by effectiveness, but also in the methodology that will ensure sustainability and minimize exposure to humans. Through the implementation of carefully planned, proven IPM strategies in communities with partners, it is possible to create sustainable tick prevention programs in communities to reduce the impact of tick-borne diseases.

Appendix A: Conference Agenda

Promoting Community IPM for Preventing Tick-Borne Diseases Conference
March 30-31, 2011
Arlington, Virginia

Conference Goals:	• Identify successful strategies for community IPM programs • Identify research priorities and knowledge gaps • Strengthen partnerships amongst participants
Wednesday - March30, 2011	
8:00 am to 8:30 am	Registration
8:30 am to 9:00 am	Welcome • **Keith Matthews**, U.S. Environmental Protection Agency • **Ben Beard**, Centers for Disease Control and Prevention • **Christopher Zarba**, U.S. Environmental Protection Agency Meeting Overview, Process, and Expectations • **Michael McDavit**, U.S. Environmental Protection Agency
9:00 am to 10:30 am	**Session I: Creating Institutional Structures for Community Level IPM** *Explore institutional structures such as mosquito control districts that provide models for area-wide tick management programs in concert with household initiatives.* • **Karl Malamud-Roam**, IR-4, Rutgers University *(Co-Moderator / Presenter)* • **John Carroll**, U.S. Department of Agriculture *(Co-Moderator / Presenter)* Panelists • **Sean Healy**, Monmouth County (NJ) Mosquito Extermination Commission • **Thomas Mather**, University of Rhode Island • **Peter Jesson**, Chadd's Ford Township, PA • **Brooke Bissinger**, TyraTech, Inc. Moderated Discussion *(45 minutes)*
10:30 am to 10:45 am	Break
10:45 am to 12:15 pm	**Session II: Protecting Children in Schools and Outdoor Environments** *IPM practices are being effectively used at schools and other public facilities to reduce risks of tick-borne diseases while minimizing pesticide impacts. This session will discuss the outstanding needs and opportunities for research, education, regulation and implementation to further protect people using and visiting these facilities.* • **Kathy Murray**, Maine Department of Agriculture, Food, and Rural Resources *(Moderator / Presenter)* • **Thomas Green**, IPM Institute of North America *(Presenter)* Panelists • **Christine Dunathan**, Friends Community School, College Park, MD • **Benedict Pagac**,U.S. Army Public Health Command-Region North • **Sally Schoessler**, National Association of School Nurses • **Herbert Bolton**, U.S. Department of Agriculture • **Audrey Moore**, U.S. Environmental Protection Agency Region 2

	• **Clara Fuentes**, U.S. Environmental Protection Agency Moderated Discussion *(45 minutes)*
12:15 pm to 1:15 pm	Lunch

1:15 pm to 2:45 pm	**Session III: Landscape Planning and Tick Management** *Working with land planners and resource managers to utilize the potential of landscape design to minimize transmission of tick-borne diseases.* • **Charles Lubelczyk,** Maine Medical Center *(Co-Moderator)* • **MontiraPongsiri,** U.S. Environmental Protection Agency *(Co-Moderator)* • **Howard Ginsberg,** U.S. Geological Survey *(Presenter)* • **Kirby Stafford**, Connecticut Agricultural Experiment Station *(Presenter)* Panelists • **Wink Hastings**, National Park Service • **Laura Jackson,** U.S. Environmental Protection Agency • **Terra Rentz**, The Wildlife Society • **Robert Snieckus**, U.S. Department of Agriculture • **Kevin Sweeney**, U.S. Environmental Protection Agency • **Kendra Briechle**, The Conservation Fund Moderated Discussion *(45 minutes)* Practical steps to engage planning and landscape design professionals in the management of tick-borne diseases
2:45 pm to 3:00 pm	Break
3:00 pm to 4:30 pm	**Session IV: Public Outreach Strategies to Reach Targeted Populations** *School-age children and older Americans constitute the highest risk populations for tick-borne diseases. This session will recommend how best to communicate with parents, teachers, outdoor educators, nurses and at-risk populations.* • **Emily Zielinski-Guiterrez,** Centers for Disease Control and Prevention *(Co-Moderator)* • **Patricia Smith**, Lyme Disease Association *(Co-Moderator)* • **Diane Blanchard,** Time for Lyme, Inc. • **Douglas Fearn,** Lyme Disease Association of Southern Pennsylvania, Inc. • **Jennifer Reid**, Ridgefield (CT) Health Department • **Kathy White**, Lyme Association of Greater Kansas City • **Katie Kuffner**, Chester County (PA) Health Department • **Anne Kjemtrup**, California Department of Public Health Moderated Discussion *(45 minutes)*
4:30 pm to 5:00 pm	**Summarization of Day** *Reporters will summarize the research needs and knowledge gaps identified during the day's sessions and overarching themes will be highlighted.* • **Brooke Bissinger,** TyraTech, Inc. *(Moderator)*

Thursday - March, 31, 2011	
8:00 am to 8:30 am	Registration
8:30 am to 9:00 am	Opening Remarks • **Christopher Zarba**, U.S. Environmental Protection Agency
9:00 am to 10:30 am	**Session V: Protecting Outdoor Workers Exposed to Ticks** *Outdoor workers in many industries are at risk for contracting tick-borne diseases. Appropriate workplace controls and prevention education can help decrease the risk of workers contracting tick-borne diseases.* • **Tom Delaney**, PLANET *(Moderator / Presenter)* • **Brenda Jacklitsch**,National Institute for Occupational Safety and Health *(Presenter)* Panelists • **Ronald Harrison**, Orkin, Inc. • **David Brassard,** U.S. Environmental Protection Agency • **Sarah Fletcher,** Sterling Family Practice • **Jim Fredericks,** National Pest Management Association Moderated Discussion *(45 minutes)*
10:30 am to 10:45 am	Break
10:45 am to 12:15 am	**Session VI: Measuring the Impact of Prevention Strategy** *While numerous studies have demonstrated success in reducing tick and deer populations, there are limitations in the current methods and products and little data on their effectiveness in preventing human illness. This session will explore novel products and ongoing monitoring and prevention research.* • **Ben Beard**, Centers for Disease Control and Prevention*(Moderator)* • **Joseph Piesman**, Centers for Disease Control and Prevention • **Joshua Smith**, Fairfax County Health Department • **Ellen Stromdahl**, U.S. Army Public Health Command • **Paul Mead**, Centers for Disease Control and Prevention Moderated Discussion *(45 minutes)*
12:15 pm to 1:15 pm	Lunch
1:15 pm to 2:00 pm	**Session VII: Research Strategies** *While white-tailed deer are not reservoir hosts for the Lyme disease agent, they are the keystone host on which adult female blacklegged ticks engorge on blood essential to production of tick eggs and completion of the life cycle. This session will advise on current and experimental technologies to prevent these ticks from feeding on deer to reduce tick density, and thus the risk of being bitten by ticks.* • **Mat Pound,** U.S. Department of Agriculture, Livestock Insects Research Service Question/Discussion Period *(15 minutes)*
2:00 pm to 2:45 pm	**Session VIII: Cost Effectiveness of Prevention** *The session will review the economics of community-based interventions to control tick-borne diseases. The methodological framework and data needs for a rigorous, cost-effectiveness analysis of a community-level tick control program to reduce tick-borne disease incidence will also be described.* • **Martin Meltzer**, Centers for Disease Control and Prevention Question/Discussion Period *(15 minutes)*
:45 pm to 3:30 pm	**Session IX: Case Study for Public Health Protection** *The increased risk of malaria, like tick-borne diseases, cannot be underestimated. The session will highlight cost-effective approaches to reduce mosquito infestations and ensure minimal exposure to humans through the analytically*

	evaluation of mosquito behavior and control programs. Lessons learned from mosquito control programs may be applicable to tick management. • **MactionKomwa**, George Mason University Question/Discussion Period *(15 minutes)*
3:30 pm to 3:45 pm	Break
3:45 pm to 4:30 pm	**Session X: Summary of Research Needs and Knowledge Gaps** *Research needs and knowledge gaps identified during the meeting will be presented and participants will provide advice on prioritization and cost-effectiveness.* • **Christopher Zarba**, U.S. Environmental Protection Agency *(Moderator)*
4:30 pm to 5:00 pm	**Formal Public Comment Period** • **Thomas Brennan**, U.S. Environmental Protection Agency *(Moderator)*
5:00 pm	Closing Remarks • **Thomas Brennan**, U.S. Environmental Protection Agency

Appendix B: Conference Participants

Promoting Community IPM for Preventing Tick-Borne Diseases Conference Participants			
Last Name	**First Name**	**Organization**	**Participation**
Aicher	Dorothy	Hopewell Citizen	On-Site
Allan	Sandra	U.S. Department of Agriculture, ARS	On-Site
Anderson	Judi	Kroeger Associates	On-Site
Ansher	Alison	Virginia Department of Health	On-Site
Arias	Jorge	Fairfax County Health Dept. DCIP	On-Site
Roth-Schechter	Barbara	Board of Health	Webinar
Barnes	Lucy		Webinar
Barnwell	Pat	University of Tennessee	Webinar
Beard	Charles (Ben)	Centers for Disease Control and Prevention	On-Site
Bennett	Diane		Webinar
Bennett	Sara	Fairfax County Health Dept. DCIP	Webinar
Berlin	Nancy	Virginia Cooperative Extension-Prince William	On-Site
Bernido	Alyssa	Frederick County (MD) Government	Webinar
Best	Curtis	Central Massachusetts Mosquito Control	Webinar
Bissinger	Brooke	TyraTech, Inc.	On-Site
Blanchard	Diane	Time for Lyme, Inc.	On-Site
Block	Mindy	Quality Parks	Webinar
Bolton	Herb	U.S. Department of Agriculture, NIFA	On-Site
Borden	Danielle	Chester County Health Department	On-Site
Brandt	Edward	U.S. EPA Office of Pesticide Programs	On-Site
Brassard	April	George Mason University	On-Site
Brassard	Candace	U.S. EPA Office of Pesticide Programs	On-Site
Brassard	David	U.S. EPA Office of Pesticide Programs	On-Site
Brennan	Thomas	U.S. EPA Office of Pesticide Programs	On-Site
Briechle	Kendra	The Conservation Fund	On-Site
Brodeur	Nina		Webinar
Brown	Catherine	Massachusetts Dept of Public Health	Webinar
Brunkhorst	Kris	Lyme Disease Organization of Iowa	Webinar
Bryks	Sam	IPM Consultancy	Webinar
Buffone	Mark		Webinar
Burgos	Jorge	U.S. EPA	Webinar
Caliboso	Filipinas	Gypsy Moth and Mosquito Control	Webinar
Carlos	Maria	Maryland Dept. of Health and Mental Hygeine	On-Site
Carroll	John	U.S. Department of Agriculture, ARS, IIBBL	On-Site
Castillo	Luis	Fondo Italo Peruano	Webinar
Chason	Lisa		Webinar
Cilek	James	Florida A & M University	Webinar
Clark	Carol	TIC-NC	Webinar

Promoting Community IPM for Preventing Tick-Borne Diseases **Conference Participants**			
Last Name	**First Name**	**Organization**	**Participation**
Cohen	Barbara	National Capitol Lyme & Tick-Borne Disease Association	Webinar
Cole	Teri	Nova Scotia Department of Health and Wellness	Webinar
Coleman	Cathy	Master Gardeners of Northern Virginia	On-Site
Collins	Kristin		Webinar
Connolly	Carol		Webinar
Cooper	Linda	NASA	Webinar
Cornine	Frank	Central Mass. Mosquito Control Project	Webinar
Crepeau	Taryn	Monmouth County (NJ) Mosquito Extermination Commission	Webinar
Dammin	Tristram	Vector Borne Disease Center, Nantucket MA	Webinar
Degnan	Carolyn	California Lyme Disease Association	Webinar
Deichmeister	Jayne	Virginia Department of Health	Webinar
Delaney	Tom	Professional Landcare Network	On-Site
Densmore	Karen		Webinar
Deschamps	Timothy	Central Mass. Mosquito Control	Webinar
Dinkins	Darlene	U.S. EPA Office of Pesticide Programs	On-Site
Diuk-Wasser	Maria	Yale School of Public Health	Webinar
Doyle-Hennin	Natalie	The RainbowSurfer Institute	Webinar
Duffrin	Nancy		Webinar
Dunathan	Christine	Friends Community School	On-Site
Dunn	Gail	AOS 92 Waterville	Webinar
DuPont	Larry		Webinar
Durand	Lynn		Webinar
Elias	Susan	Maine Medical Center	Webinar
Ellis	Frank	U.S. EPA Office of Pesticide Programs	On-Site
Farhangi	Leslie		Webinar
Fearn	Douglas	D.W. Fearn & Associates	On-Site
Feldman	Katherine	Maryland Department of Health and Mental Hygiene	On-Site
Ferraro	William	Philadelphia Dept. of Public Health	Webinar
Finkenstaedt	Cathy	Master Gardeners of Northern Virginia	On-Site
Fletcher	Michael	Y-TEX Corporation	Webinar
Fletcher	Sarah	Sterling Family Practice	On-Site
Fredericks	Jim	National Pest Management Association	On-Site
Friedland	Leslie	Envolve	Webinar
Fuentes	Clara	U.S. EPA Office of Pesticide Programs	On-Site
Gaff	Holly	Old Dominion University	Webinar
Gaines	David	Virginia Department of Health	On-Site
Gillies	Linda	Town of Islesboro (ME)	Webinar
Ginsberg	Howard	USGS Patuxent Wildlife Research Center	On-Site
Glick	Sherry	U.S. EPA Office of Pesticide Programs	Webinar
Gouge	Dawn	University of Arizona	Webinar
Graves	Sonya	Fairfax County Health Department	Webinar
Green	Lee	Indiana State Department of Health	On-Site

Promoting Community IPM for Preventing Tick-Borne Diseases **Conference Participants**			
Last Name	**First Name**	**Organization**	**Participation**
Green	Thomas	IPM Institute of North America Inc.	On-Site
Greenway	Denise	U.S. EPA Office of Pesticide Programs	On-Site
Grissom	Louis	U.S. EPA Office of Pesticide Programs	Webinar
Halbach	Nicholas	Hesperian Group	On-Site
Hall	Loyal	PSU Cooperative Extension	Webinar
Hardin	Mark	Howard County (MD) Public School System	Webinar
Harrison	Ronald	Orkin Pest Control	On-Site
Hartman	Deborah	U.S. EPA Office of Pesticide Programs	On-Site
Hastings	Wink	National Park Service	On-Site
Haun	Kimberly	Arlington County (VA)	On-Site
Healy	Sean	Monmouth County Mosquito Extermination Commission	On-Site
Hellman	Mindy		Webinar
Hellyer	Greg	U.S. EPA - New England Regional Lab	Webinar
Hoskins	Bart	U.S. EPA	Webinar
Hunter	Lisa		Webinar
Hutchinson	Mike	Pennsylvania Department of Environmental Protection	Webinar
Imlay	Marc	Maryland-National Capital Park and Planning Commission	On-Site
Jacklitsch	Brenda	National Institute for Occupational Safety & Health	On-Site
Jackson	Laura	U.S. EPA Office of Research and Development	On-Site
Jesson	J Peter	Chadds Ford Township Tick Reduction Task Force	On-Site
Johnson	Amaris	U.S. EPA Office of Pesticide Programs	On-Site
Johnson	Lorraine	California Lyme Disease Association	Webinar
Jones	Erin	Maryland Department of Health and Mental Hygiene	On-Site
Kearney	Marie	Arizona Lyme Disease Association	Webinar
Kjemtrup	Anne	California Dept. of Public Health, Vector-Borne Disease Section	On-Site
Komwa	Maction	George Mason University	On-Site
Kuffner	Katie	Chester County (PA) Health Department	On-Site
Kunst	Robert	Fischer Environmental Services	On-Site
Kyle	Andrew	PA Dept. of Environmental Protection - Vector Management	Webinar
Lafon	Nelson	VA Dept of Game & Inland Fisheries	On-Site
Lapsley	Will	Massachusetts Department of Public Health	Webinar
Lavelle	Judy	Centers for Disease Control and Prevention	Webinar
Lawson	Jerry	U.S. EPA	On-Site
LeCouteur	Brian	Metropolitan Washington Council of Governments	Webinar
Leland	Dorothy	California Lyme Disease Association	Webinar
Lentowski	James	Nantucket Conservation Foundation	Webinar
Lepore	Timothy	Timothy J. Lepore MD FACS	Webinar
Lima	Andy	Clarke	On-Site
Lisanby	David	Nick's Pest Management, Inc.	On-Site
Lobes	Linda	Michigan Lyme Disease Association	Webinar
Loftin	Kelly	University of Arkansas	Webinar
Love	Joe	Accurate & Thrifty Pest Control	Webinar

Promoting Community IPM for Preventing Tick-Borne Diseases **Conference Participants**			
Last Name	**First Name**	**Organization**	**Participation**
Lubelczyk	Charles	Maine Medical Center	On-Site
Lyons	Christina		Webinar
Malamud-Roam	Karl	IR-4 Project, Rutgers University	On-Site
Mather	Thomas	University of Rhode Island	On-Site
Matthews	Keith	U.S. EPA Office of Pesticide Programs	On-Site
Maurais	Barb	Mainely Ticks	Webinar
McAllister	Janet	Centers for Disease Control	Webinar
McDavit	Michael	U.S. EPA Office of Pesticide Programs	On-Site
McGlinchy	Timothy	Central Mass Mosquito Control	Webinar
McGonegal	Tim	Prince William County (VA) Public Works	On-Site
Mead	Paul	Centers for Disease Control and Prevention	On-Site
Meltzer	Martin	Centers for Disease Control and Prevention	On-Site
Messenger	Matthew	U.S. Department of Agriculture	Webinar
Miller	Juliana	Central Massachusetts Mosquito Control	Webinar
Monk	Patricia	New Mexico State University	Webinar
Moore	Audrey	U.S. EPA Region 2	On-Site
Moore	Jacob	U.S. EPA Office of Pesticide Programs	On-Site
Motherway	Felicia		Webinar
Murray	Kathy	Maine Department of Agriculture, Food, and Rural Resources	On-Site
Musa	Christine	Warren Co. Mosquito Commission	Webinar
Myre	Anne	Minnesota Lyme	Webinar
Nelson	Katherine	Montgomery County Planning Department	Webinar
Nolan	Ellen	Prince William County Government	On-Site
Norman	Philip	Howard County Recreation and parks	Webinar
Nu	Ari		Webinar
O'Brien	Elizabeth		Webinar
O'Connor	Linda	City of Alexandria (VA) Environmental Health Department	On-Site
Ortel	Cheryl	Cheryl D. Ortel, MD PA	Webinar
Osborne	Lisette	Howard County Health Dept	Webinar
Ozkan	Arife	New Hampshire Dept. of Agriculture	Webinar
Pagac	Benedict	US Army Public Health Command Region-North	On-Site
Paluch	Gretchen	EcoSMART Technologies	Webinar
Parker	Carol	U.S. EPA Office of Pesticide Programs	On-Site
Patterson	Cindy	Beautiful and Carefree Native Landscaping	On-Site
Paulson	Sally	Virginia Tech	On-Site
Pelletier	Carrie	Philip W. Suggs Middle School	Webinar
Perea	Anna	Centers for Disease Control and Prevention	Webinar
Perry	Tasha	Texas A&M University - Kingsville	On-Site
Piesman	Joseph	Centers for Disease Control and Prevention	On-Site
Pollack	Richard	Boston University	Webinar
Pongsiri	Montira	U.S. EPA	On-Site

Promoting Community IPM for Preventing Tick-Borne Diseases **Conference Participants**			
Last Name	**First Name**	**Organization**	**Participation**
Pound	Mat	USDA-ARS Knipling-Bushland U.S. Livestock Insects Research Lab.	On-Site
Price	David	PermaTreat Pest Control	On-Site
Proctor	Katrina	Central Massachusetts Mosquito Control	Webinar
Raiche	Paul	Derry Health Department	Webinar
Reid	Jennifer	Ridgefield Health Department	On-Site
Rentz	Terra	The Wildlife Society	On-Site
Richardson	Mark	Brookside Gardens	On-Site
Ridge	Gale	CT Agricultural Experiment Station	Webinar
Robbins	Richard	Armed Forces Pests Mgt Board / DOD	On-Site
Rohm	John	Virginia Department of Game & Inland Fisheries	On-Site
Romero	Sarah	Beyond Pesticides	Webinar
Rose	Peter		Webinar
Rosenberg	Robert	National Pest Management Association	On-Site
Russell	Benjamin	Pennsylvania Dept. of Environmental Protection - Vector Mgt	Webinar
Schoessler	Sally	National Association of School Nurses	On-Site
Schuster	Greta	Texas A&M University - Kingsville	On-Site
Serocki	Nichole		Webinar
Sheffer	Gail	York Lyme Disease Support Group	Webinar
Simpson	Bill	Kennebunk School Department	Webinar
Skillen	James	RISE (Responsible Industry for a Sound Environment)	On-Site
Smith	Brooke		Webinar
Smith	Joshua	Fairfax County Health Department	On-Site
Smith	Patricia	Lyme Disease Association, Inc.	On-Site
Smith	Thomas	Penn State Coop. Ext.	Webinar
Song	Junes	Interstitial Cystitis Alternative Medicine Association	Webinar
Spagnoli	Julie	FMC	Webinar
Sprague	David	U.S. EPA	Webinar
Stafford	Kirby	CT Agricultural Experiment Station	On-Site
Stamer	Gary	Chemtec Pest Control	On-Site
Steiner	John	NaturaLawn of America	On-Site
Stewart	Iris		Webinar
Stinson	Pamela	Auburn School Department	Webinar
Stotts	Donna	University of Maryland	Webinar
Stromdahl	Ellen	U.S. Army Public Health Command	On-Site
Sweeney	Kevin	U.S. EPA Office of Pesticide Programs	On-Site
Telford	Sam	Tufts University	Webinar
Thompson	Victoria	MCMEC	Webinar
Tietze	Claudia	TinyTimmy.org	Webinar
Timothy	McGlinchy	Central Mass Mosquito Control	Webinar
Todaro	Bill	Allegheny County Health Department	Webinar
Toliver	Marcee	NC Dept. of Environment and Natural Resources, PHPM	On-Site

Promoting Community IPM for Preventing Tick-Borne Diseases **Conference Participants**			
Last Name	**First Name**	**Organization**	**Participation**
Torpy	Steve	Loudoun County (VA) Parks, Recreation and Community Services	On-Site
Torrey	Lisa	National Tick-Borne Disease Advocates	Webinar
Tracz	Dennis	141 Repellent, Inc.	Webinar
Tufts-Moore	Susan		Webinar
Varga	Denise		Webinar
White	Kathy	Lyme Association of Greater Kansas City, Inc.	On-Site
White	Kimberly		Webinar
Worn	Robin		Webinar
Wright	Chelsea		Webinar
Zarba	Christopher	U.S. Environmental Protection Agency	On-Site
Zielinski-Gutierrez	Emily	Centers for Disease Control, Division of Vector-Borne Diseases	On-Site