

**4-POSTER
DEER TICK MANAGEMENT PROJECT^{ON}
CAPE COD, MARTHA'S VINEYARD^{AND} NANTUCKET ISLAND
2007 - 2010**



**Cape Cod Cooperative Extension
Barnstable, MA**



Table of Contents

Part 1	Synopsis	Page 3
Part 2	Project description	Page 4
Part 3	Site Layout –CC&I	Page 5
Part 4	Treatment/Control Sites	Page 6
Part 5	Corn Consumption	Page 14
Part 6	Permethrin Application	Page 17
Part 7	Station Maintenance	Page 19
Part 8	Nymph Deer Tick Comparison	Page 21
Part 9	Adult Deer Tick Comparison	Page 24
Part 10	Nymph Deer Tick Infection	Page 25
Part 11	Adult Deer Tick Infection	Page 26
Part 12	Deer Sample Residual Wipes	Page 27

PART 1 - SYNOPSIS

This project was initiated in September, 2007 by Barnstable County Cooperative Extension following issuance of permit 072.07LP from the MA Division of Fisheries and Wildlife. In 2008, project continuance was secured by research permit #012.08LP after mandated reporting and discussion of the project. In 2009, the project continued with permit #016.09LP and in 2010 with project permit 031.10LP.

As noted, the permittee shall report in writing, stating, ‘the progress of the project and summarizing the data collected and results analyzed including, but not limited to: amount of corn/bait used, number of deer sampled for ticks and residue, areas sampled for ticks and the number of ticks collected from deer and the study area.’

As described (see Part 2), seven treatment sites and seven control sites are established, with four treatment/ four control sites in Barnstable County, MA (zone 12), two treatment/ two control sites in Dukes County, MA (zone 13) and one treatment/one control site in Nantucket Island, MA (zone 14). A total of forty-two deer stations are erected and activated in these sites, with eighteen stations in zone 12, twenty stations in zone 13 and four stations in zone 14 (see page 6).

As per protocol, stations were provided with whole, re-cleaned corn and treatment rollers activated with a 10% solution of permethrin (labeled as ‘tickicide’) beginning on March 15, 2010, then deactivated by June 15, 2010. Following months of inactivity, stations were activated on September 15, 2010 and all stations were deactivated by November 15, 2010.

Stations were visited and maintained at regular intervals with corn and tickicide added, as per label directions. In 2010, 9,000 pounds of corn (4090.9 kg) and 273 ounces of tickicide (8.07 liters) were added to stations.

Deer tick nymphs were sampled beginning in May and adults were sampled in October, providing an estimate of the tick population and ultimately, comparison between the treatment and control sites. Nymph tick populations in treated and control sites are compared to similar samples obtained two years prior, as this generation of ticks ultimately gives rise to the succeeding population. Thus, nymph ticks sampled in an even year will give rise to the new generation of nymph ticks only in the next even numbered year. Nymph ticks sampled in an odd year will be compared with the succeeding odd year population.

The 4 –poster project in progress, with all stations established appropriately and operational as per product label and permit requirements. The project is funded by a EPA ‘RARE’ grant through December 31, 2011.

Part 2 - PROJECT DESCRIPTION

In this project, 4-poster deer baiting stations were activated from March 15-June 15 and from September 15-November 15, then deactivated prior to shotgun hunting season and through the winter months from 2007-2010.

Multiple stations are arrayed within approved areas at coverage of ca. one station per 150 acres, and each station is maintained weekly or biweekly, with corn added as needed and acaricide added biweekly, dependent upon corn consumption.

Inputs to each station, including the amount of corn consumed monthly, the volume of permethrin, the number of station visits, as well as the any necessary replacements or repairs are documented.

As during the previous trial, nymph ticks were sampled by the cloth drag procedure, and each treatment area was sampled in May, in June and in July, as were all control areas. The numbers of deer tick nymphs and adults were compared.

Additionally, each treatment and each control site were drag sampled in October in order to count and collect adult deer ticks for site comparison.

Annual results will be submitted yearly for reapplication of the letter permit from MA Wildlife and a comprehensive four-year summary will provide thorough documentation of the project. This effort is viewed as complementary to the stated goal density in wildlife management zones 12-13-14, in an effort to reduce the number of cases of tick-borne illnesses.

The 4-poster concept is regarded as a management tool, not a panacea, in the sustained challenge to control ticks and their transmitted diseases. It would be particularly helpful to have a tool such as the 4-poster as an option for use in areas like Barnstable County, which is currently at the stated (desired) deer density, yet continues to be plagued by tick-borne diseases (S. Soliva, MA DPH, pers. comm.)

PART 3 – SITE LAYOUT – CC&I

Seven sites are designated as treatment (**red icons**) and seven sites as control (**white icons**). Town, number of stations in each site, and coordinates of sites are provided in Table 1, below.



Table 1. Overview of treatment and control sites on Cape Cod and the Islands.

Treatment Sites	Town	Number of Stations	Latitude	Longitude
BARNSTABLE COUNTY				
1. Bell’s Neck	Harwich	4	41.680891	070.119802
2. Dennis Pond	Yarmouth	4	41.694104	070.255179
3. Bridge Creek	Barnstable	4	41.701463	070.377569
4. Shawme Crowell	Sandwich	6	41.762437	070.523490
DUKES COUNTY				
6. Cedar Tree Neck	West Tisbury	5	41.433444	070.699473
7. Chappaquiddick Island	Edgartown	15	41.384505	070.479044
NANTUCKET COUNTY				
5. Loring Nature Center	Nantucket	4	41.292226	070.169995
		42		
Control Sites	Town			
BARNSTABLE COUNTY				
Burgess Wildlife	Sandwich	--	41.734007	070.430091
Jehu Pond	Mashpee	--	41.568500	070.108269
Syrjala Conservation	Dennis	--	41.657247	070.224257
Punk Horn Conser.	Harwich	--	41.718950	070.224257
DUKES COUNTY				
Fulling Mill Conser.	Chilmark	--	41.356251	070.720680
Sepiessa Point Conser.	West Tisbury	--	41.370968	070.647201
NANTUCKET COUNTY				
Almanack Pond	Nantucket	--	41.290129	070.004105

PART 4 – TREATMENT/CONTROL SITES

Individual stations within treatment sites are arranged in an array, with each station providing coverage for ca.150 acres. Coordinates of sites and stations within sites, as well as pertinent data for each site are noted below.

Treatment Site 1



**Bells Neck Conservation:41.680891\070.119802
Harwich, MA
4 Stations**

	2007	2008	2009	2010	Total
Corn (lbs)	400	2010	1590	400	4400
Permethrin (mL)	400	1910	1970	640	4920
	2007	2008	2009	2010	
Nymphs/h	24	20	28	33	--
Adults/h	176	36	44	180	--

Treatment site 1 is the Bell’s Neck Conservation area in Harwich. This is a 250+ acre tract with adjacent conservation woodland (ca. 200 acres) and upland cranberry bogs (100 acres). Four stations are erected in this 600 acre treatment site. The area is bordered by the East and West Harwich Reservoirs to the north and Swan pond to the west. The area is south of the mid-Cape Highway.

Bells Neck (Harwich)					
	CC-15	Bike Trail	On left past bike trail	41.68525	070.11243
	CC-16	Hill Top	On left road off main	41.68144	070.11277
	CC-17	Cranberry Bog	Left of cranberry bog	41.68110	070.11643
	CC-18	Flume Area	Flume side-County Rd.	41.68180	070.12292

Control Site 1C



**Punk Horn Conservation 41.718950/070.098322
Harwich, MA**

	2007	2008	2009	2010
Nymph/h	154	112.8	213.6	191
Adults/h	112	216	228	136

Control site 1C is the Punk Horn Conservation area, in Brewster/Harwich, consisting of 800 mixed hardwood/coniferous acres. This area is five miles from the treatment site, but is to the north of the mid-Cape Highway. It is bordered by Seymour Pond to the east, and Upper Mill Pond to the northwest.

Treatment site 2



Dennis Pond Conservation: 41.694104\070.255179
Yarmouth, MA
4 Stations

	2007	2008	2009	2010	Total
Corn (lbs)	400	1330	1340	400	3470
Permethrin (mL)	400	1670	1760	640	4470
	2007	2008	2009	2010	
Nymphs/h	23	21.6	32.8	32	--
Adults/h	316	252	824	488	--

Treatment site 2 is the Dennis Pond Conservation area, a Yarmouth town owned site that yields a remarkable number of adult deer ticks. The area is situated near the south of Dennis Pond and four stations will be maintained along the trail and in the adjacent area within a 600-700 acre treatment zone. This area is bordered by Dennis Pond to the northwest and by the mid-Cape Highway to the south.

Dennis Pond (Yarmouth)					
CC-11	Summer Rd.	Side trail on Summer St.	41.69253	070.25313	
CC-12	Willow St.	Left of power line	41.69292	070.25524	
CC-13	Power Line	Behind Summer St.	41.69373	070.25013	
CC-14	Pine Woods	East trail to pine woods	41.69323	070.25434	

Control site 2C

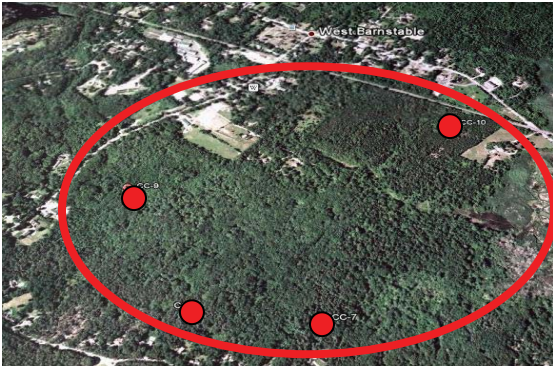


Syrjala Conservation 41.657247/070.224257
Yarmouth, MA

	2007	2008	2009	2010
Nymph/h	66	52.8	38.4	34
Adults/h	188	100	140	312

Control site 2C is the Syrjala Conservation area in Yarmouth (ca. 100 acres), owned by the town. This area is bordered by the mid-Cape Highway to the north and Swan Pond to the east. It is about five miles from the treatment site, but separated by the mid-Cape highway.

Treatment site 3



**Bridge Creek Conservation: 41.701463\070.377569
Sandwich, MA
4 Stations**

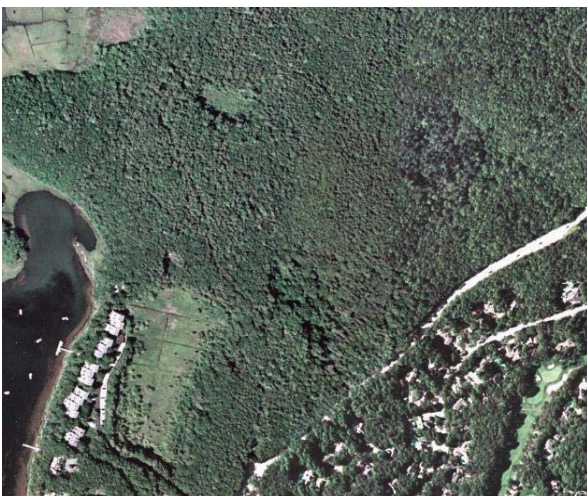
	2007	2008	2009	2010	Total
Corn (lbs)	400	1240	1240	400	3280
Permethrin (mL)	400	1520	1700	640	4260
	2007	2008	2009	2010	
Nymphs/h	152	55.2	28.8	25.6	--
Adults/h	132	176	380	92	--

Treatment site 3 is the Bridge Creek Conservation area located in West Barnstable, owned by the town (ca. 246 acres). Four stations are maintained here and in the area contiguous, generating a 600 acre treatment site. It is bordered by the mid Cape highway to the south and Scorton Creek to the north.

Bridge Creek (Barnstable)					
	CC-7	Jenkins Wildlife	Right trail on right	41.69720	070.36827
	CC-8	Hinckley Rd	Follow road	41.69734	070.37370
	CC-9	Fire Station	Left trail on left	41.69970	070.37320
	CC-10	Railroad North	From 6A to N trail	41.70360	070.36677

Control site 3C

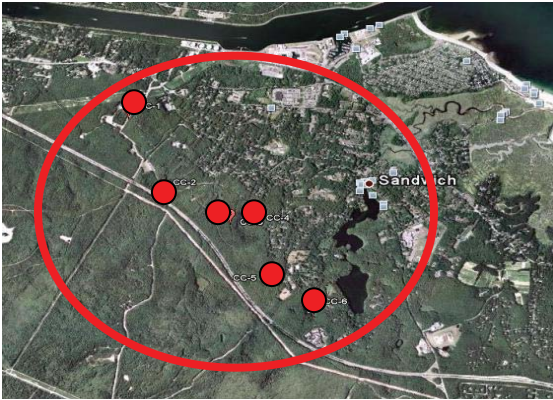
**Jehu Pond 41.56850/070.491378
Mashpee, MA**



	2007	2008	2009	2010
Nymph/h	54	10.4	39.2	37
Adults/h	68	384	212	184

Control site 3C is the Jehu Pond Conservation area, owned by the Town of Mashpee. It is about 100 acres, but is contiguous to the Mashpee national Wildlife Refuge (5,800 acres). It is bordered by Jehu Pond to the west, South Cape Beach to the south and Poponneset Beach to the east.

Treatment site 4



**Shawme Crowell State Forest: 41.762437\070.523490
Sandwich, MA
6 Stations**

	2007	2008	2009	2010	Total
Corn (lbs)	600	1770	1810	600	4780
Permethrin (mL)	600	2370	2580	960	6510
	2007	2008	2009	2010	
Nymphs/h	48	11.2	39.2	12.8	--
Adults/h	108	112	180	56	--

Treatment site 4 is the Shawme-Crowell State Forest, a 700+ acre public use site. Six stations are erected and maintained here and on adjacent land held by the Town of Sandwich and the Heritage Plantation, located to the southeast, creating a treatment zone of about 900 acres. The area is bordered by Cape Cod Bay to the northeast, the Cape Cod Canal to the northwest, and the division of the mid-Cape highway, Route 6, to the south.

Shawme Crowell (Sandwich)					
CC-1	Bay View Rd.	Past Gas Co. gate to right	41.76406	070.52580	
CC-2	Group Camping Area	Near Rt. 6 south	41.75639	070.52176	
CC-3	Fire Rd. C	Past Fire Rd. gate on left	41.75354	070.51472	
CC-4	Site B-89	Behind site off trail	41.75345	070.51196	
CC-5	Heritage Trail	Past Coyote Den sign	41.74762	070.51080	
CC-6	Maintenance Garage	In hollow toward road	41.69964	070.37814	

Control site 4C



**Burgess Wildlife Conservation 41.734007/070.430091
Sandwich, MA**

	2007	2008	2009	2010
Nymph/h	24	8.8	24	13.6
Adults/h	172	644	180	84

Control site 4C is the Burgess Conservation area in east Sandwich, a mixed habitat parcel of 243 acres, located about five miles from the treatment site. It is bordered by Hoxie Pond to the west, the mid-Cape Highway to the south, and a tributary of Scorton Creek (tidal) to the east.

Treatment site 5

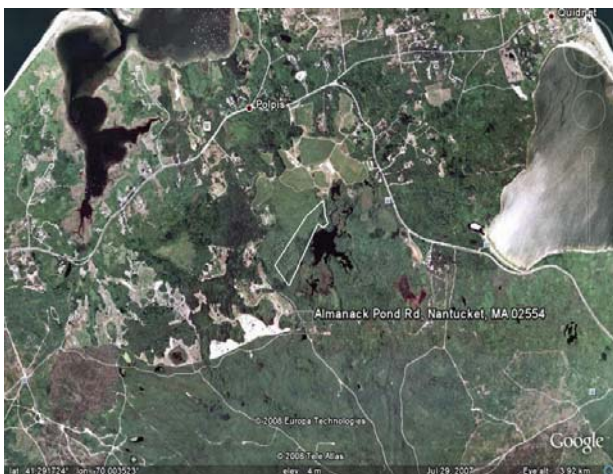


Loring Nature Center		41.292226\070.169995			
Nantucket, MA					
4 Stations					
	2007	2008	2009	2010	Total
Corn (lbs)	2600	7390	3900	800	14690
Permethrin (mL)	1720	4850	2900	640	10110
	2007	2008	2009	2010	
Nymphs/h	40	50	38.4	14.4	--
Adults/h	36	4	56	12	--

Treatment site 5 is a private, approximately 500-acre parcel located in northwest Nantucket between Eel Point Road to the north and Madaket Road to the south, bordered to the west by the North Head of Long Pond. This parcel had two deer stations activated in 2005 and 2006. Two additional stations will be added to this ‘hunting prohibited permanently’ site, to create a 600-acre treated zone.

NANTUCKET					
	N-1	Foundation House	Hill Top House	41.29052	070.17085
	N-2	Pond House	Back house	41.29018	070.16723
	N-3	Crooked Tree	Along road to right	41.28793	070.16644
	N-4	Madaket Rd.	Near Madaket Rd. gate	41.28525	070.16686

Control site 5C



Almanack Pond 41.290129/070.004105
Nantucket, MA

	2007	2008	2009	2010
Nymph/h	75	50	94.4	37.6
Adults/h	80	44	96	108

Control site 5C is a wooded tract (ca. 65 acres), within land held by the Nantucket Conservation Foundation and known as the Almanack Pond area, located in eastern Nantucket, south of Polpis Road. It is bordered to the northeast by several hundred acres of cranberry bog and upland. This area is approximately 8 miles distant from the treatment site, to the east, with these sites divided by the town of Nantucket.

Treatment site 6



Cedar Tree Neck		41.433444\070.699473			
West Tisbury, MA					
5 Stations					
	2007	2008	2009	2010	Total
Corn (lbs)	300	6380	3050	1000	10730
Permethrin (mL)	300	4360	2830	800	8020
	2007	2008	2009	2010	
Nymphs/h	150	48	42.4	58	--
Adults/h	92	124	144	92	--

Treatment site 6 is the Cedar Tree Neck Conservation site managed by the Sheriff’s Meadow Foundation; this 300+ acre, non-hunting area will serve as the treatment core, but several additional stations will be maintained at the area boundary on residential property (ca. 450 acres), with five stations covering the treatment area. The area is a promontory on the northwestern side of the island, bordered by Daggetts Pond and Ames Pond.

DUKES COUNTY					
Cedar Tree Neck	MV-16	Taylor	Right side of Taylor prop	41.42531	070.69401
	MV-17	Irons Trail	500’ trail left	41.43130	070.69684
	MV-18	Hough	Off Fish Hook Rd	41.42380	070.69806
	MV-19	Kinney	Rear of Meadow	41.42773	070.69124
	MV-20	Neck	On Neck site	41.43356	070.70004

Control Site 6C



Fulling Mill 41.356251/070.720680
Chilmark, MA

	2007	2008	2009	2010
Nymph/h	105	85.6	27.2	70
Adults/h	52	92	164	80

Control site 6C is the Fulling Mill Conservation area, a 47 acre wooded tract located seven miles south west of the treatment, and is maintained by the MV Land Bank. This area is bordered by Chilmark Pond to the south, and is dampened by the Fulling Mill Brook.

Treatment site 7



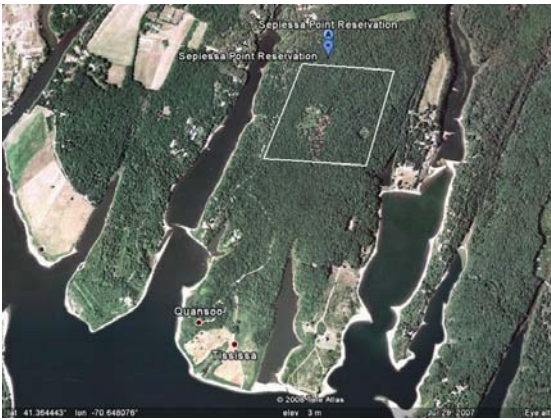
Chappaquiddick Island 41.384505\070.479044
Edgartown, MA
15 Stations

	2007	2008	2009	2010	Total
Corn (lbs)	1500	13700	8550	3000	26750
Permethrin (mL)	1500	9990	8070	3750	23310
	2007	2008	2009	2010	
Nymphs/h	58	31.2	61.6	93	--
Adults/h	160	88	76	64	--

Treatment site 7 is the southeastern Edgartown island of Chappaquiddick, a 3,200-acre wooded and residential tract that includes land held by the MV Land Bank and MA Trustees of the Reservation. Here, nearly 800 acres are barrier beach or unsuitable deer habitat and the treatment area (about 2250 acres) is within the targeted rate of one station per 150 acres. Three subplots, surveyed in 2006, continue to provide tick related data (Poucha Pond, 100 acres; Brines Pond, 40 acres; and Five Corners, 30 acres).

Chappaquiddick	MV-1	Plumb	North Neck Rd.	41.38696	070.48054
	MV-2	Brine II	Litchfield Rd. left	41.38297	070.48146
	MV-3	Murray	Dike Rd. right	41.37696	070.46374
	MV-4	Floyd	Dike Rd. left	41.37794	070.46098
	MV-5	Potter	Chappaquiddick Rd.	41.37656	070.46897
	MV-6	Bettencourt	Old Indian Trail Rd.	41.37610	070.48071
	MV-7	Wilmerding	Off Windward Rd.	41.36291	070.47344
	MV-8	Williams	Garrett Rd.	41.36297	070.46362
	MV-9	Shifter	Wasque Point	41.35365	070.45248
	MV-10	Spiro	Old Poucha Rd.	41.36660	070.48608
	MV-11	Knox	Litchfield Rd.	41.37291	070.48016
	MV-12	O' Connell	Off Litchfield #95	41.37174	070.48916
	MV-13	Green Pastures	Off Mead Rd.	41.36962	070.49192
	MV-14	Brine I	Chappy Rd. left	41.38087	070.49669
	MV-15	Pollock	Off Hotel Ave.	41.37649	070.48822

Control site 7C



Sepiessa Point 41.370968/070.647201
West Tisbury, MA

	2007	2008	2009	2010
Nymph/h	66	23.2	60.8	56
Adults/h	44	32	24	36

Control site 7C is the Sepiessa Point Conservation area (165 acres) held by the MV Land Bank, located on the northeastern edge of Tisbury Great pond in West Tisbury, off County/South Road in the southwestern end. This area is nearly ten miles to the west of the treatment area and on island.

PART 5 - CORN CONSUMPTION

Whole corn is purchased in 50# lots from various grain or agricultural suppliers as needed and is transported to station sites, then loaded into station bins. Initially, each station bin was fortified with 50# of whole, re-cleaned corn. Stations were monitored regularly and, as according to label directions, were refilled as corn was removed. Amounts of corn consumed in each station and in each site are noted below for 2007, 2008 and 2009.

	Station	Designation	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010
Shawme Crowell									
(Sandwich)	CC-1	Bay Rd.	100	220	100	160	100	100	100
	CC-2	Group Area	100	220	50	110	100	100	100
	CC-3	Fire Rd. C	100	220	50	210	100	100	100
	CC-4	Site B-89	100	220	100	210	100	100	100
	CC-5	Heritage	100	220	50	210	150	100	100
	CC-6	Maintenance	100	220	100	210	150	100	100
Total SC			600 lbs	1320 lbs	450 lbs	1110 lbs	700 lbs	600 lbs	600 lbs.
Bridge Creek									
(Barnstable)	CC-7	Jenkins	100	260	50	160	150	100	100
	CC-8	Hinckley Rd	100	260	50	160	150	100	100
	CC-9	Fire Station	100	260	50	160	150	100	100
	CC-10	Railroad	100	260	50	160	150	100	100
Total BC			400 lbs	1040 lbs	200 lbs	640 lbs	600 lbs	400 lbs	400 lbs.
Dennis Pond									
(Yarmouth)	CC-11	Summer Rd.	100	220	100	160	150	100	100
	CC-12	Willow St.	100	220	100	160	200	100	100
	CC-13	Power Line	100	220	150	160	200	100	100
	CC-14	Pine Woods	100	220	100	110	200	100	100
Total DP			400 lbs	880 lbs	450 lbs	590 lbs	750 lbs	400 lbs	400 lbs.
Bells Neck									
(Harwich)	CC-15	Bike Trail	100	310	250	260	200	150	100
	CC-16	Hill Top	100	290	200	260	150	150	100
	CC-17	Cran Bog	100	270	200	210	150	150	100
	CC-18	Flume Area	100	290	200	210	150	100	100
Total BN			400 lbs	1160 lbs	850 lbs	940 lbs	650 lbs	550 lbs	400 lbs.
TOTAL CAPE			1800 lbs	4400 lbs	1950 lbs	3280 lbs	2700 lbs	1950 lbs	1800 lbs

NANTUCKET			Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010
	N-1	Foundation	650	1210	550	700	250	800	800
	N-2	Pond House	750	1410	600	700	300	800	800
	N-3	Crked Tree	650	1360	600	700	300	800	800
	N-4	Madaket Rd.	550	1110	550	700	250	800	800
TOTAL NAN			2600 lbs	5090 lbs	2300 lbs	2800 lbs	1100 lbs	3200 lbs	3200 lbs

			Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010
Chppquiddick (Edgartown)	MV-1	Plumb	100	710	300	350	250	250	200
	MV-2	Brine II	100	760	300	450	200	300	200
	MV-3	Murray	100	860	350	450	300	300	200
	MV-4	Floyd	100	560	400	350	200	200	200
	MV-5	Potter	100	810	400	400	250	350	200
	MV-6	Bettencourt	100	410	400	350	200	250	200
	MV-7	Wilmerding	100	610	350	350	250	250	200
	MV-8	Williams	100	560	250	300	250	250	200
	MV-9	Shifter	100	360	200	350	150	200	200
	MV-10	Spiro	100	810	350	450	300	300	200
	MV-11	Knox	100	410	350	300	150	200	200
	MV-12	O' Connell	100	360	350	300	100	150	200
	MV-13	Green Past	100	610	350	300	200	250	200
	MV-14	Brine I	100	510	250	350	150	200	200
	MV-15	Pollock	100	460	300	350	200	300	200
TOTAL CHAPPY			1500 lbs	8800 lbs	4900 lbs	5400 lbs	3150 lbs	3750 lbs	3000 lbs

Cedar Tree Neck									
(W. Tisbury)	MV-16	Taylor	100	1110	450	500	150	400	200
	MV-17	Irons	100	1260	600	600	150	300	200
	MV-18	Hough	100	960	400	500	100	200	200
	MV-19	Kinney	---	750	350	500	150	300	200
	MV-20	Neck	---	200	300	300	100	50	200
TOTAL MV			300 lbs	4280 lbs	2100 lbs	2400 lbs	650 lbs	1250 lbs	1000 lbs
TOTAL CC			1800 lbs	4400 lbs	1950 lbs	3280 lbs	2700 lbs	1950 lbs	1800 lbs
TOTAL NAN			2600 lbs	5090 lbs	2300 lbs	2800 lbs	1100 lbs	3200 lbs	3200 lbs
TOTAL CHAP			1500 lbs	8800 lbs	4900 lbs	5400 lbs	3150 lbs	3750 lbs	3000 lbs
TOTAL MV			300 lbs	4280 lbs	2100 lbs	2400 lbs	650 lbs	1250 lbs	1000 lbs
GRAND TOTAL			6200 lbs	22570 lbs	11250 lbs	13880 lbs	7600 lbs	10,150 lbs	9000 lbs

Thus, after seven periods of activation, a grand total of 80650 pounds of corn have been consumed, an average of about 1,920 pounds per station. Generally, deer discovered, and then accepted, the stations as feeding points.

PART 6 – PERMETHRIN APPLICATION

Permethrin as a 10% solution known as ‘Tickicide’ and EPA approved/permitted for use in 4-poster devices is dispensed into four vertical fabric rollers at the onset of activation and thereafter based on corn consumption, according to label direction. Amounts of material in stations and sites are noted below.

	Station	Designation	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010
Shawme Crowell									
(Sandwich)	CC-1	Bay Rd.	100	220	190	220	190	160	160
	CC-2	Group Area	100	220	160	190	190	160	160
	CC-3	Fire Rd. C	100	220	160	250	190	160	160
	CC-4	Site B-89	100	220	190	250	190	160	160
	CC-5	Heritage	100	220	160	250	190	160	160
	CC-6	Maintenance	100	220	190	250	220	160	160
Total SC			600 mL	1320 mL	1050 mL	1410 mL	1170 mL	960 mL	960 mL
Bridge Creek									
(Barnstable)	CC-7	Jenkins	100	220	160	220	220	160	160
	CC-8	Hinckley Rd	100	220	160	190	220	160	160
	CC-9	Fire Station	100	220	160	190	220	160	160
	CC-10	Railroad	100	220	160	220	220	160	160
Total BC			400 mL	880 mL	640 mL	820 mL	880 mL	640 mL	640 mL
Dennis Pond									
(Yarmouth)	CC-11	Summer Rd.	100	220	190	220	220	160	160
	CC-12	Willow St.	100	220	190	220	220	160	160
	CC-13	Power Line	100	220	220	220	250	160	160
	CC-14	Pine Woods	100	220	190	190	220	160	160
Total DP			400 mL	880 mL	790 mL	850 mL	910 mL	640 mL	640 mL
Bells Neck									
(Harwich)	CC-15	Bike Trail	100	220	280	280	250	190	160
	CC-16	Hill Top	100	220	250	280	220	190	160
	CC-17	Cran Bog	100	220	250	250	220	190	160
	CC-18	Flume Area	100	220	250	250	220	160	160
Total BN			400 mL	880 mL	1030 mL	1060 mL	910 mL	730 mL	640 mL
TOTAL CAPE			1600 mL	3960 mL	3510 mL	4140 mL	3870 mL	2970 mL	2880 mL

NANTUCKET			Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010
	N-1	Foundation	430	760	400	490	220	550	160
	N-2	Pond House	490	880	430	490	250	550	160
	N-3	Croked Tree	430	850	430	490	250	550	160
	N-4	Madaket Rd.	370	700	400	490	220	550	160
TOTAL NAN			1720 mL	3190 mL	1660 mL	1960 mL	940 mL	2200 mL	640 mL

			Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010
Chappaquiddick									
(Edgartown)	MV-1	Plumb	100	310	280	310	250	250	250
	MV-2	Brine II	100	370	280	340	220	280	250
	MV-3	Murray	100	250	310	340	280	280	250
	MV-4	Floyd	100	370	340	280	220	220	250
	MV-5	Potter	100	340	340	310	250	310	250
	MV-6	Bettencourt	100	280	310	280	220	250	250
	MV-7	Wilmerding	100	460	310	310	250	250	250
	MV-8	Williams	100	460	280	280	250	220	250
	MV-9	Shifter	100	490	250	310	190	190	250
	MV-10	Spiro	100	430	340	340	280	280	250
	MV-11	Knox	100	340	310	280	220	220	250
	MV-12	O' Connell	100	250	340	280	190	190	250
	MV-13	Green Past	100	250	340	310	220	250	250
	MV-14	Brine I	100	340	280	310	220	220	250
	MV-15	Pollock	100	430	310	310	220	280	250
TOTAL CHAPPY			1500 mL	5370 mL	4620 mL	4590 mL	3480 mL	3690 mL	3750 mL
Cedar Tree Neck									
(West Tisbury)	MV-16	Taylor	100	640	340	400	190	340	160
	MV-17	Irons	100	670	430	460	190	250	160
	MV-18	Hough	100	550	340	400	160	310	160
	MV-19	Kinney	---	550	310	400	190	250	160
	MV-20	Neck	---	250	280	280	160	0	160
TOTAL MV			300 mL	2660 mL	1700 mL	1940 mL	890 mL	1150 mL	800 mL
TOTAL CC			1600 mL	3960 mL	3510 mL	4140 mL	3870 mL	2970 mL	2880 mL
TOTAL NAN			1720 mL	3190 mL	1660 mL	1960 mL	940 mL	2200 mL	640 mL
TOTAL CHAPPY			1500 mL	5370 mL	4620 mL	4590 mL	3480 mL	3690 mL	3750 mL
TOTAL MV			300 mL	2660 mL	1700 mL	1940 mL	890 mL	1150 mL	800 mL
GRAND TOTAL		mL	5120	15180	11490	12630	9180	10010	8070
		ounces	171 oz	506 oz	383 oz	421 oz	306 oz	334 oz	273 oz
		gallons	1.3	3.95	2.99	3.29	2.39	2.61	2.13

PART 7 - STATION MAINTENANCE

Visits to each station during the active period include maintenance and refilling with corn and permethrin, cleaning troughs and sundry other chores to keep the deer interested in attendance.

	Station	Designation	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010
Shawme Crowell									
(Sandwich)	CC-1	Bay Rd.	8	9	8	7	7	4	5
	CC-2	Group Area	8	9	8	7	7	4	5
	CC-3	Fire Rd. C	8	9	8	7	7	4	5
	CC-4	Site B-89	8	9	8	7	7	4	5
	CC-5	Heritage	8	9	8	7	8	4	5
	CC-6	Maintenance	8	9	8	7	7	4	5
Bridge Creek									
(Barnstable)	CC-7	Jenkins	8	9	8	7	5	4	5
	CC-8	Hinckley Rd	8	9	8	7	5	4	5
	CC-9	Fire Station	8	9	8	7	5	4	5
	CC-10	Railroad	8	9	8	7	5	4	5
Dennis Pond									
(Yarmouth)	CC-11	Summer Rd.	7	9	6	7	5	4	5
	CC-12	Willow St.	7	9	6	7	5	4	5
	CC-13	Power Line	7	9	6	7	5	4	5
	CC-14	Pine Woods	7	9	6	7	5	4	5
Bells Neck									
(Harwich)	CC-15	Bike Trail	8	9	7	8	8	6	5
	CC-16	Hill Top	8	9	7	8	8	6	5
	CC-17	Cran Bog	8	9	7	8	8	6	5
	CC-18	Flume Area	8	9	7	8	8	6	5

NANTUCKET			Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010
	N-1	Foundation	7	9	5	7	3	5	4
	N-2	Pond House	7	9	5	7	3	5	4
	N-3	Crked Tree	7	9	5	7	3	5	4
	N-4	Madaket Rd.	7	9	5	7	3	5	4

			Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010
Chappaquiddick									
(Edgartown)	MV-1	Plumb	7	8	7	7	4	3	4
	MV-2	Brine II	7	8	7	7	4	3	4
	MV-3	Murray	7	8	7	7	4	3	4
	MV-4	Floyd	7	8	7	7	4	3	4
	MV-5	Potter	7	8	7	7	4	3	4
	MV-6	Bettencourt	7	8	7	7	4	3	4
	MV-7	Wilmerdin g	7	8	7	7	4	3	4
	MV-8	Williams	7	8	7	7	4	3	4
	MV-9	Shifter	7	8	7	7	3	2	4
	MV-10	Spiro	7	8	7	7	4	3	4
	MV-11	Knox	7	8	7	7	4	3	4
	MV-12	O' Connell	7	8	7	7	4	3	4
	MV-13	Green Past	7	8	7	7	4	3	4
	MV-14	Brine I	7	8	7	7	4	3	4
	MV-15	Pollock	7	8	7	7	4	3	4
Cedar Tree Neck									
(West Tisbury)	MV-16	Taylor	5	9	7	7	4	3	4
	MV-17	Irons	5	9	7	7	3	3	4
	MV-18	Hough	5	9	7	7	3	2	4
	MV-19	Kinney	---	9	7	7	4	3	4
	MV-20	Neck	---	9	7	7	2	1	4

PART 8 – NYMPH DEER TICK COMPARISON

From May-August, treatment and control sites were sampled at two week intervals by the drag cloth method and nymph ticks were counted. Values below indicate relative numbers of tick nymphs per hour from the various sites, with five samples averaged per site.

	Nymphs 2006	Nymphs 2007	Nymphs 2009	Nymphs 2011		Nymphs 2008	Nymphs 2010	Nymphs 2012
TREATMENT SITES								
Shawme Crowell	-	48	39.2			11.2	12.8	
Bridge Creek	-	152	28.8			55.2	29.6	
Dennis Pond	-	23	32.8			21.6	36	
Bells Neck	-	24	28.0			20	28.4	
Chappaquiddick	90.7	58	61.6			31.2	93	
Cedar Tree Neck	67	150	42.4			48	58	
Loring Nat Found	-	40	38.4			50	14.4	
Treatment Average		70.7	38.7			33.9	35.2	
CONTROL SITES								
Burgess Conser.	-	24	24.0			8.8	13.6	
Jehu Pond	-	54	39.2			10.4	29.6	
Syrjala Conser.	-	66	38.4			52.8	27.2	
Punk Horn	19.2	154	213.6			112.8	152.8	
Sepiessa Point	-	66	60.8			23.2	56	
Fulling Mill	103.2	105	27.2			85.6	70	
Almanack Pond	-	75	94.4			50	37.6	
Control Average	-	77.7	71.1			49.1	55.3	

PART 8 – total nymph ticks per site

Actual number of nymphs per site-total of all (5) samples for year

	Nymphs 2006	Nymphs 2007	Nymphs 2008	Nymphs 2009	Nymphs 2010	Nymphs 2011	Nymphs 2012
TREATMENT SITES							
Shawme Crowell	-	48	14	49	16		
Bridge Creek	-	152	69	36	32		
Dennis Pond	-	24	27	41	45		
Bells Neck	-	24	25	35	41		
Chappaquiddick	-	29	39	77	93 (4)		
Cedar Tree Neck	-	75	60	53	58 (4)		
Loring Nat Found	-	10	50	48	18		
TREATMENT TOTAL		362	284	339	303		
CONTROL SITES							
Taylor Point	-	24 (4)	11	28	17		
Jehu Pond	-	27 (2)	13	49	37		
Syrjala Conser.	-	69 (4)	66	48	34		
Punk Horn	-	77 (2)	141	267	191		
Sepiessa Point	-	11 (1)	29	76	56 (4)		
Fulling Mill	103.2	60 (2)	107	34	70 (4)		
Almanack Pond	-	18 (e)	50	112	55		
CONTROL TOTAL	-	286	417	614	460		

PART 8 continues – average nymph ticks per site

AVERAGE number of nymphs per survey (5 surveys)

	Nymphs 2006	Nymphs 2007	Nymphs 2008	Nymphs 2009	Nymphs 2010	Nymphs 2011	Nymphs 2012
TREATMENT SITES							
Shawme Crowell	-	12.0	2.8	9.8	3.2		
Bridge Creek	-	38.0	13.8	7.2	6.4		
Dennis Pond	-	6.0	5.4	8.2	9.0		
Bells Neck	-	6.0	5.0	7.0	8.2		
Chappaquiddick	-	14.5	7.8	15.4	23.3		
Cedar Tree Neck	-	37.5	12.0	10.6	14.5		
Loring Nat Found	-	10.0	12.5	9.6	3.6		
Average		17.7	8.5	9.7	9.7		
CONTROL SITES							
Taylor Point	-	8.0	2.2	5.6	3.4		
Jehu Pond	-	13.5	2.6	9.8	7.4		
Syrjala Conser.	-	17.3	13.2	9.6	6.8		
Punk Horn	-	38.5	28.2	53.4	38.2		
Sepiessa Point	-	11.0	5.8	15.2	11.2		
Fulling Mill	103.2	30.0	21.4	6.8	14.0		
Almanack Pond	-	-	12.5	22.4	11.0		
Control Average	-	19.7	12.3	17.5	13.1		

PART 9 - ADULT DEER TICK COMPARISON

In late 2010, treatment and control sites were sampled once by the drag cloth method and adult deer ticks were counted. Values below indicate relative numbers of tick adults collected per hour from sites.

	Spring Adults 2007	Spring Adults 2009	Fall Adults 2007	Fall Adults 2009	Spring Adults 2008	Spring Adults 2010	Fall Adults 2008	Fall Adults 2010
TREATMENT SITES								
Shawme Crowell	3	11.2	108	180	0.8	6.4	112	56
Bridge Creek	8	22.4	132	380	24	11.2	176	92
Dennis Pond	58	100.8	316	824	11.2	124	252	488
Bells Neck	2	5.6	176	44	14.4	2.4	36	180
Chappaquiddick	16	9.6	160	76	13.6	2	88	64
Cedar Tree Neck	18	52.0	92	144	24	17	124	92
Loring Nature Center	4	1.6	36	56	1.0	0	4	12
Treatment Average	15.6	29.0	145.7	243.4	12.8	23.3	113.1	140.6
CONTROL SITES								
Burgess	5	23.2	172	180	4.0	4.8	664	84
Jehu Pond	-	38.4	68	212	26.4	12.8	384	184
Syrjala	14	30.4	188	140	16.8	8	100	312
Punk Horn	-	33.6	112	228	21.2	20	216	136
Sepiessa Point	-	8.0	44	24	3.2	3	32	36
Fulling Mill	36	7.2	52	164	8.8	9	92	80
Almanack Pond	-	4.0	80	96	2.0	2.4	44	108
Control Average	18.3	20.7	102.3	127.7	11.8	8.6	206	134.3

PART 10 - NYMPH DEER TICK INFECTION

	2007 Infection	% Infected	2008 Infection	% Infected			
Treatment Sites							
Shawme-Crowell	4/40	10 %	1/11	9.1%			
Bridge Creek	4/40	10 %	7/28	25%			
Dennis Pond	3/17	17.6 %	2/21	9.5%			
Bells Neck	4/23	17.4 %	2/15	13.3%			
Chappaquiddick	3/15	33 %	7/26	26.9%			
Cedar Tree	0/20	0	1/17	5.9%			
Loring Nature Center	0/8	0	1/27	3.7%			
Average	18/163	11.0 %	21/145	14.5%			
Control Sites							
Burgess Conser	1/23	4.3 %	0/7	0			
Jehu Pond	2/17	11.8 %	2/9	22.2%			
Syrjala Conser	3/29	10.3 %	1/28	3.6%			
Punk Horn	6/29	20.1 %	7/30	23.3%			
Sepiessa Point	2/8	25 %	4/18	22.2%			
Fulling Mill	0/20	0	7/33	21.2%			
Almanack Pond	0/10	0	3/24	12.5%			
Average	14/136	10.3 %	24/149	16.1%			

No samples were obtained in 2009 due to budget cuts.

2010 nymph samples have been sent to the University of Massachusetts for analysis by PCR. Results should be available in late January 2011.

PART 11 - ADULT DEER TICK INFECTION

Adult ticks collected from treatment and control sites in 2007 were analyzed by University of Massachusetts-Amherst cooperators using PCR technique. Co-infection of adult deer ticks with *Anaplasma* and *Babesia* pathogens are merged here for simplicity. Of note is the high percentage of co infected adult deer ticks (50/194= 25.8%).

	# tested	% <i>Borrelia</i>	Other Pathogen	Co- Infection			
Treatment Sites							
Shawme-Crowell	11	7/11	0	0			
Bridge Creek	16	8/16	5/16	4/16			
Dennis Pond	19	10/19	14/19	3/19			
Bells Neck	18	13/18	14/18	13/18			
Chappaquiddick	34	20/34	19/34	10/34			
Cedar Tree	11	9/11	7/11	6/11			
Loring Nature Center	6	0/6	3/6	0/6			
Treatment Average	115	67/115	62/115	36/115			
Control Sites							
Burgess Conser	15	4/15	0/15	0/15			
Jehu Pond	12	5/12	2/12	2/12			
Syrjala Conser	15	7/15	12/15	5/15			
Punk Horn	10	5/10	1/10	0/10			
Sepiessa Point	9	4/9	5/9	3/9			
Fulling Mill	12	4/12	10/12	4/12			
Almanack Pond	6	3/6	1/6	0/6			
Control Average	79	32/79	31/79	14/79			

2010 adult deer ticks have been sent to the University of Massachusetts, Amherst for analysis using PCR technique. Results should be available in late January 2011.

PART 12 - DEER SAMPLE RESIDUAL WIPES

In the previous study (2004-2006), white-tailed deer carcasses were sampled for permethrin residue on Martha's Vineyard by attending a deer check station, obtaining permission from each hunter, and then wiping a deer on the neck and lower jaw for thirty seconds with a clean organic cotton swab.

The sample was then bottled in a clean amber glass bottle and delivered to the Massachusetts Pesticide Residue Testing Laboratory, Amherst, MA. Personnel there have developed a testing protocol to detect 0.02 ug per sample.

In the current study, with the seven treatment sites scattered in wildlife management zones 12-13-14, residual sampling was conducted only on deer from Chappaquiddick Island, Edgartown, MA (zone 13). Chappaquiddick Island resident hunters were contacted and agreed to sample deer with the above procedure. In 2008, sixteen deer (eight male, eight female) were sampled. These data would be interpreted to estimate the proportion of deer treated topically within the treatment zone.

	Deer sampled 2007	Detected*	Deer sampled 2008**	Detected
Male deer	6	0	8	6
Female deer	11	2	8	5
Total	17	2 (11.8%)	16	11 (68.8%)

*both females killed and sampled during bow season

**all animals killed during bow season

In 2007, seventeen samples were executed, with twelve collected during bow season (eight female, four male) and five collected during shotgun season (three females, two males). Samples were then delivered to the cooperating laboratory for residual analysis. Of the seventeen samples, two were positive (11.8%).

In 2008, hunters were contacted and provided sampling materials as noted. All sixteen samples were executed on deer killed during the bow season beginning October 14, 2008. Samples were then delivered to the cooperating laboratory for residual analysis. Of the sixteen samples, eleven were positive (68.8%).

In 2009, no samples were obtained due to funding cuts.

2010 samples sent to the State Pesticide Lab, University of Massachusetts , Amherst for analysis. Results should be available in late January 2011.