2018 Annual Report of the Fire Island National Seashore
Tick Monitoring Program

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ABSTRACT

The Fire Island National Seashore (FIIS) Tick Monitoring and Management Program was first implemented in 2008 in response to the negative effects increasing tick populations had on park operations, specifically at the William Floyd Estate (WFE). In the past ten years, FIIS has been monitoring tick populations of different species at the WFE in order to respond to human health risks from tick-borne diseases. This site is unique in that high visitor-use areas are a part of a cultural landscape, and this distinction prohibits new structures, such as boardwalks, that would otherwise help visitors avoid vegetation and exposure to ticks. This monitoring does not only help protect the public and park employees but ensures the park's responses are appropriate. The National Park Service (NPS) is responsible for protecting all wildlife, including insects and animals that could be affected by the application of pesticides to manage ticks. This document outlines the tick monitoring program and the results from the 2018 season.

INTRODUCTION

Over the past few decades, Long Island and Fire Island have seen an increase and shift in tick species populations. Fire Island National Seashore (FIIS) has recognized this increased population and associated tick-borne diseases, as well as identified impacts to park operations. In response, the park created a Tick Monitoring and Management Program for areas of FIIS where people have a greater risk of coming into contact with ticks.

In particular, the William Floyd Estate (WFE) is the focus of FIIS's tick monitoring efforts due to the large tick numbers and the estate's unique cultural conditions. As guided by the Development Concept Plan and the Interpretive Prospectus, the integrity of the WFE's cultural landscape, among other historical and cultural resources, are to be stabilized and interpreted by FIIS. Consequently, landscape management such as constructing boardwalks, though effective for keeping people away from tick habitat, is not a feasible option. This is especially the case around the historic Old Mastic House, outbuildings and cemetery, where the WFE experiences the majority of its visitor contact. In contrast, other sites in the park, especially park sites on Fire Island, have relatively extensive networks of boardwalks allowing visitors to avoid contact with tick habitat. Pesticide applications to decrease tick populations is difficult, costly, and can have negative impacts on the wildlife within the park and therefore the use of boardwalks is a preferred method in protecting people from ticks.

Monitoring efforts focus on tick species that are associated with Lyme disease, Human Granulocytic Anaplasmosis (HGA) and Human Monocytic Ehrlichiosis (HME), which are found on Long Island. The primary vectors for Lyme disease and HGA are adult and nymph deer ticks (*Ixodes scapularis*). The main vectors for HME are adult and nymph lone star ticks (*Amblyomma americanum*). In order for a consistent monitoring program, the FIIS Tick Monitoring and Management Program relies on the Tick Population Monitoring and Management Protocol for the William Floyd Estate (Protocols) (Appendix A) to provide guidance to staff on the proper techniques, data management, and disease response required to maintain an efficient program. The Protocols contain specific criteria for varying levels of alert and action in response to tick populations.

The NPS currently monitors for ticks at the William Floyd Estate from late spring to late fall. Tick monitoring is presently conducted in seven high visitor and staff use areas. Tick abundance thresholds for human health risk have been developed with the United States Geological Survey (found in the Protocol) and, if these abundance levels are reached, specific action(s) to protect human health will be taken. This may include increasing tick safety education programs, closing park areas to the public, and/or pesticide applications.

Tick Biology

Ticks are small, blood-feeding invertebrates in the spider family that are found throughout much of the world. On Fire Island three main species can be found, the deer tick or black legged tick (*Ixodes scapularis*), the dog tick (*Dermacentor variabilis*) and the lone star tick (*Amblyomma americanum*). All three species are most often found in the back dune and forested areas, in tall grasses and shrubs. Unfortunately, ticks can serve as disease vectors, transmitting infectious diseases from animals to humans.

These main tick species progress through their two year life cycle, from eggs to larvae to nymphs to adults, by taking a blood meal from vertebrate hosts. On Fire Island, ticks will take a blood meal from animals such as rodents, red fox, white-tailed deer, and birds. After feeding, larvae and nymphs typically drop from their host to the ground and either molt or overwinter until the following spring, and then emerge as nymphs or adults, respectively. Ticks can survive under the cover of leaf litter and enter a state of reduced activity during low temperatures. After mating, females lay eggs in the leaf litter and die.

Some rodents, like mice and rats, are "reservoir" hosts and, unlike other animal hosts, they carry the bacterium that causes Lyme disease. Larval ticks have not been shown to carry the bacterium that causes Lyme disease because they have not fed on an infected host. During the nymph and adult stages, a tick that has taken a blood meal from a reservoir host can then transmit the bacterium that causes Lyme disease to the next animal it feeds on, including domestic pets or humans.

In the Northeastern U.S., deer tick nymphs are most active in early summer and adult tick activity peaks in spring and again in autumn. In contrast, all life stages of lone star ticks are active from late spring to early fall. While Lyme disease is the tick-borne disease of primary concern on Fire Island, other tick-borne diseases have been documented in the area including Ehrlichiosis, babesia, and anaplasmosis. The various life stages, number of hosts and diseases, and differences in peak activity can be confusing so it is best to take safety measures whenever we encounter tick habitat.

METHODS

Active monitoring consists of using standard tick dragging techniques. The same seven sites are dragged every year. A 5m quadrat is dragged at each of these sites with a 1m x 1m white flannel cloth. The ticks from each site are counted and identified to life stage and species.

The seven monitoring sites that were monitored this year were 1) in the cemetery, just south east of the entrance gate; 2) directly in front of the visitor entrance to the Old Mastic House; 3) in the center of the lawn, approximately 20 meters south of the old Mastic House; 4) directly in front of the Interpretive Rangers Office entrance; 5) approximately 20 meters east of the old barn; 6) around the maintenance shop and equipment; and 7) adjacent to employee housing unit (Figure 2). A description of the methods can also be found in the Protocols (Appendix A).

RESULTS

In 2018, tick dragging occurred five times (May, June, July, August, and September) and an estimated total of 741 ticks were collected (Table 1). The life stages collected of *A. americanum* and *I. scapularis* varied. Larval and nymphal ticks of *I. scapularis* and *A. americanum* were collected, *A. americanum* adults were the only adults collected, and no life stages of *D. variabilis* were sampled (Table 2). Dragging did not produce high numbers of disease carrying ticks and therefore sampling did not meet threshold numbers for management actions as outlined in the Protocols (Appendix A).

The highest number of ticks collected of a species was *A. americanum* larval ticks, and the month that produced the most ticks was September (Figure 1). The highest amount of nymphal and adult ticks collected was also *A. americanum* but was collected in May. August and September are typically the peak months in larval activity. High numbers of *A. americanum* tick larvae have also been seen in 2010 (N= 124), 2012 (N= 159), 2013 (N=118), 2014 (N=160), 2015 (193), 2016 (1041), and 2017 (174). *A. americanum* larvae can often be dragged in large numbers or "tick bombs" because larvae from egg masses stay close together while questing (searching for hosts).

DISCUSSION

The tick monitoring program at the WFE is implemented more efficiently and effectively each year. The goal is to have every month from May through September monitored at least once. Typically, time constraints of the Natural Resource Management (NRM) staff plays a large role in the ability to monitor the ticks monthly. This particular issue did not seem to persist throughout the 2018 season and monitoring occurred every month through September. In conjunction with time constraints, weather plays a large role in monitoring ticks. Climatic conditions should be such that ticks will be active and easy to collect ensuring that data collected is accurate. Rain, dew, heat, and humidity all affect the activity of ticks. In 2019, efforts in monitoring at least once a month will continue and with a plan to train volunteers or an intern for the 2019 season, this goal should be accomplished.

Tick-borne diseases are a concern for not only the public visiting the park but for the employees of FIIS. Public education efforts include signage when walking near areas of high tick densities, impromptu discussions while conducting tick drags or being seen out in the field, as well as a presentations to the public on tick information and safety. The combination of these efforts have proven to be successful in reaching the public and promoting tick safety. As part of FIIS's efforts in reducing the prevalence of Lyme disease amongst employees, NRM has provided "tailgate sessions" in the beginning of each season to discuss ticks, tick-borne diseases and other arthropod illnesses that they have the potential to contract. The discussions include topics like life stages of ticks, which tick species to be aware of, and the use of proper personal protective equipment (PPE) that will keep them safe from tick bites. NRM staff provides employees with the data collected after each monitoring effort at the WFE so staff are aware of the tick population and are reminded to protect themselves. There is also a compilation of data, linked to our network, to allow to staff to see population numbers over the years. In 2019, tailgate sessions and public outreach will be a continued effort for FIIS's tick monitoring program.

TABLES AND FIGURES

Table 1. Ticks collecting during monitoring in 2018. LL= larvae, NN= nymphs, FF= adult female, MM= adult male.

2018		A. americanum				I. scapularis				D. variabilis				
	Life stage	LL	NN	FF	MM	LL	NN	FF	MM	LL	NN	FF	MM	TOTALS
May	Cemetery	0	20	3	5	0	1	0	0	0	0	0	0	29
	Visitor Ent.	0	3	0	3	0	0	0	0	0	0	0	0	6
	Main lawn	0	5	1	0	0	0	0	0	0	0	0	0	6
	Green building	0	2	0	0	0	0	0	0	0	0	0	0	2
	Out buildings	0	5	0	0	0	0	0	0	0	0	0	0	5
	Maint shop	0	7	2	2	0	0	0	0	0	0	0	0	11
	Employee housing	0	1	0	0	0	0	0	0	0	0	0	0	1
June	Cemetery	0	7	0	0	0	0	0	0	0	0	0	0	7
	Visitor Ent.	0	1	0	0	0	0	0	0	0	0	0	0	1
	Main lawn	0	4	0	0	0	0	0	0	0	0	0	0	4
	Green building	0	2	0	0	0	0	0	0	0	0	0	0	2
	Out buildings	0	3	0	0	0	0	0	0	0	0	0	0	3
	Maint shop	0	3	0	1	0	0	0	0	0	0	0	0	4
	Employee Housing	0	0	0	0	0	0	0	0	0	0	0	0	0
July	Cemetery	0	8	2	2	0	0	0	0	0	0	0	0	12
	Visitor Ent.	0	0	0	0	0	0	0	0	0	0	0	0	0
	Main lawn	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green building	0	0	1	0	0	0	0	0	0	0	0	0	1
	Out buildings	45	0	0	0	0	0	0	0	0	0	0	0	45
	Maint shop	0	1	0	0	0	0	0	0	0	0	0	0	1
	Employee Housing	21	0	0	0	3	0	0	0	0	0	0	0	24
August	Cemetery	91	0	1	0	1	0	0	0	0	0	0	0	93
	Visitor Ent.	15	0	0	0	2	0	0	0	0	0	0	0	17
	Main lawn	4	0	0	0	0	0	0	0	0	0	0	0	4
	Green building	13	1	0	0	0	0	0	0	0	0	0	0	14
	Out buildings	6	1	0	0	0	0	0	0	0	0	0	0	7
	Maint shop	0	0	0	0	0	0	0	0	0	0	0	0	0
	Employee Housing	16	0	0	0	1	0	0	0	0	0	0	0	17
September	Cemetery	135	0	0	0	1	1	0	0	0	0	0	0	137
	Visitor Ent.	73	1	0	0	5	0	0	0	0	0	0	0	79
	Main lawn	121	0	0	0	4	0	0	0	0	0	0	0	125
	Green building	7	2	0	0	0	0	0	0	0	0	0	0	9
	Out buildings	6	2	0	0	0	0	0	0	0	0	0	0	8
	Maint shop	27	0	0	0	3	0	0	0	0	0	0	0	30
	Employee Housing	33	2	0	0	2	0	0	0	0	0	0	0	37
	TOTALS	613	81	10	13	22	2	0	0	0	0	0	0	741

Table 2. Totals collected for the 2018 monitoring season

Amblyomma americanum				*Ixodes scapularis*				*Dermacentor variabilis*			
LL	NN	FF	MM	LL	NN	FF	MM	LL	NN	FF	MM
613	81	10	13	22	2	0	0	0	0	0	0

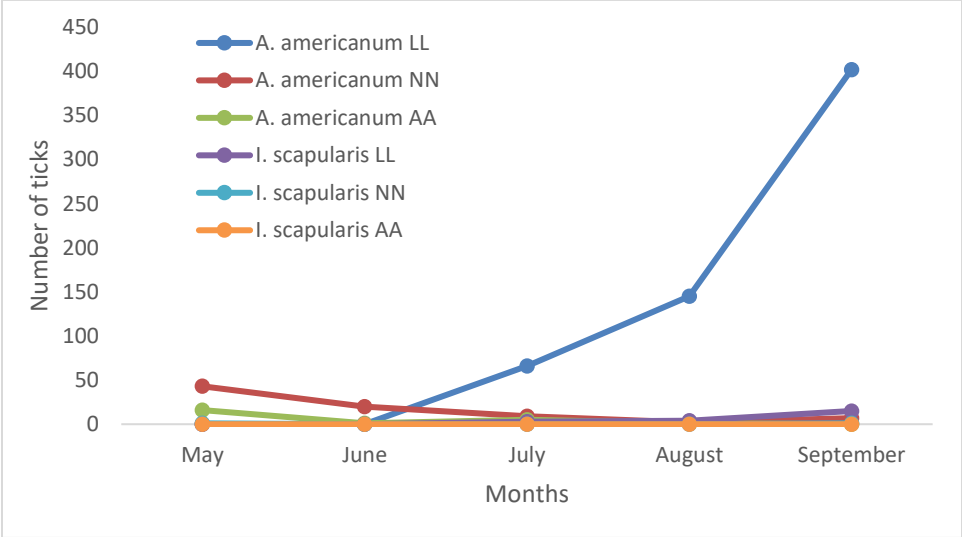

Figure 1. Number of *I. scapularis* and *A. Americanum* collected each month of the 2018 monitoring season. AA is combined adult males and females. (*D. variabilis* was not included in this graph since there were no samples collected throughout the season.)

Figure 2. Map of monitoring sites at the William Floyd Estate.

APPENDIX A

TICK POPULATION MONITORING AND MANAGEMENT PROTOCOL FOR THE WILLIAM FLOYD ESTATE

FIRE ISLAND NATIONAL SEASHORE

The purpose of this document is to present a protocol to monitor tick abundance and to establish criteria for active management of tick populations at the William Floyd Estate (WFE) of Fire Island National Seashore (FIIS), in order to minimize tick-borne disease exposure to visitors and employees. Several studies have shown that a substantial percentage of ticks, especially deer ticks, on Long Island are carrying pathogens that pose a threat to human safety. In the past several years, the WFE has especially experienced increasing populations of ticks. This increase has been negatively impacting park operations and public educational programs due to the great concern of disease risk. These efforts shall focus on management of diseases vectored by deer ticks (*Ixodes scapularis*) with the primary focus being on Lyme disease.

The rationale for the WFE being the focus of tick management efforts is due not only to the large tick numbers, but to the Estate's unique conditions as well. As guided by the Development Concept Plan and the Interpretive Prospectus, the integrity of the WFE's cultural landscape, among other historical and cultural resources, are to be stabilized and interpreted by FIIS. Consequently, landscape management such as constructing boardwalks, though effective, is not a feasible option as a method to reduce tick-human interactions. This is especially the case around the historic Old Mastic House, outbuildings and cemetery, where this Park site experiences the majority of visitor contact. In contrast, other sites in the park on Fire Island have relatively extensive networks of boardwalks, allowing visitors to avoid contact with vegetation and hence ticks. The park informs visitors about the ticks and we encouraged them to stay on these boardwalks. Park employees are also constantly reminded of the dangers of working in areas with ticks. Moreover, those who may need to expose themselves to the vegetation can properly protect themselves by wearing personal protective equipment (PPE). Thus, with the proper education, PPE and precaution, these areas do not pose an imminent safety threat to visitors and employees.

Criteria for active management at the William Floyd Estate:

The decision to manage tick populations by chemical means will depend on the abundance of ticks in the high-traffic areas for employees and visitors. Because these conditions vary from year-to-year and season-to-season, the park should refer to this process to determine whether the situation warrants intervention (pesticide application), which is to be addressed on a case-by-case basis. The following should be considered BEFORE any chemical application to control ticks:

1.) the tick abundance strongly suggests that there is an imminent disease risk to people; and
2.) the risk of disease transmission to humans will be reduced by the intervention * (i.e. the tick abundance will be immediately and substantially lowered below the established threshold by the pesticide application); and
3.) the use of pesticides at the William Floyd Estate is more effective than other available approaches to managing this disease risk (e.g. education, personal protective equipment, etc.). Most studies to date have shown little to no efficacy of pesticides applied to the landscape in preventing tick or mosquito borne illnesses. The best means of reducing these illnesses is to properly use PPE (per communication with Dr. Danielle Buttke). Moreover, the potential for a rapid re-infestation of a treated site is high, especially at the WFE making a chemical treatment hardly worth the effort.

*The population trend and cycle of ticks should be taken into account before any pesticide application. For example, if adult and nymphal tick activity is expected to decrease during the considered application time, such as in late summer to early fall, chemical treatment should be reconsidered.

Specific criteria for level of monitoring and management:

Three levels of action are proposed: (1) Education and Passive Monitoring, (2) Active Monitoring, and (3) Imminent Health Risk and Tick Management. Based on data collected from monitoring, guidelines present decision-making criteria to determine the level of action. Similarly, arrangements for possible pesticide applications or other management interventions (to be applied in accordance with this protocol) should be completed before any pesticide application. These arrangements will include pesticide-use approval, arranging for applicators (if no staff in the park is certified to do so), etc. Non-chemical management interventions can include mowing of high-risk areas, use of a leaf blower to remove leaf litter and increase desiccation of ticks

present, or placement of a mulch border between visitor use area and tick habitat. Decisions to move to higher levels will be made by park staff, in consultation with appropriate experts if needed.

Pre-Season Preparations

As a first step to this process, the product and active ingredient to be used should be considered. Once this has been decided, a proposal for the treatment should be submitted and approved through the National Park Service's Pesticide-Use Proposal System (PUPS). This is a critical step, as no pesticides may be applied within the boundary of the park before going through this approval process and being authorized for the application by the Regional or National Integrated Pest Management Coordinator(s).

Level (1) - Education and Passive Monitoring

Criteria for move to Level (1): Nymphal and adult deer ticks and lone star ticks are active in the spring and early summer, generally starting around mid-March. Depending on the weather during the winter-spring transition, their activity can start even earlier. Therefore, this level should begin in April or when staff start reporting tick encounters, whichever comes first.

Education consists of park brochures, interpretive programs, emails, etc., to inform the public and employees about ticks, the potential for disease transmission, associated monitoring and management programs and proper protection against ticks and tick-borne diseases. Efforts in Level (1) shall focus on education and prevention.

Monitoring in this level consists of passive observations and reports from staff and visitors about their encounters with ticks.

Level (2) – Active Monitoring

Criteria for move to Level (2): Adult and nymphal tick activity generally peaks in April/May and June, respectively. However, substantial reports of tick encounters from staff are also a good indicator that there is a heavy infestation of ticks. Therefore, the park should move to Level (2) in May or when a substantial number of field staff report concerns about tick population abundance, whichever comes first.

Active Monitoring will be implemented using standard tick dragging techniques. For consistency purposes, monitoring will occur approximately in the same sites within each of the general areas of concern. A $25m^2$ quadrat will be established at each monitoring site. A 1m x 1m white flannel cloth will be used to drag within these quadrats, for a total of 5 drags per site. If a new monitoring area is established that does not have enough space to set up a $25m^2$ (5m x 5m) quadrat, an equivalent area of $25m^2$ should be dragged with the 1m wide drag cloth. Monitoring should be implemented at least once a month.

Monitoring Sites are currently located in 7 areas at the William Floyd estate: 1.) in the cemetery, just south east of the entrance gate; 2.) directly in front of the visitor entrance to the Old Mastic House; 3.) in the center of the lawn, approximately 20 meters south of the Old Mastic House; 4.) directly in front of the Interpretive Ranger Office (green building) entrance; 5.) approximately 20 meters east of the Old Barn (i.e. area surrounded by the out-buildings); 6.) around the maintenance shop and equipment; and 7.) adjacent to employee housing unit. New monitoring sites should be established in consideration of altering conditions and situations and when deemed appropriate by staff.

In Level (2), efforts of continual public and employee education will still occur. Supervisors will be strongly recommended to supply their field staff with proper PPE, such as Tyvek suits/pants, gaiters, tick removal devices and repellants. Treating Tyvek suits/pants and boots with permethrin at least 2 hours before use (24 hours beforehand is recommended) can be extremely effective in reducing the risk of an attached tick. Supervisors should provide their respective staffs with this standard PPE.

Level (3) - Imminent Risk and Tick Management

Criteria for move to Level (3): Response to each of the areas will be different, depending on monitoring data collected from their respective monitoring sites. Therefore, although certain area(s) may be increased to Level (3), the other(s) may not be because the criteria were not met for that area. An increase to Level (3) for each of the areas will result if the criteria for active management (above) are met and when the following thresholds are reached:

1.) at least five nymphal deer ticks (not in a cluster) are detected within the sampling quadrat, each tick should be a at least 15 cm away from each other. This excludes a "nest type situation", which would not be representative of the site being dragged.

This process can result in an increase to Level (3) if such action is deemed appropriate by the park staff after consultation with the appropriate experts and in accordance with NPS Management Policies. The decision should be unanimous among the Cultural Resources Manager, the Chief of Natural Resources Management and the Park Biologist. If a consensus cannot be reached among these staff members, outside tick and health experts (such as from USGS, CDC, the County, etc.) should be consulted. The park superintendent ultimately has the authority to make the final decision.

Tick Management should be considered if the area(s) meets all these criteria. Once the proper approvals and arrangements are made, the park can carry out the treatment in the areas that warrant such a response (through a contracted NYS certified applicator monitored by the Park Biologist). Every effort should be taken to minimize drift and effects to non-target species. A Notice of Pesticide Application should be posted before the application to inform visitors and employees of the treatment, product, re-entry period (recommended as 24-48 hours after treatment) and any precautions that need to be taken (see Appendix A). A copy of the product label and MSDS should be provided to the site staff, if it has not already.

IMPORTANT NOTE: Most pesticides that are traditionally used for tick control are extremely toxic to bees and some aquatic wildlife. To minimize these effects, the product label should be followed carefully and, as a precaution, the application should take place in the evening, when bees are no longer foraging.

Post-Treatment Monitoring will be implemented shortly after the re-entry period to determine the effectiveness of the application. Regardless of which areas were treated, all monitoring sites should be surveyed during post monitoring, in order to determine if the treatment was effective by using a simple comparison analysis of treated versus non-treated (control) areas. The same monitoring techniques will be used as described above.

Conclusion of Active Tick Monitoring

The active monitoring may conclude when there is an average of less than one adult and/or nymphal tick collected in all of the monitoring sites for two consecutive surveys. Data should be filed and stored.

Notice of Pesticide Application

United States Department of Interior

National Park Service
Fire Island National Seashore
120 Laurel Street
Patchogue, New York

NOTICE OF PESTICIDE APPLICATION
STOP -READ BEFORE ENTERING

PESTICIDE TRADE NAME: _____

ACTIVE INGREDIENT(S): _____

_____

TARGET PEST(S): _____

_____

SPECIFIC AREAS / SITE TO BE TREATED: _____

_____

PRECAUTIONS: _____

_____

DATE & TIME POSTED: DATE:_____; TIME:_____(AM_PM)

DATE & TIME OF SCHEDULED APPLICATION: DATE:_____; TIME:_____(AM_PM)

DATE & TIME OF RE-ENTRY: DATE:_____; TIME:_____(AM_PM)

CONTACT NAME: _____ **(CAPITOL LETTERS)**

CONTACT PHONE:_____

CAUTION-PESTICIDES ARE TOXIC CHEMICALS. The degree of risk depends upon the degree of exposure, so exposure should be minimized. If within 24 hours following application you experience symptoms similar to common seasonal illness comparable to the flu, contact your physician or poison control center. Poison Control Center : 1-800-222-1222